

# IDC FutureScape: Worldwide Life Sciences 2022 Predictions

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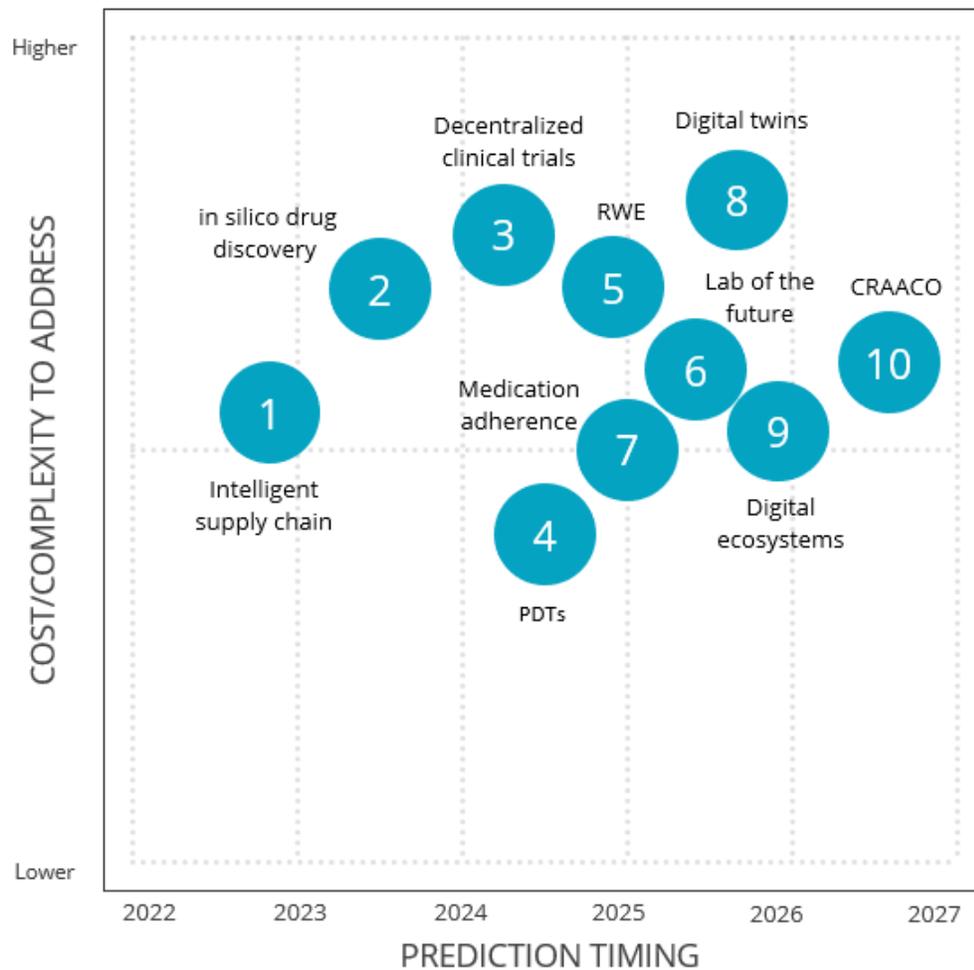
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## IDC FUTURESCAPE FIGURE

FIGURE 1

### IDC FutureScape: Worldwide Life Sciences 2022 Top 10 Predictions



Note: Marker number refers only to the order the prediction appears in the document and does not indicate rank or importance, unless otherwise noted in the Executive Summary.

Source: IDC, 2021

## EXECUTIVE SUMMARY

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This IDC FutureScape for life sciences provides IT and business executives across the globe with actionable insights into key trends shaping the future of the life sciences industry across the value chain. The intended readers include but are not limited to members of the business, clinical, and IT leadership of life sciences organizations worldwide. The IDC FutureScape 2022 predictions suggest that, in the next five years, life sciences organizations will focus on the learnings gleaned from dealing with the business disruption wreaked by the COVID-19 pandemic. It will move on from the pressing need to ensure business continuity to the need to drive digital resiliency and growth.

The predictions explore several key themes concerning the life sciences industry, including:

- A data hungry world in which data liquidity and real-world evidence (RWE) will connect the dots between life sciences and healthcare
- Digital convergence between business, operations, and IT in building strategic road maps
- An inward focus on building data fluency and upskilling teams to leverage data and technology effectively
- The use of artificial intelligence (AI)/machine learning (ML) and extended reality (XR) to accelerate innovation and help the industry develop new capabilities for the future
- The need to drive digital resiliency and establish sustainable models to deal with possibility of the resurgence of other emerging threats, including another pandemic
- The importance of *in silico* models, digital twins, and intelligent supply chains in transforming business operations
- Disaggregated care models, "patient centricity," and engagement reimaged

Our worldwide life sciences industry predictions for 2022 are as follows:

- **Prediction 1:** By 2023, 75% of life sciences manufacturers will invest in intelligent supply chain solutions to enable resilience and prevent future disruptions during health emergencies such as COVID-19.
- **Prediction 2:** By 2024, AI investments in *in silico* drug discovery will double to fuel growth of genomics and precision medicine to bring vital vaccines and medicines to patients faster.
- **Prediction 3:** By 2025, 75% of trials will be patient-centric decentralized clinical trials; 90% will be hybrid and at least 10% will be virtual, driven by 30% growth in connected health technologies.
- **Prediction 4:** By 2025, the market for prescription digital therapeutics will more than triple, led by mental health and chronic conditions, blurring the boundaries between healthcare and life sciences.
- **Prediction 5:** Investment in AI for real-world evidence by life sciences companies will double by 2025, driven by health data interoperability initiatives and platforms.
- **Prediction 6:** By 2026, two-thirds of life sciences companies will adopt the intelligent lab of the future leveraging digital transformation, integrating the Internet of Lab Things.
- **Prediction 7:** By 2026, the increased adoption of medication adherence apps, smart IoT-based solutions, and connected drug delivery systems will reduce treatment compliance gaps in clinical trials by one-third.

- **Prediction 8:** The use of digital twins in manufacturing and supply chain planning at multinational life sciences firms will double by 2026, with deeper adoption in R&D coming later.
- **Prediction 9:** Triggered by COVID-19, half of new business value created in the global life sciences market by 2026 will be driven by cloud-based digital ecosystems and federated learning, powering R&D co-innovation.
- **Prediction 10:** Integrated research organizations will double in number by 2027, fueling the adoption of clinical research as a care option within the healthcare ecosystem.

This IDC study discusses the top 10 predictions for the life sciences industry for 2022.

