Generative AI: The next frontier in the transformation of global capability centres for pharma and life sciences

pwc

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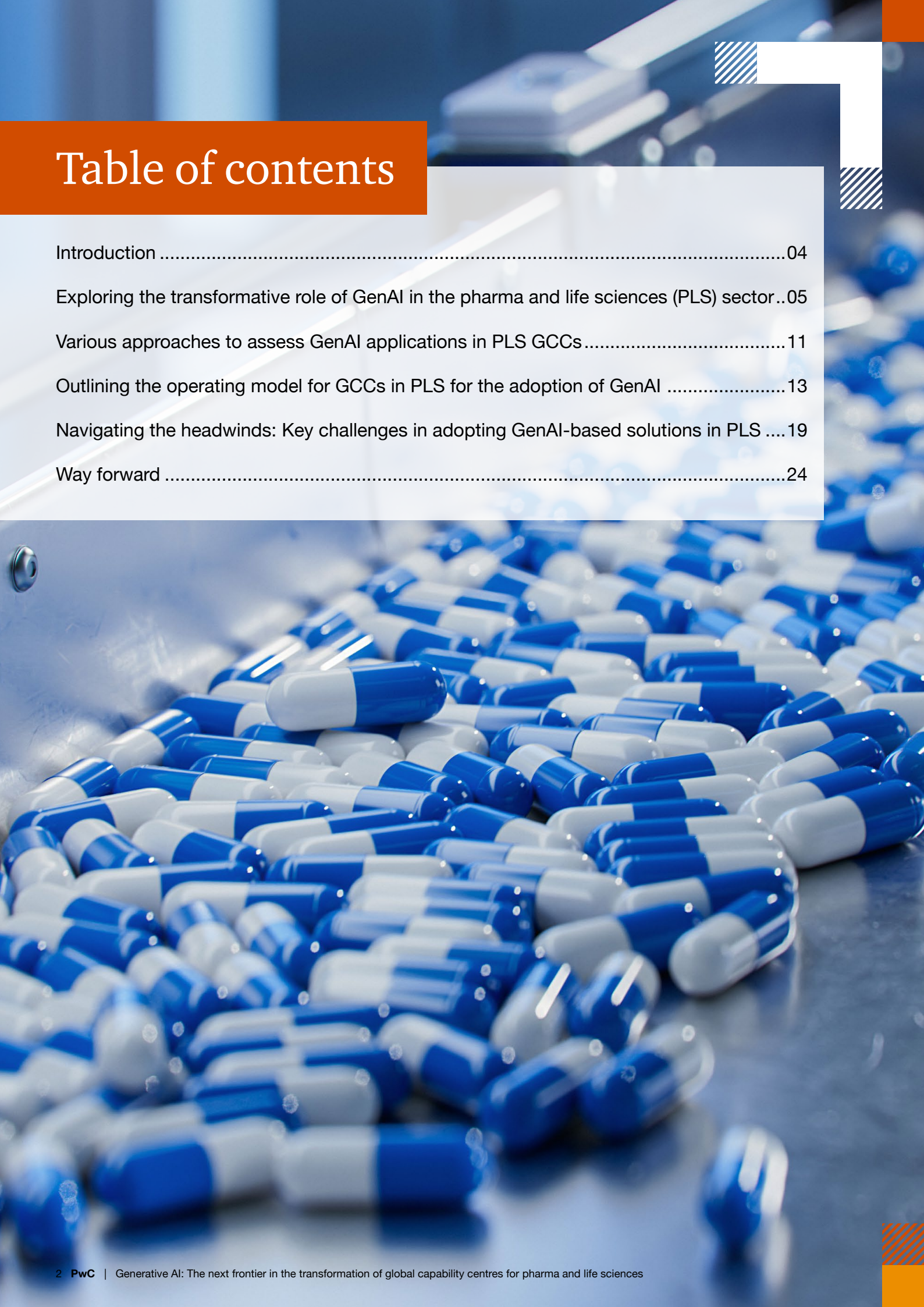


Foreword

In an era defined by rapid technological advancements, artificial intelligence (AI) has emerged as a transformative force for the PLS sector in reshaping research, diagnostics and patient care. The role of global capability centres (GCCs) is increasingly becoming important due to the unprecedented changes in the pharma industry in the last decade. These centres – which are strategically established by organisations to harness global talent and expertise – are evolving into innovation hubs for the PLS sector. In recent years, generative AI (GenAI) has emerged as a powerful tool which offers novel capabilities in areas such as data analysis, pattern recognition and knowledge synthesis. Since the primary characteristic of GenAI is its capability to generate novel solutions on its own, it can offer numerous benefits for the PLS sector. For example, conventional drug development processes require years of time and resources to find out potential drug molecules. GenAI can work with a large repository of information to identify trends and forecast possible candidates for drug trials based on various parameters. Since GenAI tools can process a vast amount of information quickly, the tools can help GCCs in speeding up the process of identifying potential compounds and optimise trial design.

GenAI can also enhance personalised medicine. The ability to analyse individual patient data, identify unique genetic markers and predict treatment responses enables GenAI tools to develop a precise and personalised approach to healthcare. However, the path for GenAI's adoption in the PLS sector are not without obstacles. This paper examines issues related to bias, data privacy and ethical implications of GenAI. By acknowledging these challenges, we can pave the way for responsible innovation and the integration of GenAI in PLS while adhering to the principles of equity, transparency and patient welfare.

It is our hope that the insights presented here inspire thoughtful discussions, foster collaboration and guide the industry towards a future where the transformative power of technology can be harnessed responsibly for the betterment of global health.

Introduction

To understand how GCCs in the PLS industry are adopting GenAI, PwC, in collaboration with National Association of Software and Service Companies (nasscom), conducted multiple comprehensive roundtables and one-on-one interviews between November 2023 and January 2024, eliciting point of views and responses from leaders and decision makers of GCCs of a few global firms which are operating out of India, that are also nasscom members. The primary objective of this study was to understand the awareness, adoption and impact of GenAI across various sectors.

