Hype Cycle for Higher Education, 2023

Generative AI has pushed higher education into a frenzied state globally, and stakeholders are considering how to leverage automation, business intelligence and immersive technologies. Higher education CIOs can influence how to foster innovation, engage students and meet stakeholder expectations.

Analysis

What You Need to Know

Higher education faces an ongoing challenge of managing and sustaining the digital acceleration forced upon it by the COVID-19 pandemic and the recent rise in generative AI. Growing skepticism about the value of higher education, combined with relentless financial strain and the competitive market landscape, highlights persistent questions about:

- Accountability and opportunities to incorporate new business and operating models

- Shifting demographics and learner expectations

- Changing workforce expectations

- Hybrid environment and the impact of technology on teaching and learning

As higher education continues to redefine itself, CIOs must move away from the COVID-19 pandemic response mode and refocus their efforts on next-level innovation strategies. CIOs should focus on collaborating with stakeholders to compose a strategy that introduces:

- New ways of thinking

- Development of new processes

- Delivery of expected technology components that are critical to successful transformation

For CIOs to influence and lead this new strategic initiative, they must ensure the institution has appropriate capabilities in place to:

- Harness technology to enrich human interaction at scale

- Promote operational intelligence by leveraging real-time information

- Automate, outsource or eliminate repetitive tasks with due diligence

Our innovations highlight technologies and innovation that advance business capabilities to transform business models, business strategies and institutional operating models with focus on:

- Learning and teaching

- Student experience/engagement

- Data and analytics

- Research

- Efficiency and optimization

The Hype Cycle

The 2023 Hype Cycle highlights how higher education has successfully accelerated use of technology in support of shifting expectations and altered priorities. Higher education's transformation is more apparent as institutions struggle with supporting, sustaining and balancing their reinvented landscape of face-to-face (F2F), hybrid and virtual services around teaching, learning, student engagement, remote work and the hype surrounding artificial intelligence (AI).

AI has been available in multiple forms across higher education for some time; however, the introduction of OpenAI's ChatGPT in late 2022 has created an eruption of hype surrounding the use, integrity, value, risks and augmentation of AI products and services(in particular generative AI). The peak is packed with IPs focused on different types of AI, each relevant to and augmenting specific higher education drivers such as engagement, scaled learning, automation and intelligence. This research includes new innovations such as:

- Decision intelligence

- Responsible AI

- Everyday AI

- Generative AI
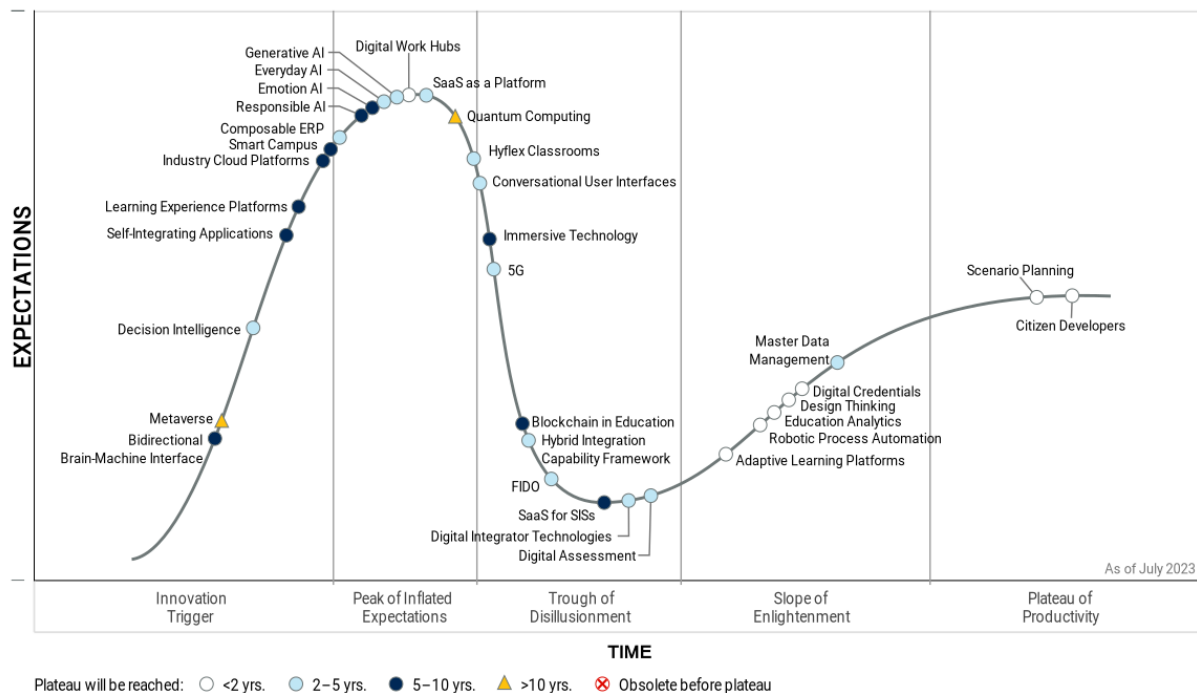
- Conversational user interfaces

Several innovations reflect nuanced designation of previous innovations. Conversational user interface (CUI) has been updated to encompass a broader set of technologies including chatbots and those that are generative AI enabled. This change has resulted in a slight backtrack in CUI's expected time to maturity. AI in higher education has been split into everyday AI, responsible AI, emotion AI and generative AI to better delineate the variations. Others such as decision intelligence and CUI offer the promise of targeted, personalized and automated action. Each new innovation shows that they are being adopted outside of the education industry, but they are still shaping higher education stakeholder expectations.

This year technology's impact is evident and pervasive. The immature technologies climbing the peak offer the greatest potential regarding relative impact, while the increasing number of mature innovations align nicely with the digital momentum institutions gained responding to the global disruption of the past three years.

The introduction of generative AI, and in particular ChatGPT, in late 2022 has created an eruption of hype for educators surrounding the use, integrity, value and augmentation of all types of AI products and services.

Figure 1: Hype Cycle for Higher Education, 2023

Hype Cycle for Higher Education, 2023

As of July 2023

Plateau will be reached: ○ <2 yrs. ○ 2–5 yrs. ● 5–10 yrs. ▲ >10 yrs. ⊗ Obsolete before plateau

The Priority Matrix

All but four of 2023 innovations project high or transformational benefits as these technologies can redefine institutional capabilities. Eight innovations — adaptive learning, digital credentials, citizen developers, design thinking, digital work hubs, education analytics, scenario planning and RPA — are on pace to reach mainstream adoption in less than two years. A larger group of 13 innovations are projected to reach mainstream adoption in two to five years. When combined with the previous eight, these 21 innovations emphasize the force of technology on higher education's evolving landscape while providing CIOs and their institutions with opportunities to:

- Influence teaching, learning, assessment and research.

- Improve administrative services and delivery.

- Replace mundane tasks with purpose-driven institutional endeavors.

Over the next five years, CIOs focused on enhancing their institutions' digital capabilities should target initiatives on the transformational and high-benefit rating cluster as they offer the greatest potential for educational and operational impact. CIOs should prepare for changes in user experience and business capabilities by experimenting with innovations leveraging multiple types of AI, composable ERP, digital integrator technologies, immersive technologies, and the expansion of mainstream education analytics and CUI. CIOs must gauge how these innovations fit in with their institutional strategies and prepare now for their deployment.

We continue to incorporate non-industry-specific innovations (such as digital work hub, quantum computing, 5G and FIDO) to illustrate their maturity, standing and relevance. Institution leaders must use institutional context and maturity when evaluating if these technologies are pervasive enough to build new services or curricula on top of them.

> **CIOs must gauge how these innovations fit in with their institutional strategies and prepare now for their deployment.**

Table 1: Priority Matrix for Higher Education, 2023

(Enlarged table in Appendix)

Benefit	Years to Mainstream Adoption			
↓	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational	Adaptive Learning Platforms Digital Credentials	Composable ERP Conversational User Interfaces Decision Intelligence Everyday AI Generative AI	Emotion AI Industry Cloud Platforms Responsible AI Self-Integrating Applications	Metaverse Quantum Computing
High	Citizen Developers Design Thinking Digital Work Hubs Education Analytics Scenario Planning	5G Digital Assessment Digital Integrator Technologies FIDO Hybrid Integration Capability Framework Master Data Management	Bidirectional Brain-Machine Interface Blockchain in Education Immersive Technology SaaS for SISs Smart Campus	
Moderate	Robotic Process Automation	Hyflex Classrooms SaaS as a Platform	Learning Experience Platforms	
Low				

Source: Gartner (July 2023)

On the Rise

Bidirectional Brain-Machine Interface

Analysis By: Sylvain Fabre, Annette Jump

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Definition:

Bidirectional brain-machine interfaces (BMIs) are brain-altering neural interfaces that enable two-way communication between a human brain and a computer or machine. Bidirectional BMIs not only monitor the user's EEG and mental states, but also allow some action to be taken to modify the state of the brain based on analytics and insights. Brain state modification occurs via noninvasive electrostimulation through a head-mounted wearable or an invasive implant.

Why This Is Important

BMI wearables can be as simple as a noninvasive, affordable headband, yet they can provide a massive net societal impact and benefit in terms of illness and accident prevention, comparable to a simple vaccination program. Therefore, this is not only a futuristic, expensive, invasive solution for the few, like Neuralink, but also a simple gadget for the benefit of the many, provided adequate security and privacy measures are in place. When connected, these enable the Internet of Brains (IoB).

Business Impact

Over the next 3 to 10 years, BMIs will enable business use cases, including authentication, access and payment, and support immersive analytics and workplaces; interactions in the metaverse; and control of power suits or exoskeletons. What is unique about "bidirectional" BMIs versus other classes of wearables/ingestibles is their brain-altering capability. Examples may include boosting alertness in response to a pilot's EEG markers of fatigue or applying relaxing cortical currents to the brain of a harried nurse.

Drivers

- Industrial safety, sports performance, marketing and audience testing, as well as consumer wellness, appear to be the most promising early drivers for bidirectional BMIs.

- Demand is growing from large consumer-focused corporations and media companies, as some of these solutions can measure the response and attitude of consumers toward products, content and companies.

- There are already applications of one-way BMI wearables, where the focus is about monitoring the state of the user or using the user's intent to operate some external device. Examples include measuring fatigue and alertness in a driver without trying to externally modify the user's mood.

- Further adoption of consumer and corporate wellness; for example, using neurotechnology to both monitor and stimulate brain function, as well as improve sleep.

- Use of BMIs as a human-machine interface to interact with emerging metaverse environments among consumers and business users.

- Direct read-and-write access to brain activity creates many opportunities for workforce enablement.

- Productivity and neurodiversity initiatives will increase the need for connections between humans, the Internet of Things (IoT) and the IoB.

- Neuralink obtained FDA approval for human trials from implantable chips in May 2023.

Obstacles

- Bidirectional BMI faces some of the same problems linked with smart wearable devices, such as high cost for early products, slow user adoption, high drop-off rates for some smart wearables and the complexity of integration between various data systems.

- Since bidirectional BMIs are a more advanced and extreme form of wearable (in effect, an implant equivalent, with bidirectional connectivity), providers must offer more affordable products with increased functionality, without added invasiveness to improve acceptability

- Bidirectional BMIs create very specific security challenges, because they directly interface with the human brain. This creates new vulnerabilities to individuals and their companies by adding a vector of attack into users' psycho-physical space.

- Social acceptance, especially for the more conspicuous form factors, may be a long way off.

- Bidirectional BMI raises serious ethical concerns, including human factor issues such as altering users' perception of reality, memories or even their personality.

User Recommendations

- Prepare for bidirectional BMI devices creeping into enterprises; "bring your own device" (BYOD) may occur long before specific legislation is in place.

- Ensure customer safety and business security by implementing data anonymity and privacy (beyond current legislation such as General Data Protection Regulation [GDPR]) for brain-wearable data collection and management.

- Highlight trade-offs in wellness solutions: more data may not equate to improved outcomes when looking at complex systems such as the human brain.

- Set up an independent steering board to monitor products sold to consumers and provided for employees. Preempt potential legal liability by regularly reviewing implanted wearables' features, data governance policies and their use cases, and deciding on what is acceptable in terms of read/write from and to users' brains.

- Establish policies for unauthorized implantables: While they cannot easily be removed, users may be prohibited from some roles such as operating vehicles or machinery, or advanced security clearance due to increased hacking risk.

Sample Vendors

Blackrock Neurotech; BrainCo; Kernel; Meta; Neuralink; Neuroelectrics; NYX Technologies; Paradromics

Gartner Recommended Reading

Maverick Research: "Metasuits" Will Be Key to Compelling Metaverse Experiences

Metaverse

Analysis By: Grace Farrell, Tuong Nguyen

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Definition:

Gartner defines a metaverse as a collective virtual 3D shared space, created by the convergence of virtually enhanced physical and digital reality. A metaverse is persistent, providing enhanced immersive experiences. Gartner expects that a complete metaverse will be device-independent, and will not be owned by a single vendor: It will have a virtual economy of itself, enabled by digital currencies and non-fungible tokens (NFTs).

Why This Is Important

A metaverse is the next level of interaction in the virtual and physical worlds. It will allow learners to replicate or enhance their in-person activities that they typically would perform in a classroom setting. This could happen either by transporting or extending physical activities to a virtual world or by transforming the physical one. Although the goal of a metaverse is to combine many of these activities, there are currently many emerging metaverses with limited functionality.

Business Impact

Institutions can begin to enhance their current academic offerings in unprecedented ways, opening up innovative opportunities. Examples of opportunities that metaverse currently offer to institutions are:

- Interactive learning (e.g., real-time information during anatomy lab for an autopsy).

- Professional training (e.g., empathy-based training for physicians, nurse training).

- Personalized learning (e.g., custom student avatars).

- Shared experiences (e.g., live virtual events, student dorm-room meetups).

Drivers

There are three drivers for metaverse:

- **Transport:** The ability to "go and immerse oneself" in a virtual world. That world may be a 3D simulation and/or in virtual reality. This is where we see the most use cases in education today, predominantly with students using headsets for discovery and experiential learning.

- **Transform:** Bringing digital to the physical world. This allows the learner to have access to real-time information, collaboration and experiences in the physical world.

- **Transact**: The economic foundation of the metaverse through the use of cryptocurrency, NFTs and blockchain. This is not prevalent in education at this point in time, but very prevalent in other industries like fashion and virtual real estate.

Some of the main activities for a metaverse that will require one or more of these drivers are:

- **Student Collaboration**: Encouraging collaboration and participation from a diverse group of students, wherever they may be located.

- **Student Engagement**: A metaverse facilitates a feeling of presence ("being there") as if the students were in-person, turning their focus to the task at hand with less distraction.

- **Student Connectedness**: Metaverse enables learners to connect in a more immersive way with classroom environments, labs and communities of interest — regardless of where or if they exist in the physical world.

Ultimately, the goal of implementing metaverse is that learners will desire to enhance and/or augment their lives in digital and physical realities driving user adoption rates.

Obstacles

- The adoption of metaverse technologies is nascent and fragmented. Be careful when investing in a specific metaverse application, use case or vendor as it is too early to determine which investments have long-term viability. Furthermore, this is a time of learning, exploring and preparing for a metaverse with limited implementation. Financial and reputational risks of early investments are not fully known, and caution is advised.