"The 2022 worldwide life sciences industry predictions focus upon how the life sciences industry is embedding innovative technologies and data centrality across the value chain, helping it transition beyond the disruption caused by the pandemic to agile, 'patient centric' business models with a focus on digital resiliency and accelerated growth," says Dr. Nimita Limaye, research VP, Life Sciences R&D Strategy and Technology at IDC Health Insights.

## IDC FUTUREScape PREDICTIONS

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### Summary of External Drivers

IDC Health Insights identified seven drivers for IT investment in life sciences. These include:

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Cybersecurity and risk** – The threat environment just keeps scaling
- **The future enterprise** – Thriving in a jungle of agile innovation
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Digital ecosystem** – Thriving in a multiplatform world
- **Workforce outlook** – Redefining teams, reinventing models, and rethinking leadership
- **Engagement reimagined** – From responsive to anticipatory

These seven key drivers are discussed in more detail in the External Drivers: Detail section.

### Predictions: Impact on Technology Buyers

#### ***Prediction 1: By 2023, 75% of Life Sciences Manufacturers Will Invest in Intelligent Supply Chain Solutions to Enable Resilience and Prevent Future Disruptions During Health Emergencies Such as COVID-19***

Life sciences supply chains were rocked in 2020 as health officials and providers struggled to acquire adequate supplies in reaction to the COVID-19 pandemic. Various countries cut off or restricted exports of personal protective equipment (PPE), critical devices such as ventilators, and essential drugs including painkillers and drug precursors. Emergency stocks of materials and equipment proved to be insufficient for the scope of the crisis. In 2021, as economies started to recover, supply chains in other industries struggled to react to awakened demand.

In IDC's May 2021 *Industry CloudPath Survey*, 63% of life sciences respondents perceived their cloud-based supply chain management applications as "business critical." Supply chain "control towers" offer a path to optimized performance through a closed-loop approach to material monitoring. At provider organizations, control towers can enable up-to-date inventory visibility and patient care-focused

analytics to predict short-term and medium-term demand, and then coordinate responses from suppliers.

Eighty-four percent of life sciences respondents in IDC's May 2021 *Industry AI Path Survey* cited benefits of using AI, with 47% citing "significant benefits" from supply chain orchestration (control tower and supply chain digital twin). IDC predicts that 75% of life sciences manufacturers will invest in intelligent supply chain solutions by 2023 to prevent future disruptions and foster resilience during emergencies such as COVID-19. Intelligent supply chains will employ AI, advanced analytics technologies, and innovative surveillance techniques to monitor, predict, and intelligently manage demand. They will anticipate supply bottlenecks and secondary sources to address and prevent supply shortages.

### Associated Drivers

- **The future enterprise** – Thriving in a jungle of agile innovation
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Engagement reimaged** – From responsive to anticipatory

### IT Impact

- Cloud-based supply chain orchestration will require highly secure, scalable infrastructure.
- Data platforms must provide access for global partners and multiple regions/countries.
- Increased data volumes will require standardization to accelerate analysis and improve insights.

### Patient Impact

- Improved access to critical medications and specialty equipment

### Guidance

- Adopt cloud-based collaboration capabilities to exchange supply chain data with partners.
- Develop in-house capabilities for integration and interpretation of AI and advanced analytics into supply chain scenario planning.
- Use supply chain control towers to orchestrate end-to-end supply networks and mitigate the effects of disruptions.

### ***Prediction 2: By 2024, AI Investments in In Silico Drug Discovery Will Double to Fuel Growth of Genomics and Precision Medicine to Bring Vital Vaccines and Medicines to Patients Faster***

The costs of bringing a drug to the market keep rising, while the internal rate of return keeps decreasing. The life sciences industry must leverage technology to optimize return on investment and bring drugs to the market faster. Companies incur extensive costs as they funnel down from thousands of molecules at the hit generation stage to a few lead candidates. The high costs of a drug do not include just the costs incurred in developing the drug but also cover the losses incurred for the molecules that failed. There is a clear need to fail fast and fail early. This is where AI/ML can make a big difference. Despite constrained IT budgets, IDC foresees a 65% increase in life sciences spending on AI as a percentage of the overall technology spend in the next 12 months. According to IDC's May 2021 *Industry AI Path Survey*, 48% of life sciences respondents plan to increase investments in drug discovery, with close to 70% focusing on precision medicine and genomics and 48% focusing on drug repurposing.

AI/ML and advanced computing are accelerating *in silico* drug discovery. GPU-based transformer models are being used to screen billions of compounds in minutes, and ML is being used to provide computational predictions of protein structures, on par with X-ray crystallography. Gene editing is used to create unique cellular models of genetic diseases, screening these against large drug molecule libraries. Computer vision then determines whether cells recover a healthy phenotype. While these are still early days, the use of AI/ML is not all hype, and pharma is beginning to see results. Drugs discovered using AI for conditions such as obsessive-compulsive disorder, cancer immunotherapy, and Alzheimer's are now undergoing clinical trials, and another drug has been shown to delay the onset of amyotrophic lateral sclerosis. The life sciences industry is opening up to collaborative learning models and industry consortiums, such as the Machine Learning Ledger Orchestration for Drug Discovery (MELLODY) European consortium led by IMI, leveraging federated learning models to drive co-innovation and accelerate drug discovery.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Digital ecosystem** – Thriving in a multiplatform world

### IT Impact

- Increased focus on building scalable and secure digital infrastructure storage
- Adoption of AI/ML to drive a focus on data governance, data sharing, and data privacy

### Patient Impact

- Faster access to innovative therapies and improved clinical outcomes
- Precision medicine enhances patients' trust in the therapy owing to targeted treatments

### Guidance

- Pursue a "multiomics" strategy, embed *in silico* drug discovery in R&D, and upskill teams appropriately to support these areas.
- Leverage AI/ML, GPU-powered transformer models to hyperscale drug discovery.
- Direct systemic industry change and foster collaborative co-innovation models based on cloud-native federated learning platforms.

### ***Prediction 3: By 2025, 75% of Trials Will Be Patient-Centric Decentralized Clinical Trials; 90% Will Be Hybrid and at Least 10% Will Be Virtual, Driven by 30% Growth in Connected Health Technologies***

More than 1,000 clinical trials were stopped or suspended because of the COVID-19 pandemic, creating an urgency for an agile technology-enabled model that could ensure trial continuity along with patient and investigator safety. Regulators worldwide have revisited regulations to offer flexibility, allowing the continuity of clinical trials, enabled by using connected health technologies. Pervasive disruption and a digital-first strategy accelerated the adoption of decentralized clinical trials (DCTs), complemented by the rapid growth in start-ups offering innovative connected health solutions, including wearables and sensors to enable the remote patient monitoring. Telehealth regulations were relaxed, and reimbursement rules were revised. These strategies brought the trial to the patient's home, providing a patient-centric model.