The study also examines several impact areas of GenAI in PLS such as speeding up of drug research and discovery, hyper-personalised patient care. Furthermore, precision and effectiveness in providing individualised healthcare are made possible by the capacity to analyse patient data on an individual basis, detect distinct genetic markers, and anticipate treatment outcomes. The analysis as a part of the study explores the legal and ethical frameworks that go along with these developments, stressing the significance of implementation of GenAI that is both responsible and transparent.

Organisations in PLS are steering towards better member, patient and provider experiences, greater productivity, and lower administrative costs and GCCs can play a crucial role in this context by empowering the organisations to:[1]

- deliver increased qualitative care by leveraging GenAI to provide enhanced support for patients, physicians, customers and other key stakeholders
- execute streamlined care operating models for the implementation and responsible use of GenAI technology throughout the company
- implement delivery models to meet production requirements for processes, decisions, capabilities, incentives and for implementing effective governance structures
- reducing the cost of care by offering new ways to address the industry's pressing challenge of healthcare affordability and cost control
- encouraging employee engagement by enabling employees to focus on higher value-added activities such as serving patients and members
- enabling dynamic and context-aware workflow execution by reengineering workflows, managing change and recognising what GenAI can and can't do.

The study also aims to understand the risks that come with using these tools and the importance of ethics in GenAI, including the development, deployment and management of GenAI solutions and the extent to which the various large language models (LLMs) and ongoing regulations in PLS have impacted its adoption and proliferation. The paper also captures insights and responses from leaders – both from a technology and from a business perspective.

1 https://www.pwc.com/us/en/industries/health-industries/library/how-generative-ai-is-transforming-healthcare.html

Exploring the transformative role of GenAI in the PLS sector

The discovery and development of new drugs in the PLS sector is a time and cost-intensive activity. The time spent on the development of drug also increases the patent period, after which, generic drugs can be developed by other PLS firms. These generic drugs are much cheaper and have significant impact on the revenue gained from the drug. The long duration of the drug development process can be attributed to limited data and computing for molecular research and the lack of availability of suitable target population for clinical trials.

Another challenge faced by the PLS sector is the low penetration of insurance. Since most patient care is delivered on cash payment, it puts tremendous burden on the patients' family and becomes a concern for hospitals to get compensated for their services. Although governments across the world are launching benefit schemes, most of them have not achieved the desired levels of success, owing to limited awareness of the population.

In the absence of strict regulatory frameworks for digital health, the adoption of digital platforms and tools like hospital information system (HIS)/electronic medical record (EMR), clinical decision support system (CDSS), laboratory information system (LIS) and picture archiving and communication system (PACS) are in the early stages in emerging geographies as only leading hospitals have taken initiatives to digitalise their patient data to provide better care delivery experience to their patients. There is limited industry convergence on data sharing between hospitals and interoperability of systems. Although some governments are taking active measures to enhance digital health, to get to a desirable level of digital adoption will take some more years, if not decades.

Limited digital adoption in hospitals is another deterrent for opening clinical trials market in emerging geographies, despite a large eligible population which can benefit from research both from a health and from an economical perspective. Better outreach and enrollment in trials can also help speed up the drug discovery process for pharmaceuticals resulting in higher revenue margins.

A further factor contributing to the lower percentage of real patient data is the low affinity for digital systems in provider settings, which is likely due to the high perceived cost of deployment and change management. GCCs operating in PLS can use this data for research, innovation, and predictive maintenance of their deployed devices, which is based on usage patterns and operational downtimes. As a value-added offering to hospitals, some medical device companies bundle hospital software solutions with their hardware in an effort to increase device adoption. This eventually leads to the generation of a 360-degree view of patient data that aggregates to useful population health data.

90% of GCC organisations surveyed by PwC believe that the adoption of GenAI will help add new business lines, thereby impacting revenues and 91% have felt a tangible increase in productivity which will help

them in reducing costs.[2] GCCs are playing a critical role in integrating GenAI with existing systems in the PLS, which can help organisations by building new capabilities and improve people performance by reworking and redesigning workflows, improving efficiency. Within existing automated process and increasing accuracy while predicting outcomes, thus strengthening decision support systems. Besides, GenAI can improve member, patient, and provider experiences, increase productivity and lower administrative costs through various ways such as personalised care, remote monitoring, streamlining workflows and supporting clinical decision-making processes.

To reap the long-term benefits of investing in GenAI solutions, investments for GCCs in the PLS sector are driven primarily by three factors:

Revenue: GenAI can aid drug discovery by predicting molecular structures and optimise clinical trials by automating data management, adverse event management, side effect analysis, and real-time drug safety monitoring. This enables pharma companies with faster time to market for new product lines which can enhance the revenue for these organisations.

Capability building: GCCs can be beneficial in fostering a culture of up-skilling by ensuring seamless access to information and insights by developing innovative AI-powered training modules and governance frameworks. This can help organisations in training their employees to stay ahead of the curve and equip them with the necessary skills to be future-ready.

Cost: The role of GCCs in PLS is evolving from being cost arbitrage hubs to becoming strategic partners for their headquarters. GCCs also help organisations in leveraging AI for non-linear delivery capability and for the centralisation of support functions for innovation, economies of scale and cost reduction.

While these factors are the primary decision drivers for investment in GenAI technology, it is also important for the GCCs to assess the maturity of the organisation on the maturity assessment curve (Figure 1).

2 PwC India's 2024 Digital Trust Insights

Measuring organisational maturity for GenAI's adoption

In terms of organisational maturity of adopting GenAI, businesses in the PLS sector can be divided in four categories:

Explorers: Companies in the initial stage of adopting GenAI focus on assessing their readiness and identifying areas of interventions that can improve processes, assess the risks involved and develop mitigation plans along with estimating the expected business value.

Executers: In this stage, organisations focus on building use cases, assessing infrastructure, systems and architectural readiness.

Enablers: Organisations in the third stage develop governance models and stay up-to-date with the market trends.