- Current manifestations of metaverses are siloed, app-based, noninteroperable experiences that do not satisfy the decentralized content and interoperable vision of the metaverse. This current, walled-garden approach also strongly limits users' control of experiences.

- Set realistic expectations for a metaverse. Education institutions often struggle to identify desired outcomes of a metaverse implementation. Key performance indicators like student attendance, engagement, test scores and quality of content should be analyzed routinely through these trials.

User Recommendations

Recommendations for strategic approaches toward the metaverse will vary. In general:

- Identify metaverse-inspired opportunities by evaluating current high-value use cases within their academic institution.

- Work with stakeholders to evaluate the viability of metaverse technologies in terms of learner reach and outcome.

- Develop technology strategies that leverage the built-in infrastructure and participants of the metaverse, and provide digital product or service opportunities.

- Take a cautioned and measured approach when investing in a specific metaverse, as it is still too early to determine which investments will be viable in the long term.

Sample Vendors

Decentraland; Meta; Microsoft; NVIDIA; Roblox; VictoryXR

Gartner Recommended Reading

Emerging Tech: Top Enabling Technologies for Metaverse

Emerging Tech: Metaverse Providers Must Refine Their Go-to-Market Strategy and Use Cases to Succeed in the Emerging Metaverse

Decision Intelligence

Analysis By: Erick Brethenoux

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Decision intelligence (DI) is a practical discipline that advances decision making by explicitly understanding and engineering how decisions are made and how outcomes are evaluated, managed and improved via feedback.

Why This Is Important

The current hype around automated decision making and augmented intelligence, fueled by AI techniques in decision making (including generative AI), is pushing DI toward the Peak of Inflated Expectations. Recent crises have revealed the brittleness of business processes. Reengineering those processes to be resilient, adaptable and flexible will require the discipline brought by DI methods and techniques. A fast-emerging market (DI platforms) is starting to provide resilient solutions for decision makers.

Business Impact

Decision intelligence helps:

- **Reduce technical debt and increase visibility.** It improves the impact of business processes by materially enhancing the sustainability of organizations' decision models based on the power of their relevance and the quality of their transparency, making decisions more transparent and auditable.

- **Reduce the unpredictability of decision outcomes.** It does so by properly capturing and accounting for the uncertain factors in the business context and making decision models more resilient.

Drivers

- **A dynamic and complex business environment, with an increasingly unpredictable and uncertain pace of business.** Two forces are creating a new market around decision intelligence platforms (DIPs). The first is the combination of AI techniques such as natural language processing, knowledge graphs and machine learning. The second is the confluence of several technology clusters around composite AI, smart business processes, insight engines, decision management and advanced personalization platforms.

- **The need to curtail unstructured, ad hoc decisions that are siloed and disjointed.** Often uncoordinated, such decisions promote local optimizations at the expense of global efficiency. This phenomenon happens from both an IT and a business perspective.

- **Expanding collaboration between humans and machines.** This collaboration, supplemented by a lack of trust in technologies (such as AI), is increasingly replacing tasks and promoting uneasiness from a human perspective. DI practices promote transparency, interpretability, fairness, reliability and accountability of decision models critical for the adoption of business-differentiating techniques.

- **Tighter regulations that are making risk management more prevalent.** From privacy and ethical guidelines to new laws and government mandates, it is becoming difficult for organizations to fully understand the risk impacts of their decisions. DI enables an explicit representation of decision models, reducing this risk.

- **Uncertainty regarding decision consistency across the organization.** Lack of explicit representation of decisions prevents proper harmonization of collective decision outcomes. DI remedies this issue.

- **Emergence of software tools in the form of decision intelligence platforms.** DIPs will enable organizations to practically implement DI projects and strategies.

- **Generative AI.** The advent of generative AI is accelerating the research and adoption of composite AI models, which are the foundation of DIPs.

Obstacles

- **Fragmentation:** Decision-making silos have created data, competencies and technology clusters that are difficult to reconcile and that could slow down the implementation of decision models.

- **Subpar operational structure:** An inadequate organizational structure around advanced techniques, such as the lack of an AI center of excellence, could impair DI progress.

- **Lack of proper coordination between business units:** The inability to impartially reconsider critical decision flows within and across departments (also because of fragmentation) diminishes the effectiveness of early DI efforts.

- **Lack of modeling in a wider context:** In organizations that have focused almost exclusively on technical skills, the other critical parts of human decision making — psychological, social, economic and organizational factors — have gone unaddressed.

- **Lack of AI literacy:** Many organizations still suffer from a lack of understanding when it comes to AI techniques. This AI illiteracy could slow down the development of DI projects.

User Recommendations

- **Promote the resiliency and sustainability of cross-organizational decisions** by building models using principles aimed at enhancing traceability, replicability, pertinence and trustworthiness.

- **Improve the predictability and alignment of decision agents** by simulating their collective behavior while also estimating their global contribution versus local optimization.

- **Develop staff expertise** in traditional and emerging decision augmentation and decision automation techniques, including predictive and prescriptive (optimization, business rules) analytics. Upskill business analysts, and develop new roles, such as decision engineer and decision steward.

- **Tailor the choice of decision-making technique** to the particular requirements of each decision situation by collaborating with subject matter experts, AI experts and business process analysts.

- **Accelerate the development of DI projects** by encouraging experimentation with generative AI and expediting the deployment of composite AI solutions.

Gartner Recommended Reading

Innovation Insight for Decision Intelligence Platforms

Reengineer Your Decision-Making Processes for More Relevant, Transparent and Resilient Outcomes

How to Choose Your Best-Fit Decision Management Suite Vendor

AI Security: How to Make AI Trustworthy

Top Strategic Technology Trends for 2023: Adaptive AI

Self-Integrating Applications

Analysis By: Keith Guttridge

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Self-integrating applications will use a combination of automated service discovery, metadata extraction and mapping, automated process definition, and automated dependency mapping to enable applications and services to integrate themselves into an existing application portfolio with minimal human interaction.

Why This Is Important

Integrating new applications and services into an application portfolio is complex and expensive. Gartner research shows that up to 65% of the cost of implementing a new ERP or CRM system is attributable to integration. The technology for enabling applications to self-integrate exists in pockets, but no vendor has yet combined all the elements successfully. As applications develop the ability to discover and connect to each other, the amount of basic integration work will dramatically reduce.

Business Impact

Self-integrating applications can:

- Improve agility, as the time to onboard applications and services is massively shortened.

- Cut costs by up to 65% when onboarding new applications and services.

- Reduce vendor lock-in, as platform migration becomes simpler.

- Improve the ability to focus on differentiation and transformational initiatives, as the "keeping-the-lights-on" burden is dramatically reduced.

Drivers

- Cloud hyperscalers provide features such as service discovery, metadata extraction, intelligent document processing and natural language processing.

- Automation or integration vendors provide features such as intelligent data mapping, metadata extraction, next-best-action recommendations, process discovery and automated decision making.

- SaaS vendors provide features such as process automation, packaged integration processes, portfolio discovery and platform composability.

- In the new era, intelligent application portfolio management is placed on top of augmented integration platforms in order to properly address the challenge.

- Generative AI simplifies the build process to create integration processes.

Obstacles

- Embedded integration features within SaaS are good enough to enable organizations to get started quickly, thus stalling investment in improving self-integration capabilities.

- Generally, organizations are not well aware of the availability of augmented integration technologies for enabling self-integrating applications. Many organizations still view integration as a complex issue requiring specialist tools.

- There is not a clear market leader that is looking to push this technology forward as the major application vendors look to protect their customer bases.

- Complex scenarios across multiple datasets and service interfaces are too challenging for the current technology. Organizations place too much trust in the solution to do the right thing. Ownership and visibility of the integrations might become contentions within the organizations.

User Recommendations

Software engineering leaders responsible for integration should:

- Ask your major application vendors about the interoperability of applications within their portfolios. This is the area where self-integrating applications are most likely to emerge first.

- Investigate integration vendors that have augmented artificial intelligence features to automate the process of onboarding applications and services into a portfolio.

- Manage your expectations for ease of integration. Self-integrating applications will provide just enough integration with the rest of the application portfolio to enable a new application to work efficiently.

- Keep track of governance capabilities. Who can authorize access? Has the appropriate observability been established? Is everything fully audited? Does something need to change? An organization's integration landscape is an ever-evolving environment, and each integration has a life cycle that needs to be maintained.

Sample Vendors

Boomi; IBM; Microsoft; Oracle; Salesforce; SAP; SnapLogic; Tray.io; Workato

Learning Experience Platforms

Analysis By: Paul Riley, Grace Farrell

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

A learning experience platform (LXP) is the front-end layer that typically sits on top of a learning management system (LMS). LXPs are used to enhance an individual learner's interactions and engagement via greater personalization, content curation, and expanded breadth of content.

Why This Is Important

Students are demanding education institutions provide learning platforms that are easier to use and offer better personalization. LMSs have traditionally focused on delivering course content and tracking learner activities. LXPs look to go a step further by delivering personalized learning paths, channels and collections that allow learners to easily organize, access and share relevant resources, and gain visibility on additional learning assets, including noninstitutional developed content.

Business Impact

LXPs in corporate learning allow organizations to improve learner experience and engagement by providing a more open, interactive, and effective way to learn. Education institutions are now looking to enhance online and blended learning, and seeking solutions to provide enhanced learner engagement and stronger student performance. However, LXPs do not fully duplicate LMS functionality and are not a direct LMS replacement.

Drivers

- Sharing content without personalization risks low adoption and engagement. Especially when learners are spread across geographies and are made up of various cultures, jobs and preferences, a more targeted approach is needed. LXPs have emerged from the corporate learning space as a solution to address this challenge.

- Remote/hybrid teaching environments and digital workplaces have changed expectations for learners. While some are still happy to consume lecture-based teaching experiences, others more familiar with workplace collaboration tools may now expect more frequent and detailed insight on context. Institutions must blend approaches to engage different learner preferences.

- Students are demanding a wider range of resources and upskilling options beyond traditional course design.

- Some students are willing to learn with content purely from the institution. However, others are seeking to supplement their learning through access to a wider range of content sources to support learning and skills development for employability. This opens up opportunities for new styles of content partnerships and credential pathways.

- Education institutions must develop a balance of structured pathways and social/personalized approaches aligned to learning design. As online learning design evolves, so do demands for evolution and expansion of LMS functionality to incorporate LXP-style solutions.

Obstacles

- The landscape for LXPs in education is still maturing and evolving. Recent and potential consolidation in the market adds a layer of uncertainty and risk. At present, very few corporate LXP vendors sell in the education space and there is no commonly defined feature set.

- Education LMS vendors are evolving in response to market need to offer similar benefits to LXPs. Therefore, the boundaries between LXP and LMS in education are not clear.

- Quantifying LXP return on investment is challenging in corporate environments and even more so within education. Enhanced learner engagement can be tracked and measured, but education institutions are currently faced with multiple paths and potential systems to support improved student outcomes.

- Institutions historically have provided students with structured pathways, learning resources and academic e-portfolios. Shifting to a more open, personalized environment requires a high-level investment in course design, content provision and change management.

User Recommendations

- Evaluate the strengths, weaknesses and roadmap of the various LXP providers to determine their advantages relative to existing systems and their fit for institutional strategy, culture and context.

- Assess their compatibility with existing education learning technologies to ensure integration, appropriate functionality and continuity across platforms.

- Acknowledge that corporate LXP products may not fully fit higher education requirements.

- Keep track of the evolution of existing education LMS platform providers toward LXP functionality.

- Pilot any LXP for a small, targeted population of learners to clarify benefits prior to major investment.

- Prioritize any initial pilot on programs, where the LXP can demonstrably enhance programs and the overall institution.

- Ensure that thorough business-case evaluation and change management communications are carried out prior to any LXP initiative.

Sample Vendors

360Learning; Absorb Software; Cornerstone OnDemand; Degreed; Fuse Universal; Learning Technologies Group; Microsoft; Skillsoft

Gartner Recommended Reading

Market Guide for Corporate Learning Technologies

Market Guide for Higher Education Learning Management Systems

Tool: RFI/RFP Questions for Selecting Learning Technology Platforms

Industry Cloud Platforms

Analysis By: Gregor Petri

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

Industry cloud platforms address industry-relevant business outcomes by combining underlying SaaS, PaaS and IaaS services into a whole product offering with composable capabilities. These typically include an industry data fabric, a library of packaged business capabilities, composition tools and other platform innovations. IT leaders can use the composability of these platforms to gain the adaptability and agility their industries need to respond to accelerating disruption.

Why This Is Important

Cloud, software and service providers are launching industry cloud platforms (ICP) by combining SaaS, PaaS and IaaS offerings with industry-specific functionality and composable capabilities to create more compelling propositions for mainstream customers. Emerging industry cloud platforms are leveraging innovative approaches such as composable packaged business capabilities (PBCs), PBC marketplaces, data grids and fusion teams to accommodate faster change and platform adaptability.

Business Impact

Broader cloud adoption within enterprises requires more whole-product business solutions that enable defined industry scenarios and process models, rather than technology-oriented solutions that enterprises have to largely configure and integrate themselves. ICPs enable enterprises to adopt more holistic cloud strategies that span across established cloud service categories such as SaaS, PaaS and IaaS.

Drivers

- As the complexities of both business and technology continue to increase, enterprises are looking for more outcome-based engagements with their cloud providers. However, such outcomes must be flexible enough to be able to adapt to the changing circumstances.

- To be relevant and be able to resonate with enterprise audiences, such outcomes must be business relevant, specific, measurable and tangible — a goal that is easier achieved when approached in a specific industry context.

- Industry cloud platforms can create value for enterprises by bringing traditionally separately purchased solutions together in a composable and modular way. This simplifies the sourcing, implementation and integration process.

- Currently, industry cloud platforms are being initiated and created by various technology providers. In addition, we see some enterprises considering creating — often in collaboration with a technology provider — a dedicated industry cloud platform as the basis for a more autonomous industry ecosystem.

- Enterprises can gain business value from industry clouds through shared best practices; vertically specialized go-to-market and implementation teams; compliance of the infrastructure platform with industry-specific regulations.

- Value can also be gained through analytical capabilities to integrally mine the data from existing and new applications; industry-specific add-on functionality in front- and back-office enterprise applications; combined with collections of composable building blocks available from industry cloud marketplaces.

- Providers are on a pathway to creating whole-product offerings that cater directly to the established needs of vertical industry enterprises.

Obstacles

- Industry clouds are at risk of following the same path as classic government and community clouds where providers created difficult to support or slightly outdated copies of the original cloud with specific functionality.

- Industry cloud platforms can be overwhelming in terms of the wide breadth of functionality they potentially cover. Customers and providers must therefore be disciplined and not burn precious resources on fixing/replacing things that are not broken.

- Implementing an industry cloud platform must be approached as adding an exoskeleton, bringing new and improved capabilities rather than a vital organ transplant, replacing or repairing functionality that was already present.

- To reach their full potential, industry clouds will need to evolve into something best described as ecosystem clouds. Enterprises can leverage these ecosystems by participating in shared (business) processes, such as procurement, distribution, payment procession, and maybe even R&D and innovation.

User Recommendations

- Target ICPs to complement the existing application portfolio like an exoskeleton by introducing new capabilities that add significant value, rather than as full-scale replacements of largely already existing functionality with more up-to-date technology.

- Start building composability skills by engaging business technologists and fusion teams to create enterprisewide understanding and support for the ICP journey.