DCTs, as defined by the Clinical Trial Transformation Initiative, are studies executed through telemedicine and mobile/local healthcare providers, using processes and technologies differing from

the traditional clinical trial model. In the hybrid model, DCTs may incorporate tools such as digital recruitment and e-consenting and data collection may be done from a patient's home, complemented by direct-to-patient shipment of drugs, home nursing, and the use of local labs. Fully virtual trials do not require in-person interactions (not to be confused with *in silico* trials, which do not use real participants but computer programs to model participants).

The explosion in connected health technologies and telehealth solutions will lead to patient engagement models being reimaged. Changing societal norms and willingness to adopt technologies are driving a systemic industry change. While some of this is bound to slip back, IDC foresees that three-fourths of trials will be decentralized, with 90% of these being hybrid by 2025. Yet it will be important to provide patients with choices, since some will want to retain the personal touch and be seen in-person by their physicians. Integration of technologies with electronic health records (EHRs) and clinical workflows will reduce physician burnout. Digital upskilling will be essential across pharma, sites, and patients to support rapid adoption of DCTs and overcome the fear of the digital divide.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Engagement reimaged** – From responsive to anticipatory

### IT Impact

- Critical need for establishing data standards and driving interoperability
- Growth of mobile platforms, wearable technology, and digital ecosystems
- A focus on data ownership, data sharing, and data privacy

### Patient Impact

- DCTs to drive a truly patient-centric focus, bringing trials to patients' homes
- Enhanced patient engagement and empowerment, as a result of a sense of data "ownership"

### Guidance

- Design systems with a "patient first" approach, and design to provide scalable models.
- Establish strategic partnerships – DCTs are not about one technology or one product.
- Engage early with regulators, and ensure regulatory compliance.

### ***Prediction 4: By 2025, the Market for Prescription Digital Therapeutics Will More Than Triple, Led by Mental Health and Chronic Conditions, Blurring the Boundaries Between Healthcare and Life Sciences***

Life sciences firms are exploring new ways to harness the potential of technology and offer innovative products that go beyond "traditional pills" to differentiate their offerings on the market. They strive to engage with their ultimate beneficiaries more directly and better meet the expectations of the "Patient sapiens" – the empowered patients of the new digital era – who expect more choice, convenience, and innovative personalized treatments beyond traditional pharmacotherapy.

At the frontiers of healthcare and life sciences, innovative tech-enabled treatment solutions based on software as an "active ingredient" have emerged as the new chapter in therapeutics, referred to as prescription digital therapeutics (PDTs). Prescription-based digital therapies commonly require regulatory approval as "software as a medical device" and can be used independently or in combination with standard treatments. PDTs had already been gaining traction before the pandemic,

blurring the boundaries between healthcare and life sciences. But COVID-19 has provided a whole new impetus, offering new viable remote delivery options for evidence-based treatments for various chronic diseases, easing access to care, and adding resilience to care delivery systems. PDTs help improve patient-provider communication, patient engagement in care processes, and self-management capabilities, while also improving their clinical outcomes and experiences.

Worldwide, evolving regulations are creating a conducive environment, too. Germany has introduced a "fast track" for regulatory approval of prescription digital health applications called DiGA, which can be reimbursed by the country's statutory health insurance. Early last year, the U.S. FDA relaxed regulations for the use of digital health therapeutics to address the rise of behavioral and mental health issues caused by the pandemic. As digital engagement channels and technologies proliferate and life sciences firms strive to reimagine patient engagement models, IDC expects that the global market for PDTs will more than triple by 2025. PDTs will grow particularly fast to fight the "next pandemic" of mental disorders and chronic diseases, accelerated by the disruptions in chronic care and lifestyles during the global health crisis.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Engagement reimaged** – From responsive to anticipatory

### IT Impact

- There will be an enhanced focus on data governance, data sharing, and data privacy.
- There will be a need for intelligent collaboration with clinicians to deliver effective treatments as well as to raise their awareness on PDTs and build appropriate skills and culture.

### Patient Impact

- Proactive engagement of patients in their own care and improved self-management of diseases
- Improved convenience and access to care and improved health outcomes and experience

### Guidance

- Partner with innovative tech start-ups; closely engage with and educate clinicians and patients.
- Investigate the regulatory environment and reimbursement schemes for the use of prescription digital therapeutic products in target markets.

### ***Prediction 5: Investment in AI for Real-World Evidence by Life Sciences Companies Will Double by 2025, Driven by Health Data Interoperability Initiatives and Platforms***

Real-world evidence is playing a growing role in life sciences and healthcare to support decision making in drug and device approvals, development, safety monitoring, clinical trial design, and discovery. RWE may include sources such as electronic health records, claims and billing activities, product and disease registries, patient-generated data, and data gathered through IoT devices such as wearables for both clinical trial patients and patients in therapeutic settings. To that end, life sciences companies are increasing investments in RWE. According to IDC's April 2021 *European Industry Acceleration Survey*, 66% of European life sciences firms have already invested in RWE utilization and about half of them plan to invest next year. The 21st Century Cures Act of 2016 in the United States

presents opportunities for faster FDA approvals for new indication of existing drugs and reducing the cost of clinical trials.

Patient matching and site selection for clinical trials and product safety monitoring have become major use cases for the use of RWE during the pandemic, triggering the utilization of RWE across the broader R&D ecosystem. In IDC's May 2021 *Industry AI Path Survey*, 33% of life sciences respondents already have algorithms in place for utilization of AI in RWE; another 32% planned to deploy in 2021, and 19% plan deployment in 2022 or later. IDC forecasts that investment in AI for RWE by life sciences companies is set to double by 2025.

In the future, RWE will assume a major role in supporting and justifying drug pricing and formulary access. Owing to the huge amount of data involved, AI and prescriptive analytics are being employed to sort through data to develop insights that would be nearly impossible to generate manually.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Digital ecosystem** – Thriving in a multiplatform world

### IT Impact

- Multisource data platforms will combine third-party data with internal data sources.
- Analytics and AI software will be utilized to develop insights from RWE data sources and embedded into interoperable platforms.

### Patient Impact

- Analysis of population-level RWE will result in more innovative therapies and faster approval and time-to-market for drugs and devices.
- Patient privacy will remain a key concern, adhering to regulations such as HIPAA and GDPR. Opt-in will offer a trade-off between personalization benefits and privacy.