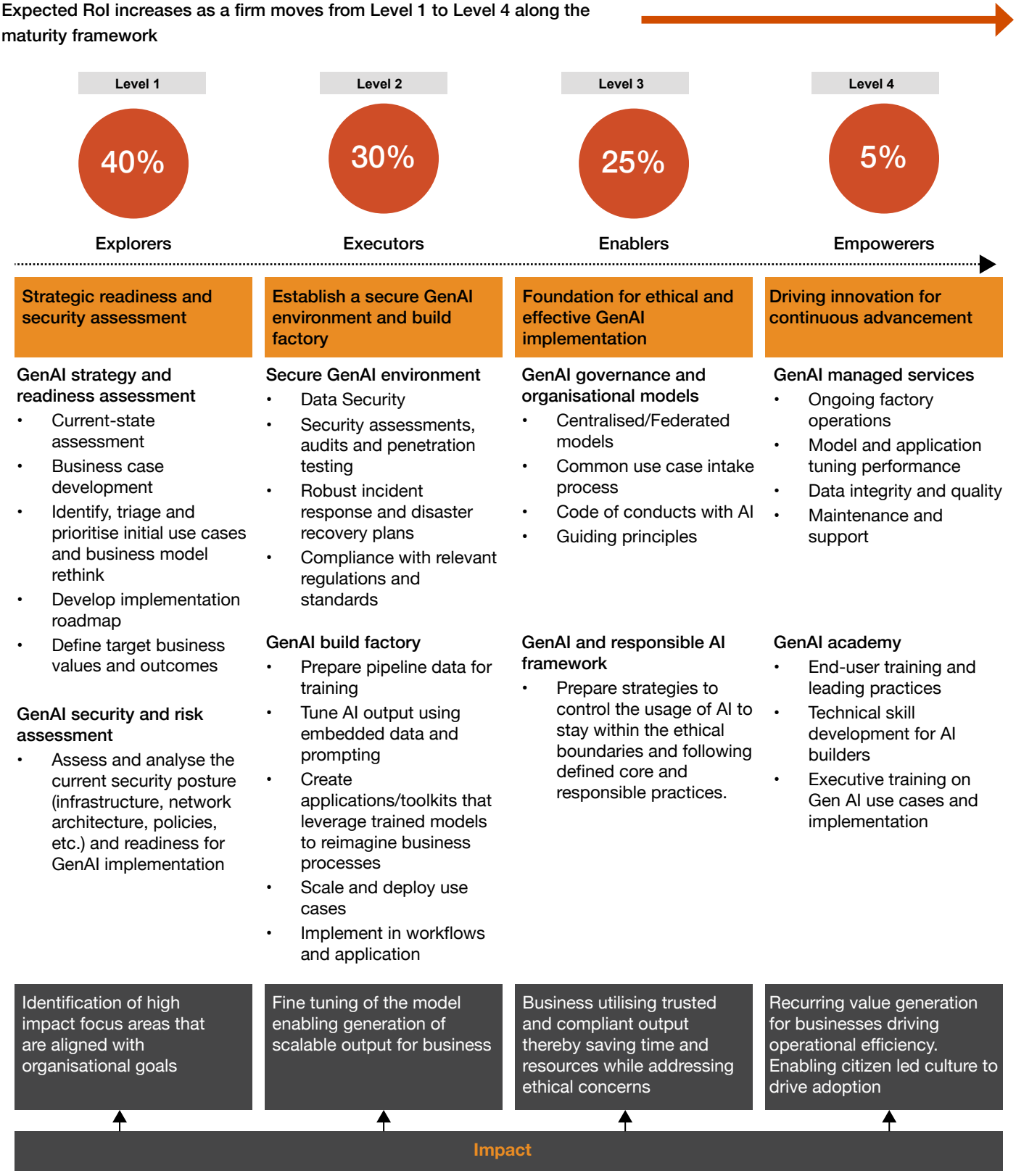
Empowerers: The final stage involves companies actively using GenAI to enhance performance, reduce costs and eventually generate an RoI .

The figure below is based on a recent study completed by PwC, where 40% of the organisations (GCCs in the PLS sector) fell into the Explorers bucket reaping marginal or no returns on investments, 30% are Executers with 25% acting as enablers and only 5% qualify as Empowerers who have seen maximum impact of GenAI adoption and proportionally higher returns on investments (Figure 1). Typically, organisations have identified break-even of their investments to be somewhere on the curve during transitioning from 'Enablers' to 'Empowerers'.

Fig1: Maturity assessment for generative AI in GCCs operating in PLS

Percentage of firms in each level

Expected RoI increases as a firm moves from Level 1 to Level 4 along the maturity framework



Source: PwC analysis

Since GenAI deals with complex data and regulatory norms, its accuracy relies on both high-quality datasets and human review to ensure that any inconsistencies do not have an adverse impact on a patient's health. As an organisation moves from left to right on the maturity assessment curve (Figure 1), concerns related to accuracy and regulations are addressed besides generating recurring value for the organisation. Therefore, organisations need to be careful in their approach towards adopting GenAI solutions and follow a thorough, step-wise approach which can be monitored and reviewed periodically to ensure accurate results.

GenAI's advancements across the PLS value chain

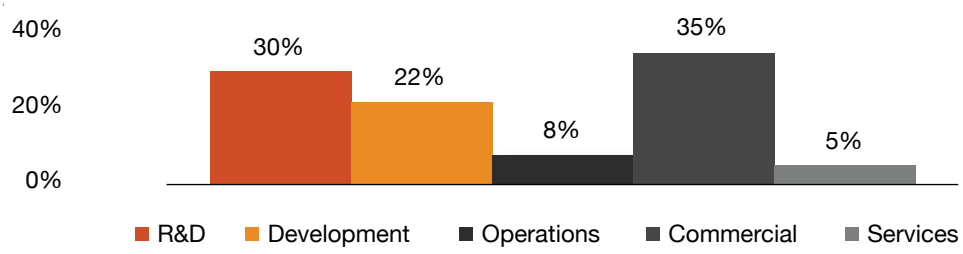
The adoption of GenAI in each stage of the GCC value chain has an impact on the overall organisational goal of the parent company. The table below discusses some of the business functions and the use cases of GenAI in these functions and how they can reshape each stage of the value chain.[3]