- Formulate rules for when to deploy ICP capabilities as a productive platform for optimization and modernization by improving existing processes, and when to actively recompose them for more differentiating transformation and innovation initiatives.

Sample Vendors

Amazon Web Services (AWS); Google; IBM; Infor; Microsoft; Oracle; Salesforce

Gartner Recommended Reading

Top Strategic Technology Trends for 2023: Industry Cloud Platforms

Presentation: Industry Cloud Platform Adoption by Vertical Industry

Analyzing Industry Cloud Offerings From CIPS Providers

Providers of Cloud Managed Services: Use Composable Industry Platforms to Productize Your Offerings

Changes and Emerging Needs Product Managers Must Address in the CIPS Market

Composable ERP

Analysis By: Robert Anderson, Neha Ralhan

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Composable ERP is an adaptive technology strategy that supports the foundational administrative and operational digital capabilities that enable an enterprise to keep up with the pace of business change. It is not a single, off-the-shelf product; rather, it defines a strategic technology framework in which application and platform capabilities support dynamic and user-centric enterprise business capabilities via a networked solution.

Why This Is Important

ERP strategies are evolving from more than just loosely coupled applications into a mesh of ERP applications, platforms and non-ERP vendors. Composable ERP strategies fuel growth, flexibility and profitability while minimizing risks, costs and disruption of business operations. They enable CIOs to take a future-proof approach to ERP that can support changing business needs without compromising application stability.

Business Impact

The ability to deliver value is changing radically, due to the influx of new technologies, mindsets and practices. The main changes are:

- **Business outcomes** — A shift of focus away from "how" to invest to "why" to invest and what can be achieved.

- **Complexity** — It is a must to accept complexity and work toward managing ERP. Trying to address the challenge through a single-vendor approach may be a mistake.

- **Customer value creation** — How to understand and keep pace with customers' demands.

Drivers

Organizations need to rapidly assess and create an ERP strategy that is capable of enabling composability. The key drivers for this journey are:

- Application flexibility. Organizations require ERP application strategies to be more flexible than the traditional monolithic application capabilities. They demand highly configurable business applications complemented by business technology platforms that enable them to compose, recompose and extend applications as business strategies change.

- Hybrid integration. In order to address changing business requirements, organizations seek hybrid integration approaches that more easily enable business value beyond the borders of monolithic ERP.

- Faster achievement of business outcomes. The days of five-year waterfall ERP implementations are over. Organizations are demanding more agile approaches to ERP implementation that can address the demands of a rapidly changing digital world, while minimizing risks, costs and disruption of business operations.

Obstacles

- Software vendors are still discovering the impacts and directions of this customer-led future state. Tactical roadblocks, such as licensing models and out-of-the-box integration capabilities, remain barriers to a more-open ecosystem. Many still treat composable ERP as a product story, rather than a strategic approach led by customers.

- Systems integrators (SIs) continue to grapple with how to position and align themselves in support of frameworks in which application and platform capabilities can be fused to deliver business value. Most continue to focus on vendor-led technology modernization, as opposed to a customer-driven, composable enterprise approach.

- Articulating business value hasn't always been a priority for IT initiatives. Therefore, the engagement between IT and the business to discuss an enterprise IT-enabled vision focused on delivering value is not a trivial exercise for most and is a notable barrier.

User Recommendations

- Ensure that business and IT work as a single unit to create a composable ERP strategy to ensure it delivers business value and creates possibilities for enabling agility for the longer run.

- Establish the scope of what ERP means — and should mean — for your organization by synchronizing capabilities with business values, plans, desired outcomes and experiences. Reimagine ERP to align it with the emerging generation of applications, architectures and technologies. Avoid the temptation to revert to an old, monolithic ERP mindset.

- Exploit the emerging technologies across all pace layers, based on your organization's growth, transformation or optimization goals.

- Invest in enabling technologies along the core ERP journey. AI, low-code/no-code, integration capabilities, master data management (MDM) and security discussions must all be part of a new composable ERP strategy.

Gartner Recommended Reading

ERP Primer for 2023

Predicts 2023: In a Period of Global Upheaval, Will ERP Come to the Rescue?

Two-Tier ERP: A Useful, Composable ERP Strategy for Complex Organizations

2022 Strategic Roadmap for ERP

What CIOs Must Do to Avoid Disappointing ERP Initiatives

Smart Campus

Analysis By: Grace Farrell, Kelly Calhoun Williams

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

A smart campus is a physical or digital environment in which humans and technology-enabled systems interact, using gathered data and coordinated technologies. Multiple elements, including people, processes, services and things, come together to create a more immersive and automated experience for the students, staff, faculty, and stakeholders of an institution.

Why This Is Important

A smart campus can heavily influence many aspects of student life. Education leaders are under pressure to retain students and staff, strengthen their reputation, and reduce carbon footprint. Smart campus initiatives offer these institutions opportunities to personalize the student experience, save money on energy-draining technologies and fortify security measures on campus. As more students return to a physical campus, smart-campus technologies can reinvigorate the education experience.

Business Impact

A smart campus will boost efficiencies for utilities, traffic, parking, safety, space usage and campus navigation. As the digital campus matures, learning and student retention will improve, as an immersive and content-rich environment emerges. Mature smart campuses are likely to support higher education research in new ways and act as critical sources of research data. In K-12, a smart campus can free up critical funding and people resources, given the current staff and funding shortages.

Drivers

- The development of smart cities has yielded significant positive outcomes for local governments and their constituents. These smart cities are partnering with local universities to improve safety, reduce waste and enhance navigation in the area.

- Like many other organizations, education institutions are being pushed to report on their sustainability efforts. Smart-city-related measurement and data visualization can be important ways of accomplishing these sustainability goals.

- Where applicable globally, funds designated to support a shift toward renewable energy, building modernization, or greening and decarbonization will provide schools with more funding to support smart-campus efforts.

- There is a growing public concern that many institutions must bolster safety and security efforts. The use of automated license plate readers, facial recognition, AI-based gunshot detection and location intelligence has helped to ensure that stakeholders feel safer on campus.

- The ability to measure and automatically adjust heating, cooling and lighting presents potentially significant cost-saving opportunities.

- As the student experience demands more personalization, education organizations are looking to differentiate by incorporating smart-campus technologies in stadiums, laundry services, classrooms and food services.

Obstacles

- Designing a smart campus takes significant time and resources. Institutions will need to begin by upgrading their wireless and wired infrastructure, and improving bandwidth and software-defined networks.

- Many smart campus initiatives begin with a hyperfocus on one particular aspect, rather than a holistic strategy for the ecosystem. Smart-campus goals can range from traffic and parking, to virtual health services. Cross-collaboration among different departments is essential for interoperability, yet many institutions fail at this step and get stuck at the individual project level.

- Education leaders will need to think beyond technologies implemented, and look toward the utilization of data and how it will impact the student experience.

- Decentralizing large systems and securely using gathered data have proven to be challenging for many.

- Stakeholders may resist smart-campus initiatives due to unforeseen risk and privacy concerns.

User Recommendations

- Identify the business purpose and specific objectives for developing a smart campus first. Campus and organization stakeholders must be involved.

- Investigate opportunities to leverage sustainability and recovery funding.

- Create a strong data infrastructure by investing in robust data integration, data mining and analytics capabilities. The underlying fundamentals of a smart campus are solid integration, privacy and security.

- Engage with facilities departments in the earliest possible stages of building design. New buildings being planned on campus will need the appropriate infrastructure to support smart-campus applications.

- Prepare the institution for a future smart campus by planning for highly scalable network availability, especially in high-volume areas, such as outdoor spaces, classrooms, and dorms.

- Maintain satisfaction with student- and faculty-facing smart-campus applications through continuous feedback and development.

Sample Vendors

CommScope; Honeywell International; Johnson Controls; Microsoft; NTT DATA Group; Quantela

Gartner Recommended Reading

Accelerating the Digital Campus in Higher Education

Smart City Funding Models: It's Time to Get Creative

Case Study: An Intelligent Urban Ecosystem Approach to a Sustainable Smart City

Responsible AI

Analysis By: Svetlana Sicular

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Responsible artificial intelligence (AI) is an umbrella term for aspects of making appropriate business and ethical choices when adopting AI. These include business and societal value, risk, trust, transparency, fairness, bias mitigation, explainability, sustainability, accountability, safety, privacy, and regulatory compliance. Responsible AI encompasses organizational responsibilities and practices that ensure positive, accountable, and ethical AI development and operation.

Why This Is Important

Responsible AI has emerged as the key AI topic for Gartner clients. When AI replaces human decisions and generates brand-new artifacts, it amplifies both good and bad outcomes. Responsible AI enables the right outcomes by ensuring business value while mitigating risks. This requires a set of tools and approaches, including industry-specific methods, adopted by vendors and enterprises. More jurisdictions introduce new regulations that challenge organizations to respond in meaningful ways.

Business Impact

Responsible AI assumes accountability for AI development and use at the individual, organizational and societal levels. If AI governance is practiced by designated groups, responsible AI applies to everyone involved in the AI process. Responsible AI helps achieve fairness, even though biases are baked into the data; gain trust, although transparency and explainability methods are evolving; and ensure regulatory compliance, despite the AI's probabilistic nature.

Drivers

- Responsible AI means a deliberate approach in many directions at once. Data science's responsibility to deliver unbiased, trusted and ethical AI is just the tip of the iceberg. Responsible AI helps AI participants develop, implement, utilize and address the various drivers they face.

- Organizational driver assumes that AI's business value versus risk in regulatory, business and ethical constraints should be balanced, including employee reskilling and intellectual property protection.

- Societal driver includes resolving AI safety for societal well-being versus limiting human freedoms. Existing and pending legal guidelines and regulations, such as the EU's Artificial Intelligence Act, make responsible AI a necessity.

- Customer/citizen driver is based on fairness and ethics and requires resolving privacy versus convenience. Customers should exhibit readiness to give their data in exchange for benefits. Consumer and citizen protection regulations provide the necessary steps, but do not relieve organizations of deliberation specific to their constituents.

- With further AI adoption, the responsible AI framework is becoming more important and is better understood by vendors, buyers, society and legislators.

- AI affects all ways of life and touches all societal strata; hence, the responsible AI challenges are multifaceted and cannot be easily generalized. New problems constantly arise with rapidly evolving technologies and their uses, such as using OpenAI's ChatGPT or detecting deepfakes. Most organizations combine some of the drivers under the umbrella of responsible AI, namely, accountability, diversity, ethics, explainability, fairness, human centricity, operational responsibility, privacy, regulatory compliance, risk management, safety, transparency and trustworthiness.

Obstacles

- Poorly defined accountability for responsible AI makes it look good on paper but is ineffective in reality.

- Unawareness of AI's unintended consequences persists. Forty percent of organizations had an AI privacy breach or security incident. Many organizations turn to responsible AI only after they experience AI's negative effects, whereas prevention is easier and less stressful.

- Legislative challenges lead to efforts for regulatory compliance, while most AI regulations are still in draft. AI products' adoption of regulations for privacy and intellectual property makes it challenging for organizations to ensure compliance and avoid all possible liability risks.

- Rapidly evolving AI technologies, including tools for explainability, bias detection, privacy protection and some regulatory compliance, lull organizations into a false sense of responsibility, while mere technology is not enough. A disciplined AI ethics and governance approach is necessary, in addition to technology.

User Recommendations

- Publicize consistent approaches across all focus areas. The most typical areas of responsible AI in the enterprise are fairness, bias mitigation, ethics, risk management, privacy, sustainability and regulatory compliance.

- Designate a champion accountable for the responsible development and use of AI for each use case.

- Define model design and exploitation principles. Address responsible AI in all phases of model development and implementation cycles. Go for hard trade-off questions. Provide responsible AI training to personnel.

- Establish operationalize responsible AI principles. Ensure diversity of participants and the ease to voice AI concerns.

- Participate in industry or societal AI groups. Learn best practices and contribute your own, because everybody will benefit from this. Ensure policies account for the needs of any internal or external stakeholders.

Sample Vendors

Amazon; Arthur; Fiddler; Google; H2O.ai; IBM; Microsoft; Responsible AI Institute; TAZI.AI; TruEra

Gartner Recommended Reading

[A Comprehensive Guide to Responsible AI](#)

[Expert Insight Video: What Is Responsible AI and Why Should You Care About It?](#)

[Best Practices for the Responsible Use of Natural Language Technologies](#)

[Activate Responsible AI Principles Using Human-Centered Design Techniques](#)

[How to Ensure Your Vendors Are Accountable for Governance of Responsible AI](#)

Emotion AI

Analysis By: Annette Zimmermann

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Emotion artificial intelligence (AI) technologies (also called affective computing) use AI techniques to analyze the emotional state of a user (via computer vision, audio/voice input, sensors and/or software logic). Emotion AI can initiate responses by performing specific, personalized actions to fit the mood of the customer.

Why This Is Important

Emotion AI is considered transformational as it turns human behavioral attributes into data that will have a large impact on human-machine interface (HMI). Machines will become more "humanized" as they can detect sentiments in many different contexts. Furthermore, applying deep learning to computer vision or audio-based systems to analyze emotions in real time has spawned new use cases for customer experience enhancements, employee wellness and many other areas.

Business Impact

Contact centers use voice analysis and natural language processing (NLP)-based algorithms to detect emotions in voice conversations, in personal chat conversations and chatbots. Computer vision (CV)-based emotion AI has already been used for more than a decade in market research with neuromarketing platforms that test users' reactions toward products. In addition, we see the technology expanding to other verticals and use cases, i.e., healthcare (diagnostic), sales enablement and employee wellness.

Drivers

The increasing number of use cases we have identified indicates an increase in commercialization as emotion AI finds applicability in new domains:

- One of the drivers for detecting emotions/states is the need for a system to act more sympathetically. For instance, it creates anthropomorphic qualities for personal assistant robots (PARs) and virtual beings, making them appear more "human." This "emotional capability" is an important element in enhancing the communication and interaction between users and a PAR.

- This can be an empathic avatar or an emotion-detection-enabled chatbot. A person's daily behavior, communication and decisions are based on emotions — our nonverbal responses in a one-to-one communication are an inseparable element from our dialogues and need to be considered in the human-machine interface (HMI) concept.

- Combinatorial technology solutions such as computer-vision-based and audio analytics, or language-based and computer vision, enable customer experience enhancements.

- Strongest adoption is currently happening in the context of contact centers where voice-based emotion analysis supports multiple use cases such as real-time analysis on voice conversations, emotion detection in chat conversations, emotional chatbots and more.

- Market research and neuromarketing tools are continuously leveraging emotion detection in various user scenarios including focus groups and product testing. Vendors have been extending their offerings toward remote/online interviews during 2020 — due to the pandemic.

- In the creation of virtual beings in customer service or other consumer-facing scenarios, emotional responses are a critical element.

- As the metaverse unfolds, virtual beings will play an important role as business models evolve and the entire ecosystem of this new digital world emerges.

Obstacles

- Privacy concerns are the main obstacle to rapid adoption in the enterprise. This is especially a concern in real-life situations (vs. lab/research environments) for both consumer-facing (e.g., monitoring emotions in a retail environment via cameras) and employee-facing situations. Research environments like product testing have the advantage that the emotion AI is used for this specific purpose and the user (product tester) is fully aware that their emotions are being captured to improve usability or other features.

- Bias: When using facial expression analysis, models are likely to be retrained in different geographies to get the system to detect the different nuances present due to different cultural backgrounds.