### Guidance

- Investigate health data platforms, which can accelerate insights from external data.
- Enlist platform partners with expertise in multiple life sciences functions, from clinical trials and discovery to commercialization.
- Invest in AI and analytics, leveraging data from both internal sources and real-world settings.

### ***Prediction 6: By 2026, Two-Thirds of Life Sciences Companies Will Adopt the Intelligent Lab of the Future Leveraging Digital Transformation, Integrating the Internet of Lab Things***

Labs, data, and the associated equipment operate in silos across the world. To fuel innovation, independent software solutions, such as laboratory execution systems (LES), laboratory information management systems (LIMS), and electronic lab notebooks (ELNs), need to be woven together using a data fabric approach to form an integrated cloud-based, laboratory informatics platform. According to IDC's May 2021 *CloudPath Survey*, about 50% of ELNs, LIMs, and drug discovery solutions and more than 60% of research analytics and collaboration workspaces are on or will be moving to the cloud in two years. In Europe, more than 65% of life sciences firms reported near-term plans to invest in smartlab solutions, according to IDC's April 2021 *European Industry Acceleration Survey*.

The industry needs to move beyond bolting together different technologies constituting a mosaic patchwork of software solutions to an integrated virtual lab of the future (Lab 4.0), leveraging RPA, AI/ML and XR. A laboratory informatics platform should integrate a variety of software tools to support analytics, quality control, and drug discovery. It should integrate inputs from analytical and nonanalytical devices to form the Internet of Lab Things (IoLT), enabling seamless data flows. It should enable simulation, modeling, 2D, 3D, and closed-loop feedback mechanisms, supporting generative drug design.

Very few labs possess the digital infrastructure and know-how to accomplish the vision of a "lab without borders." Digital upskilling and change management will help scientists acquire digital fluency and adapt to agile, scalable, and digitally transformed operating models. It is essential to implement a comprehensive data strategy based on FAIR (findability, accessibility, interoperability, and reusability) data principles, with the right data provenance and governance model. Three-fourths of experimentation is not reproducible because of a lack of traceability of data, inconsistent metadata, and the inability to get to that "single source of truth." A systemic industry change, complemented by digital transformation (DX) and the IoLT, will drive the adoption of the intelligent lab of the future by 2026.

### Associated Drivers

- **The future enterprise** – Thriving in a jungle of agile innovation
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Workforce outlook** – Redefining teams, reinventing models, and rethinking leadership

### IT Impact

- There will be a critical need for establishing data standards and driving interoperability.
- There will be a focus on data governance, data provenance, and the use of AI/ML.
- Cloud-adoption will grow, though some percentage will move back to on-premises models.

### Patient Impact

- Innovative therapies delivered to patients faster
- Improved access to better quality products and better health outcomes

### Guidance

- Harmonize workflows and digital data flows across the organization.
- Implement agile and scalable interoperability solutions.
- Foster innovation by enabling real-time data streaming and secure data sharing.

### ***Prediction 7: By 2026, the Increased Adoption of Medication Adherence Apps, Smart IoT-Based Solutions, and Connected Drug Delivery Systems Will Reduce Treatment Compliance Gaps in Clinical Trials by One-Third***

Ensuring medication adherence remains a top challenge for the industry. As per the World Health Organization (WHO), medication adherence can have a greater impact on patient outcomes than the specific treatment itself. Adherence rates of at least 80% are required to achieve optimal therapeutic outcomes. Pharma usually increases study population size by 15% to reduce the impact of nonadherence on a study's statistical power. This results in longer trials and escalating study costs. Even a 1% increase in adherence yields dramatic cost savings. While the average compliance rate in clinical trials is around 80%, this drops significantly for chronic diseases treatments, with approximately 50% of patients discontinuing their medications within one year of being prescribed, as per the U.S.

Centers for Disease Control. According to the WHO, adherence rates are even lower in developing countries.

While patient compliance is more of an externally driven compulsion, medication adherence is driven through internal motivation. Both need to work hand in hand. Compliance can be monitored using various tools, from less reliable manual techniques (such as questionnaire scales) to more direct, objective methods that may involve measuring drug concentration in biological samples. These latter methods are most accurate but can be invasive and expensive. A growing portfolio of digital tools ranging from mobile apps, wearables, smart pill boxes, and digital pills with ingestible event markers is now available. The increased need for remote patient monitoring (RPM) solutions during the pandemic has accelerated growth of medication adherence apps and IoT-based monitoring tools.

Life sciences companies worldwide reported 49% increase in spending on IoT projects, such as RPM, due to COVID-19 (source: IDC's *Future of Enterprise Resiliency Survey*, February 2021). The market is seeing a rapid growth in connected IoT-enabled systems for drug delivery (smart injectors, smart inhalers, and innovative integrated drug/device combinations and closed-loop delivery systems) that foster medication adherence and dose optimization, as well as patient convenience for self-administration. IDC expects that treatment compliance gaps in clinical trials will be reduced by one-third by 2026.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Embracing digital first** – New strategies for complexity and ubiquity
- **Engagement reimagined** – From responsive to anticipatory

### IT Impact

- Growth of real-time data streaming and an enhanced focus on interoperability
- Data governance, data privacy, and data security to gain increasing importance
- Optimization of the UX and the use of ML to enable real-time intelligent monitoring

### Patient Impact

- Patient-centric solution, enabling real-time monitoring of longitudinal data, preventive action
- Patients to have concerns regarding data privacy, security, and ownership

### Guidance

- Hire experts that will focus on responsible and ethical AI and clinically validated solutions.
- Prioritize data privacy and security and ensure consent.
- Educate patients, providers, and pharma on the strengths and limitations of the technology.

### ***Prediction 8: The Use of Digital Twins in Manufacturing and Supply Chain Planning at Multinational Life Sciences Firms Will Double by 2026, with Deeper Adoption in R&D Coming Later***

Digital twins are becoming important in several facets of life sciences manufacturing. Simulation of manufacturing line layout is being used by life sciences companies to quickly install new lines or changeover to new products in existing facilities. Digital twins of life sciences supply chains are being constructed as companies make decisions on the location of manufacturing and warehousing facilities and to simulate alternative sourcing vendors and geographies.

Life science companies are making IT infrastructure decisions in anticipation of increased roles for digital twin capabilities. In IDC's May 2021 *Industry CloudPath Survey*, 55% of life sciences respondents cited digital twins as "important" or "very important" in choosing a cloud services provider. According to IDC's May 2021 *Industry AI Path Survey*, AI in supply chain orchestration (in control towers and supply chain digital twins) is already being deployed at life sciences firms, with 43% of life sciences respondents citing the current use of AI, and 27% planning on using AI within the next year.