Table 1: Some use cases of GenAI in different business functions of PLS GCCs

Business function	Application use cases (sample)
Business services	• Design copilots to summarise doctor-patient conversations and condense extensive clinical trial data into concise reports. • Business inquiry chatbots: Provide instant, specialised responses to business-related queries.
Research and development (R&D)	• Generate novel treatment approaches based on emerging pharmaceutical and medical research. • Standardised technical documentation: Transform varied content for streamlined collaboration and knowledge transfer.
Technical operations	• Design clinical trials by generating synthetic patient data to simulate different scenarios and test hypotheses. • Access extensive health records to inform personalised treatment and provide comprehensive healthcare planning
Commercial operations	• Retrieve detailed records for informed commercial initiatives and customer insights. • Provide real-time responses to patient inquiries, aiding in non-emergency medical advice.
Development	• Copilot trial performance • Smart data management • Intelligent compliance engine

Given below is an overview of the investments by GCCs in GenAI (Figure 2):

Figure 2: Average value generated by use cases across divisions



Source: PwC analysis

3 PwC analysis

While investing into these use cases, organisations operating in the health-tech sector align these use cases with the organisational goals in two ways – improvements in **internal value chain** and **customer experience.**

To strengthen the internal value chain, GCCs channelise their efforts towards **productivity enhancement through co-pilots, software engineering, synthetic data generation, optimising Q&A support** for internal functions and employees, support services such **as legal and compliance documentation and quality and regulatory process improvements.**

Organisations also prioritise due diligence during feasibility studies for customer-facing applications in PLS. To achieve this, the focus of the organisation is on **summary generation from clinical notes/transcripts, automation of electronic medical records (EMR) filling, automatic report generation, and IMR CT machine serviceability assistance.**

Other critical use cases include **AI-guided patient positioning, enterprise-level automation initiatives** for clinical and patient summaries, early warning systems, discharge readiness summary and precision medicine which provides patient-specific care plans based on vitals and medical history.

Various approaches to assess GenAI applications in PLS GCCs

Governance structure and prioritisation

Defining the process to classify use cases is the first step towards ensuring the success of GenAI's adoption in an organisation. In GCCs, where prioritisation happens – at the central hub or at the spoke level – depends on the governance structure of their organisation. Use cases with cross-functional synergies impacting multiple divisions get prioritised and the ones impacting only a single area of business are prioritised only if they have a significant impact on that area and the overall goals of the organisation. The central strategy team oversees the process of classifying and prioritising the use cases.

To ensure that a GenAI use case is prioritised, it should satisfy one or more horizontal, division agnostic KPIs such as improved staff experience, patient experience and cost reduction. The implementation of the use case is also based on specific vertical KPIs such as hemodynamic stability index and early warning score. Figure 3 outlines some of the KPIs which are used by organisations to assess the impact of a use case.

Figure 3: KPIs used for assessing the impact of a GenAI use case

Source: PwC analysis

Note: The factors listed above is not an exhaustive list of priority criteria but represent some of the widely used ones across the industry.

The impact assessment of use cases is essential to determine the relevance and importance of GenAI-based solutions and to understand the type of disruption it can lead to. Many organisations across the globe are using the following triad to measure disruption – business model, operating model and competitive disruption. In case of high value use cases which have huge risk probabilities, organisations mandatorily consider responsible AI challenges such as data security, governance and regulatory protocols during the prioritisation process.

Evaluating GenAI initiatives in GCCs in the PLS sector

The value generated by adopting GenAI tools in the PLS sector is measured on various parameters such as time, cost and productivity with each company having its own criteria for measuring the value it can bring for the organisation. Pharma companies usually follow a four-point model where the use case must satisfy one or more of the following:[4]

Impact on health outcomes (e.g. mortality rate)	**Improving patient satisfaction**
Reduction in health expenses	**Enhancing employee experience**

Many pharmaceutical firms also use other general metrics like earnings before interest, taxes, depreciation and amortisation (EBIDTA), revenue growth, operation expenses and customer lifetime value (CLTV) to evaluate the value of their use case for GenAI initiatives.

Since GCCs are expected to innovate and reinvent the processes to improve productivity and minimise cost, many GCCs are utilising capabilities like co-pilot automation to optimise existing processes and channelise their savings for R&D for new initiatives. An example is the case of GenAI and MRI machines. These machines have manuals which typically consist of 300–400 pages with multiple versions and languages. To rectify any breakdown or error, service engineers can take nearly three hours. In the case of a small scan centre, the average scans taken per day can be around 30 and the amount it charges per scan is approximately INR 2500. If nearly three hours are lost in fixing the machine, it would mean a loss of around six to seven scans per day resulting in a financial loss of INR 15000–17500 which cannot be afforded by a small scan centre. With GenAI's assistance, engineers can skim through the manual to identify the issue within minutes and service time can be reduced by nearly 95% with estimated savings worth USD 5 million.[5]

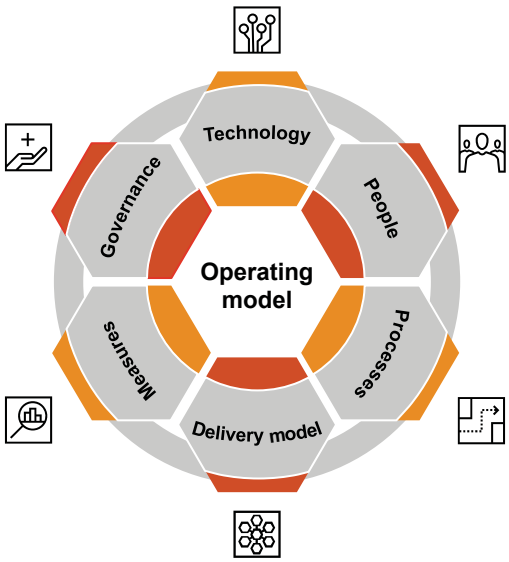
Another important use of GenAI in PLS sector can be automated filing of electronic medical record (EMR) records. It is reported that an average of 40-45% of their work time is spent on just filling these records limiting their capacity to take up other tasks that would need their skill and capability.[6] With GenAI-driven EMR auto filing initiatives, the time taken to file these records is reduced considerably which enables medical professionals to visit more patients, thereby enhancing the patient experience and satisfaction which still relies on human intervention.