- Variation across modalities. Certain emotions can be better detected with one technology mode than with another. For instance, "irony" can be detected using voice-based analysis while this is close to impossible to detect with facial expression analysis.

User Recommendations

- Review vendors' capabilities and reference cases carefully. As the market is currently very immature, most vendors are focused on two or three use cases in two or three industries. At the same time, identifying and processing human emotion is currently a gray area, especially in the EU. The EU Commission has started an initiative to review the ethical aspects of AI technologies, and emotion AI will certainly be part of this debate.

- Enhance your customer analytics and behavioral profiling by applying emotion AI technologies bringing your customer experience strategy to the next level.

- Be use-case-driven. The use case will determine the emotion AI technology to be used and vendor selection.

- Appoint responsibility for data privacy in your organization — a chief data privacy officer or equivalent.

- Work with your vendor on change management in order to avoid user backlash due to sensitive data being collected.

Sample Vendors

Behavioral Signals; Cogito; DAVI; Intelligent Voice; kama.ai; MorphCast; Soul Machines; Superceed; Symanto; Uniphore

Gartner Recommended Reading

Competitive Landscape: Emotion AI Technologies

Emerging Tech: Computer Vision, Voice Analysis and CGI Evolve Into Emotionally Intelligent Virtual Beings

Tool: Vendor Identification for Natural Language Technologies

Digital Work Hubs

Analysis By: Joe Mariano, Gavin Tay

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Digital work hubs are an assembly of ever changing team productivity and collaboration applications created for employees with diverse needs. It can be augmented with services for development, automation, artificial intelligence (AI) and analytics.

Why This Is Important

Foundational work hub services (e.g., Microsoft 365, Google Workspace, etc.) have peaked in usage. However, gaps in these services continue demand for purpose-built work hub services (visual collaboration, collaborative work management, workstream collaboration, meeting services and content services platforms, etc.). In many cases these services are not deployed enterprisewide. Instead they are implemented at the domain or situational level to meet line of business strategic needs.

Business Impact

The impact of effective work hub usage starts with productivity, but ends with opportunities to reduce cycle time and improve business results arising from more effective collaboration. This coordination via the hub can be especially helpful to citizen developers and business technologists working in fusion teams leveraging work hubs to meet organizational goals.

Drivers

■ Foundational work hub services, such as Google Workspace and Microsoft 365, have become the focal point of work hub application portfolios. However, IT leaders, business technologists and fusion teams are beginning to realize that they can't do everything for domain and situational needs. The impact on domain and situational work hub services means updating digital workplace charter to better align with strategic line of business needs.

■ Executive leadership wants to exploit the value of work hub services long term, not just for the ROI, but to drive and enable employees' digital skills to help build digital side hustles and develop employees into business technologists.

■ 2022 Gartner's Digital Worker Survey found participants on average use 11 different applications to get work done and more than 70% of the digital workers use between 6-25 applications at work. Also almost half of respondents struggled to find the information or data needed to do their job. IT leaders will need to better assess employees' needs and take greater care in creating digital employees and experience that streamline the use of multiple work hubs.

Obstacles

■ IT leaders think that a foundational work hub services will meet all their collaborative needs. In fact, best-of-breed services will be needed to meet the contextualized use cases of groups such as frontline workers, marketing and sales.

■ The rate of additional functions added to work hub services has accelerated to the point that IT resource and business employees cannot keep up, which is limiting the overall value of tools.

User Recommendations

- Assume that a single work hub vendor will not meet all your needs. In order to meet your digital employee experiences (DEX) goals it will take a combination of both foundational and domain or situational services.

- IT leaders must take on more of a collaborative role, working with business functions to understand the employee needs, especially with business technologists who can help drive new use cases and popularize digital workplace technology rather than IT working with one another.

- Use Gartner's ACME framework to govern usage efforts by focusing on domain and situational needs.

- Assess the technical fitness of your work hub applications to determine fit for purpose. If applications with similar functionality can be merged, better resource allocation can be reached. Deem the work hub to be a source of continuous innovation in a form that is relatively easy to adopt. Tie augmentation services (e.g., everyday AI, cross-tool integration and citizen development tools) to further growth in the value of the services.

Sample Vendors

Alibaba; Google Workspace; Microsoft 365; Monday.com; Salesforce; Slack; Zoho

Gartner Recommended Reading

Video: Use Gartner's ACME Framework to Rationalize Your Digital Workplace Application Portfolio

Tool: Digital Employee Experience Journey Maps

Innovation Insight for Collaborative Workflow Automation

Everyday AI

Analysis By: Adam Preset

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Everyday AI refers to snippets of AI services that help workers improve productivity, deliver higher-quality work and save time. Workers interact with everyday AI mostly as features of widely used personal and team productivity applications that are typically deployed across an organization horizontally. These AI services are used by employees throughout the day, and will become increasingly varied and integrated into our working lives.

Why This Is Important

Everyday AI technology aims to help employees deliver work with speed, comprehensiveness and confidence. Recent advances in generative AI promise to streamline content creation, analysis and collaboration. Machine learning and natural language processing capabilities are becoming more common and embedded in application features to enable automation and efficiency. Everyday AI supports a new way of working where intelligent software is acting as more of a collaborator than a tool.

Business Impact

Everyday AI can amplify the productivity of any worker. As digital work becomes more complex, workers are expected to master more capable yet complex applications. Everyday AI can simplify some of that complexity. Employees who wield everyday AI can focus on meaningful, high-value, creative output rather than the routine tasks that can be delegated away. Deployment of technology to meet this need is more scalable and efficient than hiring and training additional talent.

Drivers

Vendors in different technology markets seek to improve worker productivity in novel ways beyond simple application and feature enhancements. The development of everyday AI capabilities delivers these productivity benefits while also providing vendors with a marketable and monetizable set of new capabilities. Gartner expects to see continuing innovation from vendors as they expand their everyday AI features, with collaboration megavendors making the most aggressive investments and prominent announcements.

Several enterprise application markets have AI assist capability that aids workers in various ways. Following are examples of categories and functions that employ everyday AI:

- Business productivity: correcting errors, improving message clarity, coordinating meetings.

- Content creation: composing entire documents or designing presentations based on modest prompts.

- Workstream collaboration: notifications, canned responses, task execution.

- Meeting solutions: transcription, translation, highlighting and identifying action items, meeting scheduling.

- Search: aggregating, summarizing and citing information following natural language prompts.

- HR applications: streamlining access to organizational and employee information.

- Performance management: aggregating metrics data, providing coaching guidance.

Workers generally embrace everyday AI as it helps them save time while reducing drudgery and stress. Organizations will invest further in everyday AI as they see the technology is able to multiply their workers' output and effort. Everyday AI will become increasingly sophisticated, moving from a service that, for example, can sort and summarize chats and email messages, to services that can write a report with minimal guidance. In many ways, everyday AI is the future of workforce productivity.

Obstacles

- Employees are unaware of everyday AI features. They distrust everyday AI, are concerned about privacy and may resist use due to poor early experiences with it.

- Some routine work processes may not be suitable for everyday AI. Enterprises may need to create foundational governance policies and practice guidance to enable the use of everyday AI. New everyday AI tools backed by generative AI demand more cloud computing resources, so sustainability and environmental impact may limit comfort with the technology.

- The benefits of successful use may be hard to capture or attribute to everyday AI capabilities. Everyday AI may require an explicit request for service, rather than being integrated into how people work where contextual disclosure can be applied.

- Vendors may overrepresent the capabilities of everyday AI. They may create and charge for product models where varying levels of everyday AI features are available at different tiers, which can make broad adoption confusing or expensive.

User Recommendations

- Ensure that employees are aware of everyday AI capabilities in the tools they use. Find out why employees may be hesitant to use everyday AI features and methodically address objections, particularly around privacy.

- Maintain a running inventory of everyday AI features and create an everyday AI digital side hustle. Retain healthy skepticism when vendors claim to have advanced everyday AI capabilities.

- Track new everyday AI usage patterns to inform enablement strategies. Make everyday AI a top software evaluation criterion.

- Be increasingly bold in the approach to everyday AI; look for applications where the use of everyday AI can have an increasingly larger impact, such as in common activities such as creating written and visual content, data analysis and improving meetings.

Sample Vendors

AmplifAI; Beautiful.ai; Calendly; Google; Grammarly; Microsoft

Gartner Recommended Reading

Predicts 2022: Digital Workplace Is Foundational for Employee Experience

Quick Answer: How Can Everyday AI Improve Worker Digital Dexterity?

Quick Answer: How Will AI in Microsoft 365 Copilot Impact the Workplace?

Generative AI

Analysis By: Svetlana Sicular, Brian Burke

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

Generative AI technologies can generate new derived versions of content, strategies, designs and methods by learning from large repositories of original source content. Generative AI has profound business impacts, including on content discovery, creation, authenticity and regulations; automation of human work; and customer and employee experiences.

Why This Is Important

Generative AI exploration is accelerating, thanks to the popularity of Stable Diffusion, Midjourney, ChatGPT and large language models. End-user organizations in most industries aggressively experiment with generative AI. Technology vendors form generative AI groups to prioritize delivery of generative-AI-enabled applications and tools. Numerous startups have emerged in 2023 to innovate with generative AI, and we expect this to grow. Some governments are evaluating the impacts of generative AI and preparing to introduce regulations.

Business Impact

Most technology products and services will incorporate generative AI capabilities in the next 12 months, introducing conversational ways of creating and communicating with technologies, leading to their democratization. Generative AI will progress rapidly in industry verticals, scientific discovery and technology commercialization. Sadly, it will also become a security and societal threat when used for nefarious purposes. Responsible AI, trust and security will be necessary for safe exploitation of generative AI.

Drivers

- The hype around generative AI is accelerating. Currently, ChatGPT is the most hyped technology. It relies on generative foundation models, also called "transformers."

- New foundation models and their new versions, sizes and capabilities are rapidly coming to market. Transformers keep making an impact on language, images, molecular design and computer code generation. They can combine concepts, attributes and styles, creating original images, video and art from a text description or translating audio to different voices and languages.

- Generative adversarial networks, variational autoencoders, autoregressive models and zero-/one-/few-shot learning have been rapidly improving generative modeling while reducing the need for training data.

- Machine learning (ML) and natural language processing platforms are adding generative AI capabilities for reusability of generative models, making them accessible to AI teams.

- Industry applications of generative AI are growing. In healthcare, generative AI creates medical images that depict disease development. In consumer goods, it generates catalogs. In e-commerce, it helps customers "try on" makeup and outfits. In manufacturing, quality inspection uses synthetic data. In semiconductors, generative AI accelerates chip design. Life sciences companies apply generative AI to speed up drug development. Generative AI helps innovate product development through digital twins. It helps create new materials targeting specific properties to optimize catalysts, agrochemicals, fragrances and flavors.

- Generative AI reaches creative work in marketing, design, music, architecture and content. Content creation and improvement in text, images, video and sound enable personalized copywriting, noise cancellation and visual effects in videoconferencing.

- Synthetic data draws enterprises' attention by helping to augment scarce data, mitigate bias or preserve data privacy. It boosts the accuracy of brain tumor surgery.

- Generative AI will disrupt software coding. Combined with development automation techniques, it can automate up to 30% of the programmers' work.

Obstacles

- Democratization of generative AI uncovers new ethical and societal concerns. Government regulations may hinder generative AI research. Governments are currently soliciting input on AI safety measures.

- Hallucinations, factual errors, bias, a black-box nature and inexperience with a full AI life cycle preclude the use of generative AI for critical use cases.

- Reproducing generative AI results and finding references for information produced by general-purpose LLMs will be challenging in the near term.

- Low awareness of generative AI among security professionals causes incidents that could undermine generative AI adoption.

- Some vendors will use generative AI terminology to sell subpar "generative AI" solutions.

- Generative AI can be used for many nefarious purposes. Full and accurate detection of generated content, such as deepfakes, will remain challenging or impossible.

- The compute resources for training large, general-purpose foundation models are heavy and not affordable to most enterprises.

- Sustainability concerns about high energy consumption for training generative models are rising.

User Recommendations

- Identify initial use cases where you can improve your solutions with generative AI by relying on purchased capabilities or partnering with specialists. Consult vendor roadmaps to avoid developing similar solutions in-house.

- Pilot ML-powered coding assistants, with an eye toward fast rollouts, to maximize developer productivity.

- Use synthetic data to accelerate the development cycle and lessen regulatory concerns.

- Quantify the advantages and limitations of generative AI. Supply generative AI guidelines, as it requires skills, funds and caution. Weigh technical capabilities with ethical factors. Beware of subpar offerings that exploit the current hype.

- Mitigate generative AI risks by working with legal, security and fraud experts. Technical, institutional and political interventions will be necessary to fight AI's adversarial impacts. Start with data security guidelines.

- Optimize the cost and efficiency of AI solutions by employing composite AI approaches to combine generative AI with other AI techniques.

Sample Vendors

Adobe; Amazon; Anthropic; Google; Grammarly; Hugging Face; Huma.AI; Microsoft; OpenAI; Schrödinger

Gartner Recommended Reading

Innovation Insight for Generative AI

Emerging Tech Roundup: ChatGPT Hype Fuels Urgency for Advancing Conversational AI and Generative AI

Emerging Tech: Venture Capital Growth Insights for Generative AI

Emerging Tech: Generative AI Needs Focus on Accuracy and Veracity to Ensure Widespread B2B Adoption

ChatGPT Research Highlights

SaaS as a Platform

Analysis By: Paul Vincent, Yefim Natis

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

SaaS as a platform is the application platform underpinning a vendor's SaaS made available for other custom application development. It provides a catalog of the underlying SaaS technologies and business services to a (typically low-code) development environment supporting the development of both SaaS extensions and new applications, while reusing the underlying SaaS platform services for business logic, data, process, user experience and integration.

Why This Is Important

SaaS as a platform offerings are already disrupting the IT business. Salesforce is now the largest vendor in application infrastructure and middleware services. Microsoft, Oracle, SAP and ServiceNow also provide popular SaaS offerings with PaaS extension and development capabilities to their customers. These vendors are often considered by their customers as strategic service providers but are rapidly evolving into strategic technology platforms too. Adoption continues to expand.

Business Impact

SaaS megavendors consume increasing proportions of IT budgets. Business audiences are attracted to SaaS's commoditized services with predictable pricing, but also need differentiating custom applications and extensions. SaaS as a platform enables customers to exploit SaaS vendors' development tooling and composable services to meet their own application goals.

Drivers

▪ SaaS usage continues to expand, yet the need to differentiate these services to custom audiences and practices remains consistent. SaaS as a platform usage continues to grow to support the need for more customization of more instances of SaaS (and indeed across growing lists of SaaS vendors).

▪ Consumption of API services to provide composite/composed applications continues to grow. SaaS APIs enable applications to deliver more and extended use cases through access to shared SaaS data and services.

▪ The low-code application platform (LCAP), business process automation (BPA) and integration platform as a service (iPaaS) capabilities embedded in most core SaaS as a platform offerings also represent high-growth digital platform development technologies. SaaS as a platform provides easy access to these technologies for customer IT and business technologist developers, evidenced by Salesforce's success in becoming the largest application and infrastructure middleware services vendor.

▪ SaaS platform vendors continue to innovate in order to compete, extending further and faster the scope of their platform offerings. This, in turn, feeds interest and adoption from IT and business technologist teams.