In R&D, digital twins representing patients are being developed that may predict reactions to medicines or devices, choose between various drug delivery devices, and simulate reactions in patients using other medications or who may have comorbidities. IDC predicts that the adoption of digital twins in life sciences manufacturing and supply chain applications in life sciences will double by 2026, where benefits are already apparent.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **The future enterprise** – Thriving in a jungle of agile innovation
- **Digital ecosystem** – Thriving in a multiplatform world

### IT Impact

- Life sciences firms will adopt software and methods from discrete manufacturing such as product life-cycle management, computer-aided design, and process simulation.
- Cloud-based systems that allow collaboration with supply chain partners will increase the accuracy of digital supply chain twins.

### Patient Impact

- Modeling of manufacturing lines and supply chains will allow faster time to market for innovative medicines and devices.
- Digital twins in supply chains will help prevent or minimize disruptions, leading to more reliable availability of drugs.

### Guidance

- Hire experts familiar with digital twins from industries such as automotive and consumer packaged goods to gain a head start, as there is a paucity of this skill set in the life sciences industry.
- Partner with experienced vendors bringing both technical and life sciences industry expertise, including software and systems integration.

### ***Prediction 9: Triggered by COVID-19, Half of New Business Value Created in the Global Life Sciences Market by 2026 Will Be Driven by Cloud-Based Digital Ecosystems and Federated Learning, Powering R&D Co-Innovation***

COVID-19 has pushed life sciences players worldwide to collaborate at a near-global scale to enhance crisis response. Co-innovation has become particularly urgent to fast-track R&D efforts. This urged the need for creating standardized secure environments to enable real-time sharing of multisourced data and findings and analytic capabilities and compute across broader R&D networks.

A few large-scale multistakeholder initiatives were launched in 2020. The European Bioinformatics Institute launched the European COVID-19 Data Platform, connected to the European Open Science Cloud, to provide an open, trusted, and scalable platform and a shared computational space for secure data exchange and global collaboration. In the United States, the Accelerating COVID-19 Therapeutic

Interventions and Vaccines (ACTIV) partnership was launched by the NIH for data sharing and collaboration with relevant U.S. agencies as well as the European Medicines Agency, academia, and pharma. Recognizing the role of cloud-based digital ecosystems in expediting R&D, particularly for rare diseases and unmet medical needs, and collaborative applications is a top investment priority for life sciences companies. In Europe, 70% of life sciences firms are participating, or planning to join, an industry digital ecosystem (source: IDC's *European Industry Acceleration Survey*, April 2021). To power R&D co-innovation, the industry is actively exploring federated learning models that can support collaboration across multiple competitive partners. Federated learning allows companies to build shared machine learning models using multiple decentralized data sets, while preserving owners' control over data and ensuring data privacy and security. Several collaborative learning platforms were deployed recently, such as the one deployed in the MELLODY project launched in 2020 by IMI and the European consortium to support drug discovery collaboration among leading pharma.

Life sciences organizations' ability to generate value will increasingly rely on their participation in agile ecosystems that leverage cloud-based platforms to enable sharing of data and insights at scale. This will drive a systemic industry change. IDC predicts that half of new business value created in global life sciences market by 2026 will be driven by cloud-based digital ecosystems and federated learning.

### Associated Drivers

- **Digital ecosystem** – Thriving in a multiplatform world
- **The future enterprise** – Thriving in a jungle of agile innovation
- **Cybersecurity and risk** – The threat environment just keeps scaling

### IT Impact

- Growth in cloud-based platforms focuses on data security, governance, and interoperability.
- Growth of digital ecosystems will create new opportunities and require building new capabilities for the utilization of real-world data.

### Patient Impact

- Faster access to diagnostics, therapeutics, and vaccines for unmet medical needs
- Improved clinical outcomes and experiences and improved quality of life

### Guidance

- Design and execute an intelligent ecosystem strategy to ensure long-term resilience.
- Enhance AI capabilities and explore federated learning models supported by blockchain.

### ***Prediction 10: Integrated Research Organizations Will Double in Number by 2027, Fueling the Adoption of Clinical Research as a Care Option Within the Healthcare Ecosystem***

Clinical research as a care option (CRAACO) provides clinical trial participation as a viable medical care option to eligible patients, with dual objectives of accelerating clinical research and improving population health. In a survey conducted by the Center for Information and Study on Clinical Research Participation (CISCRP) in 2017 on 12,427 individuals from 68 countries, it was found that 44.9% reported that clinical trials were rarely considered as an option when discussing treatment options with their physicians, and 59% were not aware where studies were being conducted. In a survey conducted in May 2021 by the British National Institute for Health Research (NIHR), it was found that 78% of respondents think health research should be offered as part of NHS routine care. Yet only 13% of respondents reported they were aware that opportunities to take part in research existed in every U.K.

hospital. A lack of awareness of trials has resulted in less than 1% of the U.S. population and only a small percentage of the global population participating in clinical trials, despite a clear interest in the same.

With most physicians being employees of a healthcare system, the "systemization" of healthcare has created complexities, limiting their ability to participate in clinical trials. There is an urgent need to not only increase awareness about clinical trials but to provide patients with opportunities to participate in trials within the healthcare ecosystem itself. Integrated research organizations (IROs) are connecting the dots between healthcare and research, driving a systemic industry change, aligning clinical trials with unmet patient needs and population health initiatives. This change will result in the doubling of IROs by 2027, fueling the adoption of CRAACO within the healthcare ecosystem.

### Associated Drivers

- **Pervasive disruption continues** – Volatility, opportunity, and resilience
- **Digital ecosystem** – Thriving in a multiplatform world
- **Engagement reimaged** – From responsive to anticipatory

### IT Impact

- There is an urgent need to establish data standards and drive interoperability.
- There will be a focus on data governance, data sharing, and data privacy.
- Digital ecosystems, integrating healthcare, and research workflows will be established.

### Patient Impact

- CRAACO will increase access to care, improve outcomes, and drive patient centricity.
- CRAACO will provide patients with treatment choices and make them feel empowered.

### Guidance

- Embed critical roles, streamline clinical workflows, and integrate trials within healthcare ecosystems.
- Steer interoperability initiatives and design road maps to pull data directly from electronic health records and electronic data capture (EDC) systems to create a "source to submission" model. Establish data governance and data sharing models.
- Increase clinical trials awareness, drive not only a patient-centric but a people-centric (including caregivers) focus, and increase patient and provider involvement.