4 PwC analysis
5 Ibid
6 Ibid

Outlining the operating model for GCCs in PLS for the adoption of GenAI

The operating model put into practice by a GCC signifies the degree of digital maturity of its parent organisation and its experience in driving large-scale global transformation programmes. An operating model is built on six pillars – governance, people, processes, technology, delivery model, and measures (Figure 4). While the delivery model helps a GCC to determine the optimal approach to implement and manage GenAI for cost-effectiveness, flexibility and quality, establishing a clear governance framework ensures proper allocation of roles, responsibilities and decision-making frameworks and the alignment of GenAI solutions to the organisation's objectives. With the correct mix of people, process and technology, GCCs can ensure scalability and foster a culture of innovation, learning and collaboration while seamlessly integrating the new technology into existing operations with enhanced agility and efficiency. The last pillar assists the GCCs to develop measures to ensure success while adopting GenAI for their parent organisation. However, depending upon the organisation's degree of preparedness, a GCC can prioritise one pillar over the other. Furthermore, within each pillar, a GCC can choose to implement a model which is suitable for their individual needs and preferences. Let us discuss each of these pillars in detail in the following section.

Figure 4: 6 pillars of an operating model



Source: PwC analysis

Delivery model: Unlocking potential through changes in implementation framework

The delivery models put into practice by GCCs signify the degree of digital maturity and preparedness of the parent organisation and its experience in driving large scale global transformation programmes. Historically, organisations have been operating on a centralised centre of excellence (CoE) model. However, with the rapid adoption of GenAI, organisations are moving to a hub and spoke model from a centralised model. A few organisations have also been working on a model that provides a balance between being centralised and a hub and spoke model. In this federated model, the execution and prioritisation of GenAI use cases happens at the spoke level and the central team assists with the guidance framework consisting of the guardrails and acceleration mechanisms assisting the execution of GenAI on use case basis.

Furthermore, moving from a centralised to a federated delivery model requires employees to have a combination of different skills (e.g. data engineering and data scientist) rather than one core skill. To fully harness the power of GenAI tools, leaders must combine various delivery models and design systems which are scalable and future-proof. A core GenAI team comprising technology specialists, analysts and business leaders is essential to understand the company's needs, market differentiation factors and analyse data which can help them in customising GenAI models as per their requirements.

Technological landscape and digital capabilities

Given the cost-intensive nature of developing their own foundation models, many organisations are inclined to establish partnerships with leading service providers. Since large amounts of business data is used for model training, organisations prefer associating with leading service providers. With respect to maturity of an LLM model (Figure 5), most organisations rely on techniques such as prompt engineering and retrieval augmented generation (RAG), fine tuning existing use case-specific LLMs which are available in the market for the pharma sector.

Figure 5: The four layers how organisations are maturing with their LLM models

- Building a foundation model
- Fine tuning existing LLM models
- Retrieval augmented generation opportunities
- Prompt engineering

Source: PwC analysis

With respect to optimising the model outputs to be more specific to their data, companies can adopt one of the following approaches:

- fine-tuning with RAG
- prompt engineering and enabling prompt libraries
- adoption of low rank adaptation (LoRA), or quantised low rank adaptation (QloRA) methodologies
- comparing new models introduced in the market to the existing open-source models for effectiveness.

Many industry leaders suggest that organisations prefer a risk-based approach, starting with basic open-source models and leveraging domain-specific models. They weigh the choice between small data-large model and large data-small models based on cost, the value created by these models, data quality, totality and associated risk. Assembling models with one output as input to another is another way to improve performance.

Choosing the right LLMs: Organisations define standard LLMs based on interoperability, cost of ownership and data, while the success of the use cases depends on the current IT landscape and a business's commitment to IT solutions. With the current technology, GCCs in the PLS sector highlight the need to future-proof the following from an enterprise perspective:

- protection of data transcription
- adoption of quantum chemistry in drug discovery.

Two critical issues which the companies are managing when it comes to GenAI are hallucination and data contamination. Data contamination has been an issue since the inception of machine learning (ML) where data is split into train and test sets with the former used for training and latter containing data to determine whether the model can replicate the performance in unknown conditions. When examples of training data seep into test data, the data is contaminated which not only impacts the performance but also impairs the model's capacity to generalise new data which leads to producing inaccurate and biased results. This is a complex problem in LLMs due to the huge data sets which are utilised and the difficulty in ensuring mutually exclusive training and test sets. Since LLMs handle a wide range of problems (text generation, image generation, math, coding, etc.) incorporating rules to avoid contamination for every domain is an extremely challenging task. Organisations must also consider that fine tuning an existing LLM might affect its performance. As data contamination can lead to inaccurate predictions, unreliable results, or skewed outcomes, any such outcomes in the pharma industry would be disastrous due to the significant risk involved. Efforts are underway to develop tools to accurately evaluate, test and train data similarity to develop strong assessment models and to implement safety guardrails such as input data filtering to prevent biased or hazardous outputs. With respect to hallucination, human intervention can be beneficial for validating the reliability of the output.

While working with the LLMs, organisations choose either to use an infrastructure where the LLMs leveraged for IT processes are driven on the organisation's own custom on-premises hardware, or, a hybrid environment wherein only the LLMs reside on-premise while rest of the infrastructure is gated. Few organisations also chose the subscribe and use LLM models for certain commodities such as co-pilots (Figure 6).

Figure 6: Three stages of choosing the LLMs as per organisational needs

Anything which is core to the business, IT driven will be on the organisation's own custom hardware within the premise	**A hybrid environment wherein the LLMs major service providers resides in their premise while the data and the APIs are gated**	**A subscribe and use environment for commodities. E.g. copilots**

Source: PwC analysis

Fostering change through leadership and governance

To ensure a successful adoption of GenAI in organisations operating in the PLS domain, effective governance structures are needed to upskill the existing resource pool, form strategic partnerships with other organisations, start-ups and academic institutions and adopt new operational practices.

People: Knowledge and skill development

The rapid shift in AI across industries necessitates that the PLS sector's talent pool should comprise people with a diverse range of skillsets. Organisations can leverage GenAI tools to enhance their recruitment and training processes to address the changing needs of the sector.