▪ Hype is low but rising, as SaaS as a platform adoption evolves from departmental to strategic and enterprise use cases, and SaaS vendors increase their marketing to CIOs and IT leaders.

Obstacles

- Lock-in to strategic SaaS partners increases when usage extends to custom extensions and other applications. This results in a customer dilemma: should you invest more in your strategic SaaS partners, or diversify platform investments with best-of-breed solutions using intervendor integration?

- The technology components of SaaS vendors can be incomplete or immature compared with specialist competition. Examples are support for complex architectures, business process standards, common component catalogs, real-time event handling, decision management, or governed citizen development. SaaS-based LCAPs can also inherit a lack of B2C support and cloud portability from their SaaS parentage.

- Overall vendor charges for SaaS and associated platforms are rising as usage increases, typically based on growth of end-user-named user seats, and pricing will continue to be a major inhibitor on wider adoption from departmental to strategic and enterprise use cases.

User Recommendations

- Explore the implications of SaaS as a platform versus a best-of-breed approach for applications and platforms. Overlapping platforms will add cost, skill dilution and overlapping capabilities, but will also reduce exposure and risk to any specific vendor.

- Ensure any SaaS as a platform selection meets your requirements for platforms for custom application platform development. These could include composability to create new and custom applications via APIs, strong integration capabilities, user experience, developer experience, and complex business logic.

- Beware of legacy SaaS vendors that rely on multiple underlying platforms and architectures with disparate API styles and limited integrations, which increase operational management costs and complexity of reuse.

- Beware of high costs associated with menu-driven pricing for these platforms, and mitigate those costs through contract best practices.

Sample Vendors

Creatio; Microsoft; Oracle; Pegasystems; Salesforce; SAP; ServiceNow; Zoho

Gartner Recommended Reading

How to Navigate the Application Platforms Market Including Cloud-Native, Low-Code and SaaS

Identify and Evaluate Your Next Low-Code Development Technologies

How to Govern and Fund Platforms in a Product World

How to Establish Effective SaaS Governance

Quantum Computing

Analysis By: Chirag Dekate, Matthew Brisse

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Quantum computing is a type of nonclassical computing that operates on the quantum state of subatomic particles. These particles represent information as elements denoted as quantum bits (qubits). Qubits can be linked with other qubits, a property known as entanglement. Quantum algorithms manipulate linked qubits in their entangled state, a process that addresses problems with vast combinatorial complexity.

Why This Is Important

Quantum computing will not displace conventional computers. However, it will disrupt areas such as some classes of BQP (bounded-error, quantum, polynomial time) problem, quantum realistic simulations (used in material science, chemical simulations and drug discovery) and cryptography (security), where it will deliver results beyond what is feasible using classical techniques. Quantum computing could also advance the speed and/or quality of machine learning and optimization solutions.

Business Impact

With minimal investment required to investigate a broad range of quantum use cases, the potential rewards hugely outweigh the risks. Multiple use cases, such as optimization, run optimally on quantum computing system architectures. Also, the growing maturity of quantum ecosystems enables organizations to choose from a variety of quantum computing as a service (QCaaS) offerings. Enterprises need to plan for four key areas of impact: optimization, simulation, BQP and security.

Drivers

- Significant investments by governments, major corporations and startups amount, in aggregate, to more than $2 billion yearly.

- Enterprise and academic research teams have produced promising results for diverse use cases, including optimization and materials simulation, using current-generation noisy intermediate-scale quantum (NISQ) systems.

- Demonstrations of foundational quantum technology using electrons, ions, cold/neutral/helium atoms and photons are resulting in potential pathways to scalable quantum computing.

- The scale of superconducting gate-based quantum systems continues to increase, with some quantum computing vendors developing systems that scale to hundreds of qubits.

- Error correction algorithms and new methods such as error mitigation and error suppression are in development. These promise to make NISQ systems more usable.

- Managed service providers, including boutique quantum services companies, are partnering with enterprises to identify use cases and develop quantum algorithms.

Obstacles

- With few use cases guaranteeing an ROI, enterprises might deprioritize investments in quantum computing.

- Current, limited-scale qubit technology is too noisy and delivers returns of limited value.

- Standardization is lacking across programming, middleware and ecosystems.

- The market is highly fragmented, with over 600 startups operating in high-risk macroconditions. This exposes enterprises to innovation risk.

- Although small numbers of qubits can represent large amounts of data, quantum computers cannot convert large amounts of data to a quantum state, due to quantum RAM's immaturity.

- Unlike computing-on-silicon technology, there is no single physical computing stratum for quantum computing, and it is not possible to mix platforms at the quantum level. This results in a highly diverse range of potential platforms and in enterprises choosing platforms that might prove incompatible with future quantum computers.

- Enterprise leaders recognize that quantum computing will take more than 10 years to mature. This results in limited short-term investment.

User Recommendations

- Be frugal when it comes to investment in quantum computing. Focus on the problem you want to solve and ways to mature the quantum computing ecosystem. Quantum innovation is a long-term endeavor, so it is imperative to temper expectations.

- Create a pipeline for quantum computing talent by funding academic research projects that closely align with your use cases. When quantum computing becomes relevant to your organization, even a few quantum-capable employees will make a material difference.

- Plan for quantum-inspired classical optimization projects for skills development in areas such as warehouse routing, traffic routing, portfolio balancing and workforce planning.

- Plan for innovations in chemistry and materials science. Quantum computing has the potential to enable quantum-realistic simulations that could prove important in diverse fields, such as manufacturing, aerospace and defense.

Sample Vendors

Classiq; Google; IBM; Infleqtion; IonQ; IQM; PASQAL; Quandela; SandboxAQ; Zapata Computing

Gartner Recommended Reading

Cool Vendors in Quantum Computing

Infographic: How Use Cases Are Developed and Executed on a Quantum Computer

Preparing for the Quantum World With Crypto-Agility

Hyflex Classrooms

Analysis By: Tony Sheehan, Paul Riley

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

"Hyflex classrooms" now typically describe collaborative teaching spaces that allow faculty to teach students on-campus and online at the same time. Students and faculty are connected using technologies that allow all to be synchronously seen and heard to create rich student engagement.

Why This Is Important

Hyflex classroom use increased during the peak of COVID-19 as constrained campus access intensified interest in connecting online and any on-campus participants. Demands for continued institutional flexibility and opportunities to improve support for remote students create a need to review the performance of hyflex classrooms to date and to evolve their design to support institutional learning strategy.

Business Impact

Given the continued interest in online and hybrid models, teaching must evolve to align with student needs and expectations. Hyflex classrooms offer the potential to synchronously engage on-campus and online participants, improve collaboration and mobilize the knowledge of students and external experts. They have proved particularly popular in supporting classrooms where high faculty contact, personalization and global reach are required.

Drivers

- Poor quality online learning experiences during the pandemic encouraged exploration of technologies to support collaborative teaching experiences.

- Hyflex classrooms provided a rapid path toward continuity of education to campuses constrained by social distancing.

- By delivering hyflex learning to those students able to attend campus and those online at the same time, institutions were (in theory) able to preserve existing educational models rather than initiate complete program redesigns. This also allowed institutions to accelerate the initial teaching impact of those faculty inexperienced with online learning design, leveraging high-quality video and audio technologies to enhance learning quality.

- In parallel, they offered an opportunity for higher education institutions to reassure students that a high-contact, experiential experience would be delivered online. This offers highly collaborative teaching rather than solitary distance learning and an opportunity to compete against other institutions positioning hyflex as a critical part of online teaching.

- True hyflex models (as developed by Dr. Brian Beatty at San Francisco State University) empower students' choice of learning delivery mode but require careful coordination by the institution.

- Institutions must now review the role of the hyflex classroom. Hyflex must transition from a transient response to the pandemic toward a part of a more strategic component of online and blended learning.

Obstacles

- Complex: Mixing in-person and online interaction is technically and socially challenging. Faculty and students can find excessive use of synchronous activities inflexible and exhausting.

- Novel: Social "rules of engagement" in these spaces are evolving and optimal teaching practices are still emerging.

- Labor-intensive: Teaching, facilitation and technology support are frequently needed to preserve student engagement, particularly in breakout rooms.

- Require coordination: True hyflex teaching models allow students to choose between on-campus and online attendance. Institutions must manage attendance to preserve the teaching experience.

- A transient solution: As teaching models and student preferences evolve, hyflex classrooms must be seen as an evolving research project to manage risks of overinvestment.

- Cost: Initial technology investment in these classrooms may have been sourced from government pandemic recovery funds. Long-term maintenance and operational costs must also be considered.

User Recommendations

- Manage risks of excessive expectations of hyflex classrooms by aligning investments to institutional strategy, capabilities and budgets.

- Reevaluate the need for hyflex classrooms within the institutional learning strategy by actively seeking out faculty, student and staff insights on the experiences of hyflex classroom designs to date.

- Assess the benefits and optimal uses of hybrid classroom experiences alongside other models of purely on-campus or blended learning.

- Ensure hyflex classroom designs align with accessibility strategy and appropriately engage those students not wanting to return to previous delivery modes.

- Manage the exposure to hyflex classrooms within a blended learning strategy by balancing the use of hyflex synchronous activities with other live, asynchronous or content-based learning interventions.

Sample Vendors

Barco; Cisco Systems; Engageli; mashme.io; Microsoft; Zoom Video Communications

Gartner Recommended Reading

Top Technology Trends in Higher Education for 2023

Sliding into the Trough

Conversational User Interfaces

Analysis By: Gabriele Rigon, Stephen Emmott, Van Baker, Bern Elliot, Frank O'Connor

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Conversational user interfaces (CUIs) are human-computer interfaces that enable natural language interactions for the purpose of fulfilling a request, such as answering a question or completing a task. The sophistication of a CUI can vary from understanding basic queries to handling complex multiturn dialogs, so CUIs range from Q&A bots to more advanced virtual assistants (VAs). CUIs fundamentally shift the interaction medium from traditional point-and-click to natural-language-driven.

Why This Is Important

UIs provide direct control between the user and the applications they are operating. In a CUI, this responsibility shifts from application-specific controls to conversational controls, and the CUI is determining the intent and acting upon it. This makes CUIs more widespread as agent (acting) UIs for software, devices and the Internet of Things. AI-enabled CUIs can provide a single, intuitive, common interface to multiple application functions across the entire organization.

Business Impact

Training, onboarding, escalations, productivity, empowerment and responsibility all change with CUIs and need to be embraced as part of CUI projects. AI-enabled CUIs can dramatically standardize and improve the usability of a variety of applications across all business functions, such as CRM, the digital workplace and ERP, hence improving efficiency. They can also benefit customer experience when used to automate support in the form of self-service chatbots or VAs.

Drivers

- **Users' expectations and generative AI**: Users increasingly expect to be able to hold conversations with and ask natural language questions of the applications they use. CUIs are beginning to complement or even replace traditional interfaces in a variety of applications, such as search and insight engines, business intelligence platforms and productivity software, such as document and spreadsheet applications. The trend toward the enablement of interactions in natural language between users (customers and employees) and software has been significantly accelerated by the hype around generative AI and ChatGPT.

- **Conversational AI platforms**: The underlying technology supporting custom-developed CUIs (like chatbots and VAs) built on top of conversational AI platforms (CAIPs) has matured significantly in the last few years. Vendors are investing in core AI technologies, such as large language models (LLMs), to improve components such as natural language understanding. They are also expanding their capabilities to support broader use cases beyond self-service chatbots and toward broader B2C and B2E automation.

- **Search**: CUIs will be increasingly used for knowledge search and retrieval based on document ingestion. Some technologies driving this include LLM-enabled enterprise applications, such as Microsoft 365 Copilot, as well as ChatGPT-like Q&A chatbots and LLM-powered VAs. This is also causing the market to be flooded with dedicated add-ons and even new vendors.

- **Multimodal interactions**: Generative AI methods are increasing the availability of multimodal interactions, such as those based on images, videos, audio and other sensory data. As a matter of fact, beyond text, voice is emerging as a primary modality of interaction between users and CUIs. This can add a powerful enhancement to the communications. Multimodality can solve some of the problems of the current generation of LLMs. Multimodal language models will also unlock new applications that were impossible with text-only models.

Obstacles

- Developing CUIs is intrinsically complex and requires more effort than graphical UIs. More sophistication has to be built into VAs' conversational capabilities to deal with a range of users and edge cases. CUIs' predictions about users' intents can be wrong, so the CUI designer has to keep ambiguity in mind.

- Lack of CUI personality, poor accuracy and conversational design, as well as unreliability of answers generated by LLMs, can affect user sentiments negatively and, as a consequence, adoption and ROI.

- CUIs are available from many sources, whether offered by applications, CAIPs or through separate augmentation. For example, transactional conversational AI use cases require capabilities that only platforms can provide. Q&A scenarios may also be supported by architectures primarily leveraging search and LLMs. Understanding the sophistication and the limitations of these and other approaches is not trivial. This may lead buyers to choose the wrong tooling and many CUIs to fail.

User Recommendations

- Treat CUIs as transformative, and plan on them becoming the dominant interaction model between users and applications.

- Prioritize the requirements of your custom CUIs in terms of sophistication, integration and control. Do not underestimate the risks of building CUIs that do not meet enterprise-grade performance, accuracy and security standards.

- Develop your strategy for consolidation upon one or few conversational AI platforms or approaches, avoiding challenges that derive from the proliferation of CUIs deployed by different business units in different regions.

- Educate stakeholders around benefits and limitations of generative-AI-enabled CUIs, and encourage well-informed employees to experiment with such CUIs.

- Prepare for new roles and skills in the enterprise. Dialogue designers and AI trainers, for example, are needed to enable custom CUI initiatives. Citizen developers will acquire prompt engineering and model management skills to leverage generative-AI-enabled CUIs effectively.

Sample Vendors

Amelia; Avaamo; Cognigy; Google; IBM; Kore.ai; Omilia; OneReach.ai; OpenAI

Gartner Recommended Reading

Magic Quadrant for Enterprise Conversational AI Platforms

Critical Capabilities for Enterprise Conversational AI Platforms

Competitive Landscape: Conversational AI Platform Providers

Emerging Tech Roundup: ChatGPT Hype Fuels Urgency for Advancing Conversational AI and Generative AI

Immersive Technology

Analysis By: Grace Farrell

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Immersive technology now describes the category that includes virtual, augmented and mixed reality. These are different, yet related technologies. Virtual reality (VR) technologies create computer-generated environments to immerse users in a virtual environment. Augmented reality (AR) technologies overlay digital information on the physical world to enhance it and guide action. Mixed reality (MR) blends the physical and digital worlds in new ways.

Why This Is Important

Immersive technology represents an important, potentially transformational technology in education. Its unique ability to create interactive learning spaces not possible in the classroom is itself a compelling argument for its use, but requires a well-designed curriculum. Prices of various platforms and hardware have continued to fall, but are still too high for large-scale deployment, slowing its progress in education environments.

Business Impact

The new generation of immersive applications promises to support learning activities that improve student engagement, such as:

- Virtual field trips — Trips to remote (even historical) locations

- Vocational or practical training — Simulated experiences with a digital overlay

- Athletic experiences — For example, football accuracy training

Immersive technologies can be extremely engaging, though expert curricular design is required to lead to improved learning outcomes as a result.

Drivers

■ Good examples of quality content being adopted can be found in fields such as manufacturing and healthcare, where simulations are particularly effective for student understanding.