## ADVICE FOR TECHNOLOGY BUYERS

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The COVID-19 pandemic served as a wake-up call for the life sciences industry. Not only did it drive the industry to rapidly adopt innovative technologies to deal with the crisis, but it also made its executive leadership rethink its strategies. The life sciences industry had to transition from operating like a large, lumbering elephant, operating on high margins, to moving with the agility and the nimbleness of a deer on the run to survive. It experienced pressures like never before, but it accepted the challenge, leveraged technology, and swiftly changed paths, and yes, it delivered. Clinical trials not only continued, but new ones were also started. Vaccines were developed in record time, and intelligent supply chains enabled timely and equitable access. From an inward-looking culture, this industry transitioned to a model of collaboration and co-innovation, and one saw the rapid growth of digital ecosystems and the explosion of new start-ups. In an industry where regulatory compliance is

critical, the life sciences industry had to be creative, think outside the box, and yet, not color outside the lines.

IT executives at life sciences organizations must take into consideration the following while developing their strategic road map:

- **Focus on patient-centric solutions.** As the industry innovates, it is critical that patient experience shapes digital transformation, rather than the other way around. With growth of decentralized clinical trials, there has been a plethora of remote patient engagement solutions that have been developed. It is important to truly assess how these are perceived by the end user, namely, the patient, and how seamlessly they integrate with their daily lives. Solutions need to be customized based on the demographics of the patient population and the nature of the disease, and a "one size fits all" model will not necessarily yield the best results.

In addition, solutions need to address the ecosystem of care within which the patient dwells, including caretakers as well, as they share the healthcare journey of the patient. While mobile apps drive medication adherence and prescription digital therapeutics constitute a new digital strategy to treat disease and improve clinical outcomes, there needs to be a laser focus on trying to understand the impact on their quality of life and to incorporate the voice of the patient in solution development. While the industry may believe that the digital solutions that are being developed are state of the art (SOTA), patient optionality must be integrated into the solution, providing patients with the choice to pick and choose what works best for them.

- **Optimize the use of real-world data (RWD).** There is an aggressive focus on leveraging real-world data to derive insights, and they are being applied across all aspects of the life sciences industry. This has brought healthcare and life sciences industries closer than ever before. While the healthcare industry has data to offer and the life sciences industry wants to leverage those insights, both parties are trying to figure out the answers to multiple questions. The healthcare industry is trying to determine the best data monetization strategies and evaluate whether it should productize data, offer insights, or provide an analytics platform as a solution. Meanwhile, the life sciences industry is trying to assess how best to consume these offerings and has not really leveraged full value out of the data it has acquired. The offering needs to be customized to the specific needs of the pharma industry, and there has to be a dialog between both parties so that it is a win-win for both parties.
- **Develop flexible, modular solutions to drive interoperability.** The life sciences industry is just recovering from the challenges posed by the pandemic. IT budgets are constrained, and the industry is not looking at retiring legacy systems and making huge investments in new solutions. In view of the same, it is of essence to provide modular, flexible, and scalable "plug and play" interoperable solutions that can be easily integrated within existing workflows, while delivering high value.
- **Integrate solutions within electronic health records and clinical workflows.** Adoption of solutions by sites will increase when they are integrated with EHRs and workflows, minimizing the investigator's administrative burden, and help integrate clinical research as a care option within the healthcare ecosystem.
- **Embed AI/ML and other innovative technologies to accelerate innovation.** The industry is looking for automation, real-time insights, and accelerated innovation. Use RPA, AI/ML, GPU-powered transformer models, data streaming, and a data fabric approach to drive innovation.
- **Transition from offering transactional IT solutions to becoming a strategic partner for life sciences companies.** The life sciences industry has dealt with a lot in the past year or two, and

it is looking for IT partners that can not only implement solutions but partner with them to provide them with strategic inputs on their digital road map.

- **Reshape your digital infrastructure.** A secure, scalable, and highly available IT infrastructure is the stepping-stone of digital transformation. The pace of digital network modernization has ramped up to address the emerging needs of life sciences ecosystems, with which a traditional legacy infrastructure cannot keep up. Pharma companies should leverage the new opportunities offered by the cloud, including the ability to manage, maintain, and upgrade the vast array of IT systems and clinical solutions. Recent IDC surveys show how the need to support workflows with new capabilities and increasing automation and resources orchestration are top priorities related to datacenter modernization.
- **Infuse digital resiliency to accelerate growth.** The pandemic continues to play out, and disruption has not stopped. Emerging challenges such as COVID-19 variants, data proliferation, at speed and at scale, and new cyberthreats add to preexisting ones such as expiring patents, decreasing rate of returns, escalating R&D costs, and disparate and disconnected systems. Limited budgets further challenge the ability to advance DX via new technology investments. Enabling digital resiliency is rising on executive agendas. According to IDC's May 2021 *Digital Transformation (DX) Executive Sentiment Survey*, 62.5% of the life sciences industry sees digital transformation as critical to its success and 54% of the life sciences industry is prioritizing digital resiliency as a part of its strategic road map.  
Initiatives driving digital resiliency should focus on improving data infrastructure, information exchange, and capabilities to improve access and experience, automate and optimize workflows, and facilitate workforce collaboration. Leaders should also carefully consider the implications of such initiatives from cybersecurity and regulatory standpoints.

## EXTERNAL DRIVERS: DETAIL

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### Pervasive Disruption Continues – Volatility, Opportunity, and Resilience

- **Description:** In an interconnected world, any disruption is felt across the entire ecosystem, leading to more volatility, challenges, and opportunities. Survival is linked not to size or strength but to resilience and the ability to change – to move quickly, adapt, seize opportunities, and be ready for the next disruption. Adaptations and lessons learned from the COVID-19 pandemic are becoming permanent, requiring revised global business and operating models. Digital resilience approaches counter supply chain disruptions. Organizations are preparing for the return to office, the return to travel, new consumer spending patterns, the challenges of finding higher-cost talent, and the possible return of inflation in an environment of continued economic uncertainty. Innovation and digital resiliency become key to navigating ongoing disruption. Beyond headwinds like the pandemic are crosswinds like exponential scientific advancements and innovations enabled by enormous compute resources – leading to advances in healthcare, food production, alternative energy generation, and storage. The pace of disruption may, in fact, be increasing.
- **Context:** OECD revised its economic outlook for 2022 to 4.4% GDP growth due to strong vaccine rollout and "massive fiscal stimulus by the United States." The global economy, after 18 months of shock, has recovered to pre-pandemic levels. However, the global recovery is uneven. Many countries, vulnerable to a lingering recession, will require three to five years to return to pre-pandemic standards. IDC reports that with growing global growth, 71% of decision makers give top priority to digital infrastructure resiliency investments over the next two years. IDC projects global IT spending to increase in parallel with GDP growth in 2021 and to exceed GDP growth in 2022-2024 (~5%). Digital innovation investments continue to support

growth in digital resiliency. "An uptick in forward-looking investments aimed at accelerating the business should ensure that core investments remain stable and digital transformation remains a top priority."