Upskilling initiatives

The average half-life of skills is now less than five years, and in some technology fields it's as low as two and a half years.[7] For millions of workers, upskilling alone won't be enough. More than 40% of employees anticipate upskilling or a change in their role due to AI adoption whereas employers hope that their employees will support the adaption of new technology. This could result in a sharp decline in productivity across job functions and geographies. HR, IT teams and senior managers need to collectively support the employees throughout the transformation journey with numerous initiatives such as:

Central data academy: Emphasising data fluency as its core theme, it aims to develop employee's expertise in GenAI and collaborating with diverse divisions to integrate GenAI into their modules.

Data conferences: Dedicated sessions on GenAI ranging from introductory to advanced covering a range of topics from opportunities to pitfalls, these conferences serve as a platform for knowledge exchange, fostering a collective understanding of the transformative potential of GenAI.

7 https://hbr.org/2023/12/5-forces-that-will-drive-the-adoption-of-genai

Continuous awareness programmes: These programmes demystify the distinctions between discriminative AI and GenAI by delivering targeted training initiatives to specific groups such as developers, quality assurance (QA) and leadership teams.

Developer forums and collaboration-focused sessions: Organisations should nurture an environment where sharing new knowledge and findings is both encouraged and appreciated.

Persona-based training: Training sessions curated for employees to empower them so that they can leverage GenAI in their respective roles.

Such skilling and awareness initiatives implemented by GCCs can help organisations to foster a culture of learning and upskilling and enable the workforce to learn the responsible and ethical use of GenAI.

Strategic partnerships

Not many organisations possess the technical expertise for the creation, implementation and execution of GenAI tools; therefore, to fill this gap, many organisations seek a partnership model with firms who are adept at delivering GenAI solutions for strategic guidance, knowledge sharing and implementation support. Ideally, a skilling programme should cater to all 5 teams – development teams, data and business analyst teams, QA and legal teams and stakeholder communities.

Some of the partnerships organisations in the PLS sector are considering for the adoption and implementation of GenAI tools are:

Collaboration between the PLS sector and the academia: Many organisations in the PLS sector have established strategic partnerships with educational institutions to explore advanced research capabilities and promote knowledge sharing between the academia and the industry.[8]

Collaboration between the PLS Industry and large organisations: Technology leaders are establishing alliances with large pharma companies to create synergies by utilising their expertise, resources and infrastructure to accelerate innovation and enhance efficiency of pharma companies.

Industry and startups: Startups which specialise in specific areas of AI can help pharma companies in harnessing the benefits of AI adoption and address the challenges of the industry. Few examples of this are:

- when GenAI is used to discover cancer treatments, leveraging a company's research and advanced drug creation technologies to optimise the process.[9]
- GenAI with its advanced capabilities is used at specific stages of the value chain to accelerate the manufacturing process for new potential medicinal molecules.[10]

Transforming operational process

With the advent of GenAI tools, outdated workflows are being replaced with effective, automated procedures from procurement to customer management. Organisations need to determine the functional aspects of the operating model and assess the business's capacity to adopt GenAI at scale. As a part of the change management process, to optimise the adoption of GenAI, organisations should implement processes which facilitate exchange of feedback between employees and management. Creating small, cross-functional teams can be beneficial for these initiatives.

Developing measures to build organisational resilience

PLS organisations can determine the benefit they get from investments in GenAI using an outcome management framework which sets metrics and benchmarks to monitor development, assess outcomes and determine return on investment (RoI). An example of such a framework is A/B testing which is used to analyse the effects on workflow stages to calculate productivity and efficiency improvements.

8 PwC analysis

9 https://www.pwc.com/us/en/tech-effect/ai-analytics/generative-ai-policy.html

10 https://www.pwc.com/us/en/tech-effect/ai-analytics/scaling-generative-ai.html

The success parameters are divided into two major domains – business and people metrics, and technology metrics. When an AI model meets the predefined precision requirements it is considered to be a successful model even though it may have zero positive business impact. Therefore, it's crucial to prioritise business metrics over technological or financial metrics. While quantitative metrics like cost savings, increased sales and revenues are highly significant, qualitative indicators such as customer and employee satisfaction, loyalty improvement and model sustainability should also be given high priority. The rapid evolution and adoption of GenAI suggests combining short-term objectives with a comprehensive long-term goal which allows greater flexibility to course correct when needed. While higher accuracy is desirable by fine-tuning, the jobs might create complex tasks for humans reducing productivity overall. A well-designed outcome management system can recognise unexpected outcomes and provide resolution paths.

To assess the system quality, the degree to which the GenAI system is integrated with the organisation's current workflows, infrastructure and procedures must be measured. Some factors affecting the system quality are scalability, reliability, privacy, security and usability. User feedback should be considered carefully and incorporated into the machine's next update to make it better incrementally.

Navigating the headwinds: Key challenges in adopting GenAI-based solutions in PLS

Though GenAI has numerous benefits, it also brings along challenges to be navigated, ethical considerations to be addressed and technical limitations to overcome. Figure 7 illustrates the key challenges and associated risks under 2 categories – business and technical.

Figure 7: Challenges and risks associated with GenAI adoption

Business Challenges	Associated Risks	Technical Challenges
Compliance systems Policies and procedures	Regulatory compliance	Algorithmic bias, Intellectual Property → Model tuning Hallucinations Lack of robust LLMs
Trainings and awareness Ethics, law and security	Legal obligations	Operational risk, cybersecurity → LLMOps and GRDs Need for best practices around LLM Ops and the need for superior quality GRDs
Confidentiality Personal data protection against unauthorized Disclosure and loss of availability	Legal obligations	
Skillsets Identification of most important skill sets Upskilling vs external hiring	Operational risk	
Managing perceptions Value addition to business	Bias, regulatory compliance	

Source: PwC analysis

As GenAI is being adopted rapidly by businesses across sectors, its implementation also raises concerns related to the technological limitations and ethical considerations. To ensure that the technology is a reliable and secure tool for its users, many C-suite leaders are adopting responsible AI (RAI) so that GenAI can become a valuable and trustworthy tool for stakeholders and the society.