■ Increased sector adoption of online and blended learning has led to an interest in environments that can enhance engagement and impact.

■ Some poor online learning experiences from those institutions pivoting to online during the pandemic have stimulated a search for more interactive learning experiences.

■ The progress of this content development continues the profile's march through the Peak of Inflated Expectations.

■ Popular use cases involve simulation and skills development (for example, learning how to operate heavy machinery prior to real-life physical use.).

■ The overall costs of developing immersive technologies are falling over time. However, the hardware and space constraints, particularly in schools, still need to be solved. Most institutions implementing immersive technology now are doing so in smaller, more concentrated class sizes.

Obstacles

■ There is a relatively small amount of high-quality, education-specific content to meet the broad range of curricular needs that align with academic standards.

■ Individual comfort in immersive environments remains variable and undermines widespread adoption. Studies have warned about VR sickness, particularly in head-mounted displays, causing individuals dizziness, nausea, and blurred vision.

■ Immersive technologies' novelty can stop them from being leveraged effectively to achieve results that matter. Hence, educational institutions should ensure that quality content comes first.

■ The issue of cost and scale continues to be particularly problematic in K-12, where models for using a few expensive immersive headsets in limited physical classroom space are not very practical.

■ The technical challenges and the policy and pedagogical obstacles to be overcome mean that it will be five to 10 years before these technologies reach the Plateau of Productivity in education.

User Recommendations

Education institutions have been anticipating the large-scale adoption and practical use of immersive technology tools for some time:

- Ensure that users gain experience implementing and supporting smaller applications of immersive technologies before moving on to large, classroom-scale applications, given price concerns.

- Strengthen network coverage to support large-scale use of these tools.

- Find ways to manage the currently consumer-oriented nature of many of these tools that are in an enterprise environment.

- Continue to track effective applications and pilot and adopt those that really do impact learning outcomes for the better. Immersive technologies represent potentially powerful learning tools — do not neglect the pedagogical future that is possible here.

Sample Vendors

Alchemy Immersive; Bodyswaps; Google; INDYLAB VR; InstaVR; Microsoft; Nearpod; VictoryXR; zSpace

5G

Analysis By: Sylvain Fabre

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

5G is the fifth generation cellular technology standard by the 3rd Generation Partnership Project (3GPP). The standard targets maximum downlink and uplink throughputs of 20 Gbps and 10 Gbps, respectively. Latency is as low as 4 milliseconds in a mobile scenario and can be as low as 1 millisecond in ultra reliable low-latency communication scenarios, down to centimeter-level location accuracy indoors, and massive IoT scalability. New system architecture includes core slicing and wireless edge.

Why This Is Important

5G supports the 4th industrial revolution and IoT. Its fast and reliable real-time data transfer will benefit many industries. 5G supports eMBB, URLLC and MIoT — vital for enterprise transformation. 3GPP 5G standards releases deliver incremental functionality in: R15, extreme mobile broadband; R16, industrial IoT (massive IoT, slicing and security) — latest commercially available release; R17, MIMO enhancements, sidelink, DSS, IIoT/URLLC, bands up to 71GHz, nonterrestrial networks; and RedCap R18 is under definition with a planned freeze date in 1Q24.

Business Impact

- 5G enables three main technology deployments; each supports distinct new services for multiple industries and use cases of digital transformation, and possibly new business models (such as latency as a service). These are enhanced mobile broadband (eMBB) for HD video, mMTC for large IoT deployments, and URLLC for high-availability and very low-latency use cases, such as remote vehicle operations.

- Promising applications for 5G use include fixed wireless access, IoT support and private mobile networks.

Drivers

- Over 249 operators have rolled out 5G (see GSA), 30% of public mobile networks, and some form of 5G capability is penetrating lower cost smartphones in vendors' portfolios (with over nine versions of the technology depending on the band and the 3GPP release).

- Gartner estimates that 5G-capable handset penetration in 2025 will reach 54% worldwide, and 78% in Western Europe, with 5G-capable handset share of sales reaching 80% in 2023 in Western Europe from 51% in 2021. North America share will rise to close to 87%.

- 5G capability is starting to deliver value in emerging always-on wearables use cases.

- Increased data usage per user and device requires a more efficient infrastructure.

- Requirements from industrial users value 5G lower latency from ultra reliable and low-latency communications (URLLC) and expect 5G to outperform rivals in this area.

- Demand continues for massive machine-type communications (mMTC) to support scenarios of very dense deployments up to the 5G target of one million connected sensors per square kilometer. While diverse networks can offer adequate and cost-effective alternatives to 5G for many use cases (e.g., LPWA, NB-IoT, LoRa, Wi-SUN), overall total cost of ownership (TCO) and future proofness may not be as good.

- Availability has increased for industry-specific spectrum options (e.g., CBRS).

- Competitive pressures continue, for example, if one CSP launches 5G in the market others usually have to follow or risk losing market share — this includes both public as well as private 5G offerings.

Obstacles

- Issues with availability and cost of spectrum, in particular for industrial private networks, occur in some countries.

- Security concerns arise when using 5G in critical industrial scenarios.

- Availability and pricing of networks and modules for R16 and beyond solutions.

- Upgrade to 5G SA (stand-alone) core is needed for more advanced R16 releases (such as slicing), and commit to the continuous evolution of 5G releases over R17, R18 and beyond.

- Cost of radio network upgrades for 5G coverage and availability may require additional sites.

- Use of higher frequencies and massive capacity requires denser deployments with higher frequency reuse, which could raise network costs.

- Uncertainty exists about use cases and business models that may drive 5G for many CSPs, enterprises, and technology and service providers (TSPs).

- Feedback from some industrial clients mentioned that the majority of their use cases could be serviced by a 4G private network, Wi-Fi and/or NB-IoT, and other LPWA such as LoRa.

User Recommendations

- Enable R16 and above 5G for enterprise connectivity for mobile, nomadic and FWA secondary/tertiary use cases for branch location redundancy, as long as 5G is not the primary link for high-volume or mission-critical sites and unless there are no other options.

- Provide clear SLAs for network performance by testing installation quality for sufficient and consistent signal strength, signal-to-noise ratio, video experience, throughput and coverage for branch locations.

- Ensure backward compatibility to 4G devices and networks, so 5G devices can fall back to 4G infrastructure.

- Focus on architecture readiness — such as SDN, NFV, CSP edge computing and distributed cloud architectures, and end-to-end security — in preparation for 5G.

- Build an ecosystem of partners to target industry verticals more effectively with 5G before your competition.

Sample Vendors

Ericsson; Huawei; Mavenir; Nokia; Qualcomm; Rakuten Symphony; Samsung Electronics; ZTE

Gartner Recommended Reading

Emerging Tech: 5G mmWave at a Crossroads

Infographic: 5 Steps for Vendors to Scope and Run Successful POCs for Enterprise 5G PMNs

Invest Implications: Magic Quadrant for 5G Network Infrastructure for Communications Service Providers

Market Guide for 4G and 5G Private Mobile Networks

Quick Answer: What Vendor Product Leaders Need to Know About MWC Barcelona 2023

Blockchain in Education

Analysis By: Robert Yanckello

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

A blockchain is an expanding list of cryptographically signed, irrevocable transactional records shared by all network participants. Each record contains a time stamp and reference links to previous transactions. With this information, anyone with access rights can trace back a transactional event — at any point in its history — belonging to any participant. A blockchain is one architectural design of the broader concept of distributed ledgers.

Why This Is Important

Blockchain in education can optimize and transform higher education record keeping, including self-sovereign credentials, learner records and degrees. It can put learners in charge of their education portfolio by eliminating the need for institutions or third parties to verify credentials for employers. It has the potential to disrupt the entire education ecosystem with education specific blockchain-based platforms and tokenized academic rewards.

Business Impact

The business impacts of blockchain in education include:

- It falls into four types of applications: blockchain disruptor, digital asset market, efficiency play and record keeper. Higher education use cases continue to cluster around the last two, and disruptive power lies in the first two.

- Its distributed ledger technology can manage student records securely and transform how credentials, transcripts and faculty contracts are validated and shared.

- It can help improve accountability, transparency and educational experience for students and institutions.

Drivers

- The growing interest and conveyance of alternative credentials, digital diplomas, certified learner records and the broadening ecosystem and infrastructure can drive the use of these applications.

- Institutions in several countries have issued blockchain-verifiable credentials, many using an open standard called Blockcerts.

- The issuance of blockchain-based credentials creates operational efficiencies in the current institution-centric model and gives the credential earner control over who they share their credentials with and how. Given current workforce dilemmas, this move can support increased worker mobility and make it easier to collect, store and share credentials throughout their careers.

- Smart contracts for faculty, or confidential documents that digitally facilitate the execution of the agreement, speed up the process and provide a more secure way of executing and managing agreements.

Obstacles

- While the promise of blockchain is exciting and bold, there is a stifled interest in the technology itself and more interest in products and solutions that improve or optimize service regardless of architectural design.

- The 2023 Gartner CIO and Technology Executive Survey revealed that 52% of higher education respondents indicated they have no interest or plans to deploy blockchain.

- Higher education's averseness to change combined with the fact that organizations infrequently use blockchain features such as decentralized consensus, tokenization and smart contracts, inhibits the use of more transformational and disruptive solutions.

- There are general negative enterprise perceptions concerning digital business assets, tokens and cryptocurrency.

- There is a lack of generally accepted global standards for technical interoperability or effective governance for consortia and alliances to drive standardization.

User Recommendations

- Identify if there is a legitimate business need for blockchain. If so, educate senior university leaders about the benefits. In addition to issuing and verifying credentials of some other use cases, include things like smart contracts, certified learner records and student payment options.

- Evaluate vendor offerings and open standards for pros and cons, as well as vendor lock-in. Select low-risk pilots and proofs of concept. Evaluate the results and keep or discard them. But, be prepared to migrate off the chosen technology within 18 to 24 months due to anticipated vendor consolidation and a rapidly shifting market.

- Gain an understanding of industry standards and governance developments around significant areas, such as student payments, IP management and digital credentialing with blockchain. Otherwise, those who are involved will determine the standards and governance that impact your organization.

Sample Vendors

BitDegree; Blockchain Education Network (BEN); Educhain; Grape Technology; Hyland; Pansoft Technologies; Parity Technologies; Pistis.io

Gartner Recommended Reading

Guidance for Blockchain Solution Adoption

Hybrid Integration Capability Framework

Analysis By: Shrey Pasricha

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

The hybrid integration capability framework (HICF) defines a logical framework to amass integration and governance capabilities across an organization. It enables organizations to tackle multiple integration use cases across four dimensions — personas, endpoints, deployment model and domains. It defines how an organization can approach integration, assembling multiple integration tools from one or more providers and managing them as a cohesive, federated and integrated whole.

Why This Is Important

Organizations pursuing digital and composable business initiatives find that the integrations they need to build are required to:

- Connect systems and services residing on different endpoints.

- Implement a myriad of use cases and integration patterns.

- Enable delivery by various integrator personas.

- Deploy to different runtime environments.

The HICF helps software engineering leaders responsible for integration architecture to organize their portfolio to support a modern integration strategy.

Business Impact

Implementation will differ to reflect specific requirements, but in all cases, HICF alleviates any integration challenges by:

- Providing a reference model to match desired integration capabilities to evolving business needs.

- Reducing unnecessary duplication, diversity and expenditure in the integration portfolio.

- Accelerating time to value for integration-intensive business initiatives and putting an organization on the path to decentralized, self-service integration delivery.

Drivers

Organizations generally have an array of integration tools and scattered platforms which are not governed or managed as a logical whole. These tools and platforms include on-premises and cloud-delivered integration platforms, API management platforms, event brokers, metadata management tools, open-source integration frameworks, SaaS-embedded integration capabilities and other use-case-specific components — often from different providers. The HICF provides a way to organize and manage these multiple products and use cases in order to:

- Enable a range of diverse integration personas to perform integration work in a self-service fashion. These personas include integration specialists (professional integration developers), "ad hoc" integrators (SaaS administrators and business technologists who occasionally have to perform integration work) and citizen integrators (business users who want to automate personal or workgroup processes).

- Integrate a wide variety of endpoints residing in cloud environments, on-premises data centers, ecosystem partners, and mobile and Internet of Things (IoT) devices by using APIs, events and batch mechanisms.

- Support a differentiated set of use cases, including but not limited to application, data, B2B, process, IoT, API and event integration, robotic process automation, and digital integration hubs.

- Deploy integration platform capabilities in a hybrid, multicloud scenario — that is, one featuring a combination of public and private clouds and on-premises data centers — and embed them in applications and edge systems.

- Augment the organization's integration landscape by supporting delivery of SaaS-embedded integrations as well as integration as code delivered via software engineers through programming languages, open-source integration frameworks and serverless functions.

Obstacles

- Organizations fail to consider dimensions like endpoints, personas and use cases, and solely focus on deployment models to select a single integration platform as they confuse the "hybrid" in "HICF" with hybrid deployment models.

- A plethora of technology providers have released integrated technology stacks mirroring the HICF; however, a hybrid integration implementation often requires the aggregation of multiple products from different providers. Such a technology aggregation poses governance and operational challenges.

- The use of a wide range of tools leads to suboptimal outcomes and skills duplication. However, implementing a single, cross-product "control plane" requires notable investments in technologies and skills.

- HICF is a logical framework which is a precursor to enable self-service integration by a variety of organizational units which can lead to chaotic duplication of efforts and high costs in the absence of well-defined governance policies.

User Recommendations

- Map your organization's integration capabilities to the HICF by aggregating multiple tools and approaches instead of finding one tool, then unify them under a common strategy and governance approach.

- Federate different vendors' products instead of buying an out-of-the-box HICF-inspired platform to build target capabilities. This approach works best for large organizations as it makes it easier to maintain backward compatibility with in-place integration platforms and mitigate the risk of single-vendor lock-in.

- Adopt an iPaaS, whenever possible, to reduce the complexity of effort in building target capabilities using HICF. This approach works best for midsize organizations as an iPaaS provides a subset of the HICF capabilities that is generally sufficient for such organizations.

- Build your target HICF-inspired platform by adopting a stepwise, business initiative driven strategy, which is much easier to justify than a "big-bang" approach and reduces complexity and risk.

Sample Vendors

Boomi; IBM; Jitterbit; Microsoft; MuleSoft; Oracle; SAP; SnapLogic; Software AG; TIBCO Software

Gartner Recommended Reading

How to Select the Right Mix of Integration Technologies

Integration Maturity Model

FIDO

Analysis By: Ant Allan, James Hoover, Robertson Pimentel

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

The Fast IDentity Online (FIDO) authentication protocols published by the FIDO Alliance combine public-key credentials in a hardware or software authenticator with a local "gesture" (e.g., a PIN or a biometric method). The majority of new FIDO deployments use FIDO2, which includes enabling the W3C Web Authentication (WebAuthn) standard. FIDO2 supports platform authenticators on single or multiple endpoint devices and roaming authenticators such as FIDO2 security keys and passkey-enabled phones.

Why This Is Important

Digital identity hinges on authentication that can provide credence in an identity claim, sufficient to bring account takeover risks within an organization's risk tolerance, ideally without adding unnecessary friction to the user journey. FIDO, particularly FIDO2, including passkeys, promises phishing-resistant passwordless authentication, as a robust alternative to widely used multifactor authentication (MFA) methods, and with better user experience (UX).