## Cybersecurity and Risk – The Threat Environment Just Keeps Scaling

- **Description:** Cyberattacks keep making global headlines. Reliance on digital channels, ecommerce, and other virtual interactions exposes new attack surfaces and vulnerabilities, exploited by sophisticated global actors. The bleeding edge of digital transformation – health reporting, contact tracing, and hybrid work models – adds to the potential risk to personal information. Ransomware, phishing, email compromise, insider threats, and nation-state attacks are increasingly common events that cause significant disruptions, high costs, and reputational damage. Affected organizations talk about pre-hack versus post-hack approaches to the chain of management, policy, and process: Cyberthreats now pose serious financial risks. Effective management of risk and trust is a new competitive advantage in which "trust = value, brand, and reputation"; now, a trust framework incorporates security, compliance, privacy, and social responsibility and ethics. In a digital-first world, what is considered critical infrastructure is changing rapidly. On a national level, critical infrastructure is increasingly at risk from ransomware and nation-states, especially where it is privately owned. Governments are focusing on cyber-risk within their borders and as part of international diplomacy. Security efficacy and controlling environments in real time will come into play in determining negligence and culpability.
- **Context:** Cybercrime keeps on growing, with worldwide damages expected to reach \$6 trillion in 2021. Headline breaking events occurred in logistics, tourism, healthcare, software, and supply chain and state, local, and national governments. Perhaps the most striking was the massive attack on SolarWinds that affected thousands of systems, including those of Intel, Cisco, and Microsoft. Financially motivated actions accounted for more than 90% of incidents, with organized crime accounting for 80% of the actors. Cyber-risk may be experiencing a crossover from crime to critical infrastructure. Ransomware affecting a fuel pipeline in the eastern United States set off a wave of panic buying, while Babuk, the cybercrime organization, announced it was quitting its illicit affiliate program in favor of data theft extortion. Verizon calculates that the probability that someone in any company of over 50 people will receive a malicious URL or APK is essentially 100%.

## The Future Enterprise – Thriving in a Jungle of Agile Innovation

- **Description:** The COVID-19 pandemic proved that organizations that were well along the path to being digital businesses are surviving much better – even prospering under the pressures. Future success no longer relies on imagining what the future will look like or scrambling to adjust to immediate disruptions but rather on continuous innovation in response to "every moment" challenges and opportunities. And innovation is not just internal; organizations need to extend innovation into their ecosystems, including with partners. Innovation's accelerating velocity is enabled by digital technologies, software, AI, and cloud, which fundamentally democratize access to the building blocks for innovation. Digitally native start-ups, looking to disrupt existing industries and business models, add more urgency. Changes are everywhere: in banking and financial transactions, the workforce, decentralized corporate governance, data provenance, edge computing, and elsewhere. Dynamic change provides a constant imperative to innovate both technology and cross-functional solutions. Organizations with the ability to quickly sense and respond to market changes and dynamics are key to strategic innovation in the enterprise now and in the future.

- **Context:** Now more than ever, organizations are looking for new ideas and innovative practices to improve the effective use of resources and accelerate the ability to deliver digital products and services to customers, patients, and constituents. IDC predicts that by 2024, 80% of enterprises will overhaul relationships with their suppliers, providers, and partners to better execute digital strategies for ubiquitous deployment of resources and for autonomous IT operations. Ecosystem business models are emerging across multiple industries, and some of those most significantly affected by this change will be the IT industry itself. At the same time, IDC predicts that up to a quarter of Fortune 500 companies will have to become software producers to digitally transform and maintain their Fortune 500 status. Wherever the future takes us, those organizations with the ability to innovate with multifaceted solutions to dynamic changes will come out on top.

## Embracing Digital First – New Strategies for Complexity and Ubiquity

- **Description:** During the pandemic, changes in behavior, consumption, and supply forced companies to adopt digital-led business and operating models that endure lockdowns, movement restrictions, social distancing, and more. Work from anywhere, connectivity, scalability, security, throughput, resiliency, and redefining internal processes for remote access will define the next normal. Organizations are shifting to a complex hybrid world, changed by delivery of "anything, anywhere" and customer requirements that redefine product and service expectations. As national economies emerge from the pandemic, there is pent-up demand for products and services, especially in tourism, hospitality, entertainment, and travel. Some consumers have amassed household savings. The confluence of heightened savings, pent-up demand, and a return to normalcy will create strong growth for many, but not all, businesses – exacerbating the inequities of recovery and prolonging supply disruptions. However, the spike in demand may be the first wave of permanently altered behaviors and systemic changes. Enterprises must address the complexity and continued evolution of hybrid work, delivery, customer engagement, and supply models. Exponential change will come from successfully embracing and exploiting new complexities in innovative ways.
- **Context:** COVID-19 has acted as an accelerant to adopting digital-first business and operating models. Consumers are expecting to return to in-person shopping and still have delivery anywhere, anytime. Employees are expecting to work from anywhere and go into the office. United Airlines CEO Scott Kirby predicts "huge pent-up demand" for business travel, despite the general adoption of virtual meetings – "as tough as this pandemic has been, it has not changed human desire to be together." OECD projects global economic growth to be 5.8% in 2021 as demand increases with the vaccine rollout. WFH or WFAnywhere has created unexpected demand for long-term "workacation" rentals. Airbnb reports that a significant portion of rentals are now for 30+ days. A hybrid and more complex model is the new strategy.

## Digital Ecosystem – Thriving in a Multiplatform World

- **Description:** Understanding, participating in, and provisioning the digital ecosystem that will sustain, advance, and scale business and operations are essential for every business. A digital business platform, the architecture to support the future enterprise, is the assembly of technologies, capabilities, and data upon which digitally enabled organizations run. In the emerging multiplatform world, infrastructure, pervasive compute power, data management, intelligence, and connectivity can all be provided independently as services. The new dynamic is to integrate them at scale to gain control and minimize technical debt while still providing choice. Becoming a digital business requires a shift from traditional, linear processes that start and end in the organization toward platform-based, data-driven value chains that link to external partner ecosystems. The open integration of platforms into those ecosystems plays

together better than other models based on closed alliances and facilitates innovation across the enterprise and across the business ecosystem. This enables the network effect of ecosystem economics to generate new value beyond the organization or technology itself.