One of the biggest challenges while working with GenAI is the constantly evolving regulatory landscape from a governance standpoint. As different countries enforce various regulations such as the EU's Artificial Intelligence Act, US AI Executive order and Japan's Social Principles of Human Centric AI, it is imperative for companies to be compliant with these laws. Additionally, one of the most crucial aspects of adopting GenAI in a multi-geographical environment is to ensure the retention of regional data within that region.

Companies have looked to responsibly implement Gen AI in their closed environments to overcome this obstacle of evolving AI standards with regulatory uncertainty and to be compliant with future rules. The culture, level of trust, and alignment with corporate goals – all play important roles in the adoption of disruptive use cases. Although significant progress has been made in the adoption of GenAI technology, there is still room for businesses to adopt GenAI tools, manage perceptions around the technology and encourage diversification of its uses.

RAI and XAI as governance guardrails

Since the development of GenAI, human oversight to monitor and validate the procedures and outcomes has been considered to be an integral part of the GenAI's adoption and implementation. To ensure that stringent AI security and validity measures are in place, organisations in the PLS domain are finding ways to adopt GenAI across the value chain. However, considering that bulk of the business deals with people, these AI systems are still an assistance to humans who take final decisions. In contemporary times, the complexity of the solutions increases multifold requiring multiple users for validation as the programmes used aren't locked algorithms. For example, when multiple responses are created for the same prompt at different times by a bot, the number of permutations and combinations involved in validation increases to make sure that the outcomes remain within the parameters. AI technologies like auto evaluators and custom data prompt engines are being used to support these governance processes but human involvement remains crucial for security.

As the world advances towards adopting GenAI in various sectors, the role of Explainable AI (XAI) in the context of GenAI has become crucial as end users seek transparency and understanding backed by a certain level of clarity and trust in the myriad GenAI models available today. The need for explainability depends on the degree of functional opacity generated by a model's complexity and the impact of the decisions they make. Figure 8 explains the factors which determine the need for an explainable AI.

Figure 8: The need for Explainable AI

Working as intended?

A primary driver for model interpretability is the need to understand how a given model makes predictions, while ensuring that it does so according to the desired specifications and requirements demanded of it.

How sensitive is the impact?

The need for interpretability also depends on the impact. For an GenAI model for targeted advertising, for example, a relatively low level of interpretability could suffice, as the consequences of it going wrong are negligible. On the other hand, the interpretability for an AI/GenAI based diagnosis system would be significantly higher. Any errors could not only harm the patient, but also deter adoption of such systems.

Are you comfortable with the level of control?

The other key piece in the jigsaw is the level of autonomy. Does the AI system make decisions and perform actions consequently, or do its outputs function as mere recommendations to human users who can then decide whether or not to follow these? Explainable factors can be used for a level of rules based control or to flag to humans automatically. It's important to be able to fully understand a system before allowing it to make business decisions without human intervention.

Use case criticality

All these considerations come together to determine whether explainability is necessary and the level of rigor that would need to be applied.

Source: https://www.pwc.co.uk/audit-assurance/assets/pdf/explainable-ai-xai.pdf

Various factors such as revenue, rate, rigor, regulation, reputation and risk determine the criticality of employing an explainable AI. Figure 9 illustrates these factors in detail.

Figure 9: Components to evaluate criticality of the use case explainability

Revenue

The total economic impact of

1. single output/prediction,
2. understanding why the prediction is made
3.intelligence derived from understanding the process.

Rate

Frequency of output generated by the GenAI model (Number of decisions made by Gen AI in a certain time)

Rigor

Robustness of the system: Its accuracy and ability to generalise the unseen data

Regulation

Determining the acceptable use and level of functional validations needed for the application

Reputation

How the GenAI application interacts with businesses, stakeholders, society and the extent to which business reputation can be impacted

Risk

Potential harm due to an adverse outcome that results from the use of an algorithm and that includes executive, operational, technology, societal, ethical and workforce factors

Source: https://www.pwc.co.uk/audit-assurance/assets/pdf/explainable-ai-xai.pdf

By nurturing the knowledge behind the decision-making process of an existing AI or GenAI system, an organisation can foster confidence and transparency through the implementation of XAI as it improves accountability of the decision-makers by enabling stakeholders comprehend the thinking behind the results. Additionally, it makes it easier for human and machines to collaborate for more informed decision-making and problem-solving. Figure 10 provides a snapshot of the benefits of an XAI for an organisation.

Figure 10: Eight business benefits of XAI

Optimise	Retain	Maintain	Comply
Model performance	Control	Trust	Accountability
Decision making	Safety	Ethics	Regulation

Source: PwC analysis

Privacy seeks to anonymise the data while explainability demands things to be explicit. Organisations must strike a delicate balance between these two aspects for successful adoption of GenAI. Furthermore, given the challenges around regulations, companies in the PLS sector have always been stringent with their adoption of AI and GenAI solutions with a strong reluctance to adopt any open source or unbacked technologies by significant players. As the usage of GenAI increases, shedding more clarity on the outcomes certain regulations might become obsolete allowing room for innovation. Ethical integration of RAI and XAI is necessary to ensure that the future of technology is fair, responsible and aligned with societal values.

Sustainability and GenAI

As the field application of Gen AI's is increasing rapidly, the knowledge about balancing the advantages and disadvantages is essential for GenAI strategy and business discussions. As organisations strive to reduce and disclose emissions in direct, indirect and value chain sectors to meet regulatory requirements, achieve their net zero goals and enhance stakeholder transparency, they must be made aware of the following potential ways in which the adoption of GenAI solutions can increase their emissions:[11]

Building and training foundation and domain-specific models: Foundation models (LLMs) require compute power and energy. Corporate entities which license these LLMs share the costs and risks associated with related emission/overhead burdens.

Customisation: Businesses often license foundation and domain-specific models, embed proprietary data, and expertise to improve performance, which requires a considerable amount of compute power and energy.

Complex GenAI apps: Businesses could supplement and automate difficult use cases by introducing multistep interactions rather than solitary calls which will raise emissions and inference costs.

GenAI proliferation: Extremely specialised models are needed for domain specific issues requiring training and maintenance resulting in increased computing needs and emissions.

Below are some of the way to reduce the emissions:

Compact GenAI models: Improved architectures can result in less computing power for GenAI models.