Business Impact

Identity and access management (IAM) and other security leaders across all industry verticals and geographies can benefit from adopting FIDO, which can:

- Improve UX by eliminating passwords.

- Elevate trust by providing phishing-resistant passwordless MFA in a variety of employee and customer use cases.

- Enable consistency across different use cases.

- Simplify the implementation of third-party biometrics (for improved accountability) in some use cases.

Drivers

The adoption of FIDO protocols is mainly driven by:

- The imperative to avoid the vulnerabilities, risks and user frustration associated with passwords, which drives interest in passwordless authentication generally.

- The increase in phishing and similar attacks against phone-as-a-token authentication methods, including mobile push, as well as legacy one-time password (OTP) tokens, and the emerging imperative to use phishing-resistant MFA.

- Wide availability of physical FIDO2 security keys (i.e., "dedicated devices") from a variety of vendors, some with embedded fingerprint sensors, and increased availability of FIDO2 platform authenticators (i.e., "embedded credentials") in Apple, Google and Microsoft operating systems.

- Support for multidevice FIDO2 credentials, or passkeys, which can be synced across all of a user's devices (including hardware security keys) without them having to separately enroll every device for each service provider.

- Support for cross-device authentication, enabling a user to use a passkeys-enabled phone as a FIDO2 roaming authenticator (i.e., "companion device") to log in to an app or website from another device that the user doesn't own or which can't support passkeys.

- Widespread support for FIDO2/WebAuthn in popular web browsers and mainstream access management (AM) platforms, including Microsoft Azure Active Directory Premium (AADP), enabling the use of a variety of FIDO2 platform and roaming authenticators, potentially including passkeys. Emergence of specialist vendors facilitating the use of passkeys for customer authentication adds impetus.

- Increasing advocacy of passkeys by Apple, Google and Microsoft and visible support for login with passkeys from well-known social networks and service providers such as BestBuy, Cloudflare, eBay, GitHub, PayPal (U.S.), Stripe and WordPress.

- Microsoft's support for FIDO2 security keys, as well as Windows Hello for Business (WHfB), in Windows 10 and 11, which enables login to corporate AD networks as well as the cloud (via AADP).

Obstacles

- FIDO2 security keys may not be easily used by people with manual disabilities.

- Passkey syncing is currently limited to single-vendor ecosystems. Synced passkeys not in the user's sole possession may not meet strong customer authentication (SCA) or employee MFA requirements.

- Employees can use FIDO2 security keys for Windows login, but these have high overheads. Cross-device authentication for Windows is limited to proprietary options, but these require desktop software or dongles. Older VPNs and legacy applications that cannot be federated or otherwise integrated with a FIDO2-enabled identity provider are unsupported.

- Among customers there is not yet enough penetration of passkeys or awareness of passkeys as an option. People's privacy concerns that ecosystem vendors might collect and monetize information about their online behaviors may be an inhibitor. Additionally, standard FIDO implementations can use only local biometrics, whereas nonlocal architectures can support multiple customer channels and life cycle events.

User Recommendations

For employees:

- Seek near-term opportunities in discrete use cases. Consider using passkeys as a password replacement within a legacy MFA scheme. Take advantage of support for device-bound passkeys to enable their use as an MFA option for access via an AM platform. Evaluate the benefits of using FIDO2 security keys for passwordless Windows login against the supply chain and provisioning overheads; consider proprietary options for using device-bound passkeys on smartphones as an alternative.

- Be cautious about continued investment in legacy tokens, but note that these may be needed to support legacy nonweb applications. Multiprotocol tokens and authenticator apps can span transitional needs.

For customers:

- Support and advocate passkeys as a passwordless option for those that can use it; highlight passkeys as a login option and make enrollment easy. An additional factor might still be needed to meet SCA needs.

- Weigh the benefits of using FIDO2 to simplify the integration of third-party biometrics in mobile apps against the need for nonlocal architectures.

Sample Vendors

Apple; Corbado; FEITIAN Technologies; Google; Hanko; HYPR; Microsoft; Nok Nok; Okta; Yubico

Gartner Recommended Reading

Innovation Insight for Many Flavors of Authentication Token

Take 3 Steps Toward Passwordless Authentication

Market Guide for User Authentication

SaaS for SISs

Analysis By: Robert Yanckello, Grace Farrell

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

SaaS for student information systems (SISs) in education is software that is owned, delivered and managed remotely by one or more providers. The software is based on a single set of common code and consumed in a one-to-many model by all contracted customers at any time, on a pay-for-use basis or as a subscription.

Why This Is Important

A student information system serves as an institution's core system of record, making it a critical component of day-to-day college and university operations. It provides functionality for administrators, faculty and students to manage key institutional information assets, such as demographic data, course offerings, schedules, grades and transcripts.

Business Impact

SaaS-based SISs have the potential for high business impact. Their modern design can bolster operational efficiencies and effectiveness, while improved, updated user interfaces can boost student and faculty engagement. However, the support for new business models, such as nontraditional students, alternative credentials and borrower-based academic year "nonterm" financial aid will likely have the greatest impact, as these models remain critical to the modern institution.

Drivers

- Modernization strategies focus on composing a platform of technologies with an emphasis on improving student outcomes, student engagement and the overall total experience.

- Institutions are looking to sustain advancements in adaptability and innovation as a result of the COVID-19 pandemic.

- SaaS SIS products can provide more agility and innovation to meet changing student expectations and new business models.

- SaaS is no longer a new delivery model for the education market, with more institutions progressively having deployed SaaS applications for CRM, HR, finance and other administrative applications.

- Vendor-based SaaS SIS products for higher education continue to evolve. Some are native SaaS solutions, and others are ported and modified on-premises solutions now offered as configurable cloud offerings.

Obstacles

Despite curious optimism from clients about its future opportunities, SaaS-based SIS continues its descent into the Trough of Disillusionment as it encounters a few obstacles:

- A limited number of deployments and slow product evolution

- A lack of vendor-delivered migration paths and institutional commitments to change management

- Growing focus on deploying point solutions that provide near-term results with long-term value and strategic agility

- A lack of collaborative student life cycle strategy and corresponding modern digital architecture to support contemporary engagement experiences

- The slow pace of product development for some vendors

User Recommendations

- Prepare for the SaaS SIS transition by evaluating and addressing critical success factors like data conversion, organizational change readiness, application extension capabilities and integration architecture.

Develop a SaaS SIS strategy for modernizing your administrative processes by partnering with key stakeholders and focusing on their business requirements. Document gaps between current state and future-state expectations so you have reasonable reference points to compare both critical and emerging capabilities. When feasible, leverage third-party professional services to support and facilitate these activities.

- Position your institution to create improved digital experiences by updating and maintaining a reliable, secure and scalable infrastructure that supports a hybrid and multicloud environment.

Sample Vendors

Anthology; Ellucian; Jenzabar; Oracle; Populi; Serosoft Solutions; WDCi Group; Workday

Gartner Recommended Reading

Market Guide for Higher Education Student Information Systems

Modernization in Higher Education Means More Than Just Replacing Outdated Technology

Digital Integrator Technologies

Analysis By: Keith Guttridge

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Digital integrator technologies apply AI techniques to assist integration design and delivery, as well as optimize production performance and availability. These technologies focus on areas such as engagement via chatbots or voice; automation via process selection, next best action and intelligent data mapping to assist in integration development; and insight for processing optimization, intelligent platform operations and competitive analysis.

Why This Is Important

Digital integrator technologies are designed to simplify integration development. By anticipating user needs and making next-best-step recommendations for designing an integration flow, inference algorithms identify suitable prepackaged integration content, help rectify errors in flow and improve performance. Advanced digital integrator technologies dynamically optimize integration processing and platform operations, with capabilities to autoadjust runtime, auditing and self-healing.

Business Impact

The business impacts are:

- AI-enabled integration platforms provide automated guidance for integrating applications and data, simplifying tasks for integration specialists and improving productivity.

- Initiatives to modernize integration platforms using AI can adopt a low-code or no-code paradigm to increase adoption among business technologists.

- AI-assisted insight of the runtime environment can improve availability, identify process improvement and provide competitive market insights.

Drivers

- Delivery of integration is becoming pervasive, rather than just a specialist task. Digital integrator technologies empower a broad range of integration specialists and business technologists. This advances the ideas of democratizing integration and enabling composable business.

- Increased adoption of conversational user experiences is driving demand for connectivity to applications and data sources, producing the ability to create integration processes on demand or query the operational state of the integration platform.

- Increasing adoption of iPaaS has resulted in vendors gaining greater insight into how their tens of thousands of clients use their technologies via metadata. This, in turn, enables them to assist their clients in getting value from their offerings.

- Rapid improvement in generative AI has massively raised awareness and improved capabilities, such as communication in natural language to simplify the builder experience, data mapping between schemas, and dynamic generation of processes and tasks.

Obstacles

- Governance challenges reign when there is little or no availability of comprehensive lineage/metadata management capabilities that track the activities and outcome of data mapping or process selection. It may be difficult to ensure the traceability of integration flows or avoid potentially substantial, consequential damages created by flawed next best steps that are guided by flawed data.

- Experiences learned from AI come from the metadata generated by the huge variety of integrators building integrations, as well as the vast number of integrations run on the platform. This could misdirect the recommendation engine by highlighting poor design practices that become popular through overuse by nonspecialists.

User Recommendations

- Evaluate the AI capabilities of products against your most common and simplest integration scenarios to assess their accuracy and productivity benefits, before making them available to business technologists.

- Manage expectations by making it clear that digital integrator technology will only help with the most common integration scenarios for the leading applications and data sources. Complex integrations and data structures will see little benefit and still require integration specialists with the current generation of digital integrator technologies.

- Ensure integrations are fully managed by planning for security, monitoring, auditing, reporting and life cycle management. Digital Integrator technology only helps with the building and testing of integrations.

Sample Vendors

Boomi; IBM; Informatica; Microsoft; Oracle; SAP; SnapLogic; TIBCO Software; Tray.io; Workato

Digital Assessment

Analysis By: Saher Mahmood

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Digital assessment refers to the application of digital technologies to create, grade, administer, report and manage tests, and other assessment types, to evaluate learning outcomes. Technology enables intricate workflows, increased faculty collaboration in creating and assessing, anonymized grading and enhanced question analytics, among other things. The use of technology has helped expand the application beyond traditional formats to using immersive and other AI-enhanced capabilities as well.

Why This Is Important

Digital assessments can aid education's aim of moving from assessment of learning to assessment as a continuous part of learning. Analog methods to achieve this at scale are time-consuming. Digital can deliver both, year-end, high-stakes tests, and instructionally embedded formative assessments that continuously track individual student learning. The ability to achieve the latter at scale can offset the heavy dependence on the summative model that grades the student at the end of the learning.

Business Impact

Technology-based assessments generate valuable data on performance and learning. This can help instructors and students focus on weak areas with higher-frequency assessments and just-in-time and continuous feedback. It not only helps personalize learning but can also improve retention and graduation rates to have informed curriculum development.

Digital platforms for the development and management of assessments are also a key component for the scaling up and maturity of online learning.

Drivers

- Technology introduces or automates key features which either enhance the assessment of learning at scale or create an economy of time for the time-constrained faculty. For example, question analytics help identify questions that are poorly designed. Similarly, many commercial-off-the-shelf applications have been shown to create quantifiable value by saving 30% to 50% of the grading time, depending on class size. AI-aided grading processes promise to bring that time-saving number as high as 90% for large classes.

- The continued growth of online education, in general, is an obvious driver for the need for online diagnostic, formative and summative assessments. The key focus here is typically on both continuous evaluation of remote students and on providing a means for secure, proctored summative assessments.

- The pivot to digital during the COVID-19 crystallized the digitization of the summative assessment process for many other institutions that adopted universitywide digital assessment strategy. It also provided granular insights into student performance, helping address the learning loss experienced during the pandemic.

- Fifty-one percent of higher education respondents interviewed for the 2023 Gartner CIO and Technology Executive Survey plan to invest in digital assessments in the next one to three years. This is an increase from 44% in the 2022 survey.

Obstacles

- Online summative assessments must balance integrity of the test and student privacy concerns. Choosing a proctoring solution to protect student identity and prevent cheating presents ethical and practical considerations. Some automated solutions also generate false positives (for cheating) and can require time to investigate.

- New digital assessment tools do not always deliver major shifts in how assessments are conducted. While this may be normal, it may create assessment fatigue, warranting a need to educate faculty to diversify assessment experiences using multiple formats available on these platforms and also help digitize decades' worth of analog tests.

- Technology solutions are vulnerable to challenges like test theft and loss of assessment data and in some cases, can compound exam anxiety with technology anxiety.

- Emergence and increased use of generative AI across education may transform assessment. How this impacts the digitization of assessments is to be seen.

User Recommendations

- Prioritize a collaborative approach to take advantage of new capabilities by identifying key stakeholders among faculty.

- Experiment with new solutions to improve efficiency, effectiveness or saving time in assessment management.

- Explore transformational formats (such as immersive or collaborative formative assessment) on a small scale by piloting, making sure faculty is driving the initiative.

- Ensure data literacy and a strategy in place for collection, assessment and action on insights gained from these tools.

- Review data storage, encryption and transmission policies as well as the vendor's support for access management. Doing so will allow you to address the general concerns around privacy and instill stakeholder confidence.

- Boost adoption and scalability through robust integration of external assessment platforms with existing systems, such as learning management system (LMS) and student information system (SIS). This will ensure a smooth flow of data between these platforms.

Sample Vendors

ExamSoft; Excelsoft; Inspera; Janison; Learnosity (Questionmark); TestReach; Turnitin; UNIwise

Adaptive Learning Platforms

Analysis By: Saher Mahmood

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Adaptive learning platforms dynamically adjust the way instructional content is presented to students based on their responses or preferences. Adaptive learning relies on large-scale collection of learning data, algorithms and even AI-derived pedagogical responses to enhance student experience and success.

Why This Is Important

Adaptive learning platforms allow institutions and instructors to leverage their instructional content and integrated digital assessment to build adaptive courses or supplements to courses. They offer opportunities for institutions to enhance student attention and create personalization, rather than using solutions, such as adaptive textbooks, homework and practice systems, where content comes preconfigured.

Business Impact

Adaptive learning can scale personalized learning while retaining and improving quality. Its ultimate aim is to enhance the learning experience and empower students by addressing their unique learning styles and needs. This in turn may lead to improved learning outcomes, higher retention rates and better graduation rates, which are important accountability measures in education. Whether generative AI displaces or enhances the role of adaptive learning platforms, as deployed currently, needs to be tracked.

Drivers

- **Learning experience** — Adaptive learning platforms (aided by AI) offer considerable potential to personalize learning and improve student engagement.

- **Customization** — They allow instructors to build their content in the system, and bring in external content, override grading scales and rules, and adapt the platform to faculty needs.

- **Personalization** — The promise of enabling instructors to quickly identify learning gaps for individual students, groups or the entire class is attractive. It provides multiple potential and dynamic modifications to the curriculum that target specific needs, rather than spend time on unnecessary reteaching.

- **Flexibility** — By mobilizing multiple types of adaptive platforms to fit different institution drivers, instructors are able to tailor content and delivery to a specific audience, or segment, based on preferences or learner profiles (macroadaptive platforms). They also tailor learning delivery based on the assessment of students' mastery of the content (microadaptive platforms).