- **Context:** The digital economy has spread rapidly throughout the world. Leading organizations are shifting from digital platform thinking to new digital ecosystems to evolve their business models, capture innovation, and manage technology architecture. IDC predicts that by 2023, the need for G2000 companies to access and monetize multipartner solutions will lead to fivefold growth in marketplaces facilitated by SaaS-based ecosystem orchestration platform deployment. And that by 2024, net-new production-grade cloud-native apps will increase to 70% of all apps because of the adoption of technologies such as microservices, containers, dynamic orchestration, and DevOps. This represents a fundamental shift in business strategy – moving beyond product differentiation and pricing toward ecosystem-based value creation and the transformation into digital-native enterprises.

## Workforce Outlook – Redefining Teams, Reinventing Models, and Rethinking Leadership

- **Description:** A heightened focus on the employee experience is driving momentum for digital collaboration and hybrid models of work that enable employees to function both remotely and from company facilities. Challenges facing the 21st century economy require that workers engage as dynamic and reconfigurable teams that can quickly adapt to business demands and new market requirements. Organizations are becoming more agile and less hierarchical, refocusing on employee engagement and cross-functional collaboration and redrawing traditional boundaries. A significant challenge, the global competition to find, hire, and retain digitally skilled employees is now paired with the challenge to find employees skilled in communication, critical thought, and creativity. Complementing the shift to work from home, new models are emerging in fabrication/assembly, patient/citizen care, and warehousing/transport, changing the work experience, environments, and definition of digital work. Organizations need to rethink their relationship with workers and the creation and retention of skills to meet this demand both in person and digitally in the flow of work.
- **Context:** IDC's *2021 Future Enterprise Resiliency Survey* indicates that 49% of respondents anticipate remote and hybrid work models will be an embedded part of accepted work practices for many industries. Organizations are increasingly focused on being resilient in the face of uncertain global and business challenges, including enabling flexible work (and contract) models. These models are driving the acceleration of technology innovation focused on offering a parity of experience for workers who must access key resources across different locations, time zones, and devices. The rise of cloud platforms is enabling employees to work more independently and focus on outcomes. Physical facilities are also changing dramatically to offer safe and instrumented opportunities to support hybrid collaboration.

## Engagement Reimagined – From Responsive to Anticipatory

- **Description:** The COVID-19 pandemic has shifted what customers care about and how consumers and brands engage and interact. Self-service and "delivery anywhere" are now enduring customer engagement practices. The online digital experience has become more important in distinguishing one brand from another. Companies with the best price, coolest product, or most memorable marketing campaign do not necessarily have an advantage compared with companies that provide "empathy at scale" in safe, secured, and seamless experiences. The boundary between customers and employees is blurred, while a wealth of data allows companies to emphasize personalization and a consistent contextual experience. At the same time, this explosion of data accentuates the importance of data security.

Customers care about the safety and security of employees, how customer data is collected and used, and a company's environmental and social justice efforts. Companies need to understand the different contextual expectations of their customers – whether they are students, patients, consumers, or businesses – and shift how they engage and support their customers to create experiences that are empathetic, personal, compelling, and relevant.

- **Context:** IDC's *Future Enterprise Resiliency Survey* shows that 51.3% of enterprises worldwide expect to increase spending on customer engagement applications to stay connected digitally and intelligently with their customers. Even as more traditional physical customer interaction channels return, staying digitally connected in real time with the end customer remains the predominant method to deliver relevant and timely communications. The use of intelligent analytics-driven platforms ensures that the outcome of any customer journey is the right one. Organizations continue to focus on consistently connecting with existing customers, patients, and citizens – through ongoing engagement and collaboration – that will help drive new products, services, and experiences. The need for a hybrid physical/digital product and service capability across every industry continues to accelerate.

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### Related Research

- *IDC TechBrief: Prescription Digital Therapeutics for Life Sciences* (forthcoming)
- *IDC Perspective: Decentralized Clinical Trials – Finding a Clear Path Forward Post-COVID-19* (forthcoming)
- *IDC TechScope: The Virtual Lab of the Future* (forthcoming)
- *IDC PeerScope: RWE in European Life Sciences* (forthcoming)
- *Critical External Drivers Shaping Global IT and Business Planning, 2022* (IDC #US48047121, October 2021)
- *SAP Industry Base Camp 2021: Focus on Cloud and Ecosystems* (IDC #US48179421, September 2021)
- *European Life Sciences Key IT Deals and Initiatives Update, Q2 2021* (IDC #EUR147232821, September 2021)
- *Dassault Systemes-Medidata Industry Strategy* (IDC #US48058621, August 2021)
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- *GPU-Powered Transformer Models Poised to Accelerate Drug Discovery and Disrupt Drug Development* (IDC #US47660321, May 2021)
- *The Digital Disruption of the Life Science Industry: 2021 Top Trends* (IDC #US47623021, April 2021)
- *From the Lab to a Jab: A Review of COVID-19 Vaccine Management Solutions* (IDC #US47584421, April 2021)

- *Engaging with "Patient Sapiens" - How Pharma Can Realize New Opportunities Through Digital Patient Engagement* (IDC #EUR147232721, April 2021)
- *IDC TechScape: Worldwide Life Science R&D Patient Engagement Technologies, 2021* (IDC #US47552421, March 2021)
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- *U.S. Life Science Top 10 Market Trends for 2021* (IDC #US46583321, February 2021)
- *IDC PlanScape: Digital Transformation for Patient Engagement in Pharma - The Landscape of Opportunities* (IDC #EUR146000820, January 2021)
- *Leveraging Cloud, AI and Analytics to Derive Insights for Biomedical Research Using Terra, a Next-Generation, Open Source Platform - A Microsoft, Verily, Broad Partnership* (IDC #lcUS47316621, January 2021)
- *IDC TechBrief: Digital Technologies for Mental Health* (IDC #EUR147156220, December 2020)
- *The New Impetus for Real-World Data in Life Sciences: COVID-19 and Beyond* (IDC #EUR246718320, July 2020)
- *Coronavirus Slams Medical Supply Chains - Can Technology Help?* (IDC #US46180220, April 2020)
- *The Life Sciences Fast Track to Combatting COVID-19 in Europe: Intelligent Collaboration at Scale* (IDC #EUR246236220, April 2020)

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