Specialised processors: High energy efficient computing is made possible by specialised processors like field programmable gate arrays (FPGAs) and tensor processing units (TPUs) for forecasts, training of models and other applications.

11 https://www.pwc.com/us/en/tech-effect/emerging-tech/impacts-of-generative-ai-on-sustainability.html

Way forward

Gen AI presents an opportunity for the industry to transform and achieve unparalleled advancements in all business units which was previously unthinkable in the near future. With businesses rapidly adopting this technology and given the challenges associated with it, advancements in the technological ecosystem will help them in adoption as well as sustenance of GenAI solutions.

Technological advancements and disruptions due to GenAI

Emerging from AI as the next deeper step, the ecosystem of the Gen AI is similar with minimal changes but of increasing complexity. Given below are some of the technological considerations for organisations who are adopting GenAI:

Tensor processing units: Unlike GPU's which are made for graphics and later adopted for AI tasks, TPU's are application specific integrated circuits (ASIC) developed specifically to handle machine learning workloads. With higher speed and performance than GPUs, they disrupted the accelerated training of deep learning models, efficiently manage computational demands of natural language processing (NLP) applications (LLMs) and integration for cloud-based AI projects. The future seems to be heading in the way of hybrid models combining best of TPUs, GPUs with quantum computing and neuromorphic technologies.

Responsible framework adoption: Since there are many questions raised on the datasets utilised in training and the bias in the responses, pharma organisations are looking internally to establish governance principles and ethical AI advisories.

Furthermore, regulations like the EU AI ACT are being introduced for the betterment of AI adoption and adherence to the same is important. Hence, RAI frameworks will be designed with a comprehensive set of indicators to guide the development applied from datasets to data privacy with customisable systems adopting to diverse needs of various organisations.

LLM agents: LLM agents excel in natural language understanding and generation (NLU and NLG) with minimal human interventions. One way to reduce the hardware cost of training ML models without losing accuracy is through quantised training. LLM agents are being optimised for better performance and the future developments through pre-trained quantised models and the quantum computing and multimodal LLMs seems to be the direction of future advancements.

Multi-modal models: GenAI requires systems to process and provide outcomes using multi-modal data. For instance, a CT scan centre can save precious time by reading a patient's past hospitalisation history and old scans and minimise the scan time to reduce radiation exposure. Advancements in multimodal large language models (MLLMs) have made it simple to digitise pictures to text and understand complex images. In future, these efforts would drive research efforts towards advancing data format compatibility for optimised outcomes.

Adoption of GenAI by different business functions

Companies operating in PLS domain are using GenAI to optimise patient care and streamline operations. Additionally, GenAI provides personalised care options by personalising patient experience, streamlining administrative tasks through automation and increases clinician productivity by assisting Pharma providers with optimal decision making besides automating tasks.

Gen AI is bringing in radical changes to the business models in the PLS sector where AI-enabled products and services are disrupting and complementing current pharmaceutical business models. It can also help in increasing synergies and generating higher revenues by improving outcomes with cost savings within the pharma business model.

Some of the emerging business model in the PLS sector supported by GenAI are:

- **Algorithm-as-a-service (AaaS):** Drug discovery algorithms such as molecular modeling and predicted drug target interactions are created by third parties to offer its services through a web interface or application programming interface (API) by charging a subscription fee or pay-as-you-go fees making it accessible to businesses of all sizes.
- **Integrated treatment solutions:** Through strategic alliances with PLS companies, technology vendors and wellness experts, an integrated treatment business model offers a combination of diverse therapeutic services, medical technologies and patient-centric services as a comprehensive treatment package with tailored solutions.
- **Digital therapeutics:** By leveraging genetic data and AI algorithms, this model tries to identify potential drug targets and designs personalised therapies based on one's genetic profile, optimising clinical trials and generates valuable healthcare insights.

The immense potential of GenAI can be leveraged in a responsible way ensuring sustainability in three ways:

- allowing clinicians to review and edit AI-generated content
- prioritising and addressing issues which ensure the well-being of individuals
- reducing costs in healthcare delivery and pharmaceutical research.

Key considerations for adopting GenAI in GCCs in the PLS sector

While the advent of GenAI has democratised AI adoption, it also has posed a considerable set of risks and challenges along its adoption journey. To effectively harness the potential of GenAI in the PLS sector, organisations should adopt the following approach:

- **Assess implementation maturity through stages:** Based on PwC's suggested maturity assessment framework (Figure 1, Section 2), organisations can assess their current maturity and prepare their evolution plan to reach the highest level of maturity.
- **Prioritisation and value assessment of a use case:** GenAI use cases needs to be prioritised and aligned to the organisational goals to ensure that it delivers high-value solutions with significant impact on the efficiency of operations. It is suggested to perform value evaluation at a GCC level as well as the at the parent organisation level and focus on use cases that add both- tangible and intangible value to the organisation. Organisations can measure the value of GenAI tools based on metrics such as time, cost, productivity, and traditional financial indicators, prioritising high-impact areas such as pharmaceuticals and revenue growth.
- **Governance model:** Adopting a centralised or a de-centralised hub and spoke model for GenAI implementation is a decision that is driven by the digital maturity of the organisation and its history in driving such large transformation programmes. Irrespective of the model selected, right processes and governance frameworks need to be established to minimise duplication of efforts and deliver high impact.
- **People and change management:** Organisations must prioritise upskilling of the workforce to efficiently equip its people to leverage GenAI tools by establishing sandboxes, providing strong guidance from subject matter experts (SMEs) and senior management through continuous learning programmes and strategic partnerships.

- **Partnerships:** Owing to the risk and challenges surrounding the output from models and the data, collaborating with the most trusted service providers in terms of the of foundation models helps mitigate the risks. GCCs in the PLS sector also need to foster collaborations between industry, academia, and startups to drive the faster adoption of innovations and provide the necessary guidance for implementing GenAI solutions.
- **Ecological footprint:** PLS organisations must monitor the environmental impact of GenAI operations by measuring emissions, analysing the life-cycle assessment and aligning their business operations with sustainability goals, considering the convergence of quantum computing and GenAI for efficiency improvements.

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