- **Innovation** — Many institutions are now looking to enhance online learning experiences, following poor student feedback on recent pivots to online. Complexity limits the adoption of these platforms, but there is hope that some of the larger projects involving adaptive learning (such as those at the University of Central Florida) will result in broader acceptance and lessons learned, allowing more widespread adoption.

- **Corporate adoption** — Adaptive learning seems to have higher traction in the corporate setting at the moment. This may be due to more focused content and use cases, leading to a clearer ROI. However, the rise in demand for skills-based credentials, agile learning and education at scale, to prepare students for corporate environments, may drive adoption of similar approaches in higher education.

Obstacles

Adaptive learning platforms continue to remain in the Slope of Enlightenment as movement remains slow due to the following factors:

- The workload and culture change required to implement adaptive learning platforms at scale means the rate at which they have been implemented beyond pilots and individual course offerings remain low.

- AI-based approaches need enough data to mine to produce valid insights. The data must be available from a very large set of users using the product, larger than what would be available in most organizations.

- Tools need to be developed to streamline, accelerate and minimize the effort of moving content on to adaptive learning platforms.

- The number of vendors offering adaptive learning platforms is shrinking, and some functionality is now becoming embedded in other platforms (such as the learning management system [LMS]), contributing to slow movement up the slope.

User Recommendations

Adaptive learning platforms support and supplement student learning, but they are difficult to implement. Organizations are advised to follow a four-stage process:

- Educate themselves about the approach, products and potential.

- Enquire about vendor roadmaps for emerging technologies impacting learning experience.

- Pilot solutions that meet most needs.

- Ensure utilization of adaptive learning features within existing products, like the LMS.

- Review lessons learned, including faculty and student feedback.

- Move to implementation.

Organizations should approach adaptive learning projects less as technology projects and more as large-scale curricular redesign undertakings. To this end, organizations should:

- Seek to identify faculty champions.

- Find ways to incentivize faculty to support increasingly personalized student needs.

- Ensure that they have broad buy-in from faculty and senior leaders for these projects.

- Make clear how these approaches supplement and augment, versus replace, the work of faculty (which is what many faculty fear).

Sample Vendors

CogBooks; Fishtree; Realizeit; Smart Sparrow

Gartner Recommended Reading

Top Trends in K-12 Education for 2023

Robotic Process Automation

Analysis By: Terri-Lynn Thayer

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Robotic process automation (RPA) is software that automates tasks within business and IT processes via software scripts that emulate human interaction with the application user interface. An RPA tool enables human processes to be recorded into a script via low-code or no-code graphical user interfaces. The deployed scripts are referred to as a "bot."

Why This Is Important

RPA adoption is escalating, with 13% of higher education respondents to the 2023 Gartner CIO and Technology Executive Survey (see 2023 CIO and Technology Executive Agenda: A Higher Education Perspective on Navigating the Triple Squeeze) indicating intention to increase investment in hyperautomation in the coming year. It has the potential to reduce labor, costs and human error by automating tasks. This is advantageous as the sector is experiencing a tough talent market. It can optimize both back-office as well as student-facing functions thus improving the faculty, staff and student experience.

Business Impact

RPA is capable of the following:

- Copy and paste data

- Access applications

- Follow if-then decision rules

- Open files and attachments

- Read structured data from documents

- Prepare and send emails

- Navigate within applications.

This saves time and money while reducing errors and improves the total experience without disruptive enterprise system replacements.

Drivers

- Efficiency, productivity and agility are key drivers for education CIOs as their focus on digital and cost optimization continues to increase, especially as they navigate current economic pressures. Institutions face an abundance of legacy systems that are inflexible and require repetitive data entry tasks and rekeying across different applications, RPA is seen as the tool to alleviate these challenges.

- Institutions may have some disconnected business processes and systems. An RPA initiative facilitates rethinking processes. RPA offers a way to connect these systems together and to define algorithms to change the way system processes operate.

- With short implementation cycles, the promise of an instant impact is appealing, even if it's simply masking the inefficiencies of legacy systems thereby extending their useful life.

- Institutions often start with business processes such as financial and human resources but rapidly move on to a host of other areas of the institution including IT processes.

- RPA's role in automation is increasingly becoming defined with the technology moving toward being a commodity within a hyperautomation toolbox provided by various vendors.

Obstacles

- The time and resource investments required are often underestimated. RPA tools are cross-industry tools without prebuilt logic, so significant effort on configuration is needed.

- RPA needs structured data, and value is limited to algorithmic tasks where rules and variants can be easily defined.

- RPA is positioned in the market as a business tool when the reality of deployment requires business knowledge coupled with IT disciplines for success.

- Business purchase of RPA is causing a rise in technology duplication.

- Institutions sometimes struggle to identify the use cases and engage the interest of key stakeholders. Employees often feel threatened by the adoption of automation, making it hard to gain assistance and buy-in. Some employees express fears of the technology making mistakes as a reason to resist RPA.

- RPA should be viewed only as one tool in the larger category of hyperautomation tools. This will help to ensure that institutions select the right tool for the right job.

User Recommendations

- Purchase solutions that include RPA by focusing the evaluations on wider technology capabilities to support your automation toolbox rather than the commodity that is RPA.

- Evaluate the benefits versus drawbacks of automation over system replacement or integration strategy. Balance the short-term gains vs. the long-term robustness of the approach.

- Educate your IT and business teams on the variety of different tools and create a vision to automate processes by running a series of workshops inviting a mix of vendors to demo their solutions with education-specific use cases.

- Establish and fund a DevOps center of excellence that is resourced with a small group of individuals who collectively possess a variety of skills across business and IT.

- Avoid focusing internal communications on cost saving and FTE reduction by focusing KPIs on value-adding measures that deployments provide, such as customer satisfaction impacts, error reduction and SLA improvements.

- Focus on business outcomes, not technology.

Sample Vendors

Appian; Automation Anywhere; Microsoft; SS&C Blue Prism; UiPath

Gartner Recommended Reading

4 Steps to Hyperautomation Success in Higher Education

Quick Answer: How to Choose the Right Use Cases for Robotic Process Automation

Education Analytics

Analysis By: Marlena Brown

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Education analytics refers to the collection and analysis of data designed to provide institutions with data-driven insights that enable informed strategic decisions around impacting student outcomes, institutional performance and operational efficiency. Information, analyzed from various sources such as student records, learning data, financial data and enrollment data, provides a comprehensive view of institutional performance.

Why This Is Important

Higher education is under pressure to improve outcomes and efficiencies in all aspects of operations. The increased and effective use of data will be a key differentiator among institutions going forward, separating those that are resilient in the face of challenges from those that are unable to respond effectively.

Education analytics provide institutions with data-driven insights enabling decisions around:

- Student outcomes

- Operational efficiency

- Compliance

- Overall competitiveness

Business Impact

Higher education analytics provide data-driven insights that support:

- Improved student outcomes by predicting risks and identifying successful behaviors.

- Increased operational efficiency by analyzing process data, which can optimize resources.

- Expedited compliance reporting by continuous collection of data on student outcomes, faculty qualifications and institutional financials.

- Increased enrollment by identifying areas of institutional strength, promotion of reputation and competitive advantages.

Drivers

- **Fiscal and revenue challenges** — Higher education institutions face financial pressures that underscore the need to use data to improve efficiency, reduce costs and increase revenue streams.

- **Competition for rankings and talent** — The desire to compete for better rankings and attract premium talent drives the use of data and analytics to improve university performance, enhance the student experience and remain competitive in the market.

- **Enrollment challenges** — Institutions, facing enrollment challenges, are using data and analytics (D&A) to anticipate and respond to these challenges, as well as to improve enrollment strategies and optimize student recruitment.

- **Improve operations and enhance student experiences** — Higher education institutions can use data to drive innovation, remain relevant and meet the needs of students in a rapidly evolving landscape.

- **Pressure from legislative bodies, employers and students** — Institutions face increasing pressure from external stakeholders to provide data showing how they improve outcomes and efficiencies, demonstrate effectiveness, respond to the needs of the workforce and meet student expectations.

Obstacles

- Poor quality or incomplete data can impede the creation of a compelling D&A storyline and hinder identification of value opportunities.

- Taking action based on D&A insights is crucial, but difficult, requiring institutions to overcome inertia and implement changes, which can be an obstacle to D&A progression.

- The wide range of technology solutions available for educational analytics can be overwhelming and confusing, making it challenging to establish a clear strategy.

- Lack of clarity regarding objectives can lead to overinvestment in big data and tools with little return, impeding D&A refinement and progress.

User Recommendations

- Create a compelling D&A storyline to engage stakeholders, build buy-in and create a shared understanding of data value.

- Identify and prioritize near-term value opportunities through D&A strategy to create value and demonstrate early wins.

- Define roles, responsibilities and processes to enable collaboration and provide D&A services across the organization.

- Establish adaptive practices for D&A governance aligned with organizational goals. Ensure data quality, manage risk and protect privacy through a governance plan aligned with organizational goals and adaptable to changing needs and technologies.

Sample Vendors

Anthology; Azendian; Civitas Learning; Ellucian; HelioCampus; Jenzabar; Liaison; Microsoft; Workday

Gartner Recommended Reading

The Chief Data Officer's First 100 Days — Action Plan

Put Data and Analytics to Work in Higher Education to Impact Student Success

Top Trends in Data and Analytics, 2023

Design Thinking

Analysis By: Brian Prentice

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Definition:

Design thinking is an ideation methodology extracted from the broader, multidisciplinary design process used in the creation of physical and digital products.

Why This Is Important

Design thinking within innovation management is an ideation methodology extracted from the broader, multidisciplinary design process, and is generally delivered through a workshop format. It promotes investment in empathetic learning about the organization's customers/stakeholders as the key step to ensure the right problems are defined before innovative actions are taken to deliver solutions. It ensures a human-centered approach, and works to minimize uncertainty and risk in innovation efforts.

Business Impact

Design thinking directs the focus of innovation teams toward the human aspects of any given challenge or opportunity. It helps business innovators explore multiple solutions and incorporate different perspectives throughout the innovation effort. It is particularly useful in tackling what are known as "wicked problems" — these are issues that are difficult to solve because of incomplete, contradictory and changing factors that are not easily recognized.

Drivers

- People centricity — Design thinking starts with people. It's oriented to see an organization's business process through the lens of its stakeholders, rather than seeing these stakeholders as nodes in a process diagram or users of technology. This simple reorientation in perspective leads to dramatically different insights and applies to both customer-facing and internal operational innovations.

- Diversity of perspective — The quality of output from design thinking increases in line with the diversity of the people participating in the effort. Different perspectives add significant value in interpreting people-centric data and drawing accurate conclusions.

- Outside-in orientation — Design thinking, if done properly, forces participants to look beyond the obvious spans of control or attention. It helps organizations see how they fit within the broader context of their customers' goals or see the organization's operations through the eyes of people at the front line.

- Integration with design practices — Design thinking isn't contingent on making a new product or service. However, when it is used for that, there is seamless integration into a broader design process.

- Most design thinking occurs through workshops run by design team members who understand the connection between design thinking as an ideation methodology, and design as a process of producing products and services to solve problems for people.

Obstacles

- Cutting corners on research — Design thinking is a process of applying unique analysis techniques to data coming from usage reports and, more importantly, observational research. This data can be time-consuming and expensive to produce.

- Often, workshops proceed without any research and quickly devolve into empathy sessions, resulting personas and journey maps are more likely to echo existing biases than create an accurate picture of reality that is needed to drive innovation.

- Design confusion — A common pitfall is to conflate design thinking with the design process. Design thinking, then, ends up as a training program instead of a repeatable ideation technique. The hope is that running staff through a couple of days in a design thinking workshop will mean no incremental investments are needed to build internal design capability or to retain design agencies. The end result is design thinking workshops that have neither any follow-through activity nor any hope for design capability.

User Recommendations

- Direct design thinking toward clearly articulated business problems where stakeholders can be identified and business value can be measured. Complex, "wicked" problems are fine; however, without proper grounding, design thinking can result in very creative insights that are unactionable.

- Don't skip observational, "empathetic" research — ensure research work precedes any design thinking initiative.

- Establish high diversity within design thinking participants for robust resulting insights.

- Leverage the investments in internal design talent to establish an ongoing program of applied design thinking and to ensure qualified designers are leading design thinking workshops.

- Link, where possible, design thinking workshops to broader design initiatives in order to increase the chances of ideation moving into an actual production process.

Digital Credentials

Analysis By: Robert Yanckello, Kelly Calhoun Williams

Benefit Rating: Transformational

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Digital credentials are the digitalization of traditional diplomas, alternative microcredentials, professional licensure, certifications, badges and informal credentials. They indicate an individual's knowledge, specialized skills or qualifications via a secure framework to digitally capture and visually present achievements that are verifiable and portable.

Why This Is Important

Credentials issued by education institutions, organizations or employers are the only tangible evidence of education or skills achievement, and can be seen as "education currency." New forms of credentials are increasing the speed and granularity of credential exchange. Digital credentials will:

■ Enable decoupling of some K-12 and higher education business models.

■ Transform some education outcomes.

■ Speed up time to market for job seekers and establish a new ecosystem of learning.

Business Impact

Digital credentials enable a secure, validated and expedient exchange of skills and education, and can impact student outcomes for employment, lifelong learning and career advancement. The learner will be empowered to own the credential and share when they choose. The impact of digital credentials on K-12, corporate workforce development and higher education will transform business models for learning, talent identification and fluidity, while enabling new entrants into the education ecosystem.

Drivers

- The growing demand to address workforce needs and employability globally is driving the credential landscape to be more dynamic and responsive and is challenging the essence of traditional higher education.

- As the acceleration of digital business continues at an unprecedented pace, the delivery of all credentials in digital format is a natural progression.

- Changing business models, the increasing number of learners entering the workforce, and the length of time from graduation to employment, are influencing students and employers to reconsider traditional paper-based job and talent search models.

- Digital credentials enable employers to view student information quickly and easily, offering students and learners a swift and agile approach to sharing validated knowledge and skills with potential employers.

- The increased focus in K-12/primary-secondary education on offering more work-based programs fits well with this ability to capture and track specific skills to share with employers. It also holds the potential to capture other nontraditional course and program completions (including for faculty) as K-12 organizations struggle with shortages of staff for traditional instructional delivery models.

- Employer-funded education is growing rapidly as organizations (such as Guild Education and workforce agencies) connect employees with many programs across a variety of institutions. This employer learning market helps corporations educate and train employees with high-demand skills. Additionally, it enables individuals to enter the workforce sooner while they still have a trajectory for new career opportunities.

Obstacles

- Currently, there is no widely used digital credentialing infrastructure or common standards to easily store, share and display credentials that offer a comprehensive picture of learning experiences with employers and training institutions.

- Although digital/alternative credentials are gaining public acceptance, more education is still needed, as progress is hampered by a relative lack of understanding of what they are and how they are defined.

- Until all institutions establish habits to deliver any credential (formal/informal, traditional/new, badge/diploma) in digital format, they will struggle to understand the true essence of digital society, and needs and expectations of their students, partners and community.

- Questions linger about the degree to which digital/alternative credentials can displace traditional diplomas, and the extent to which they will gain employer acceptance.

User Recommendations

- Gain familiarity with current digital credentialing technology and standards organizations — such as Credential Engine, IMS Global Learning Consortium and The Groningen Declaration Network — by participating in these organizations regarding growing digital credential ecosystem and global standards.

- Form a community of interest by establishing a team of academic leaders, faculty, corporate partners and administrators to initiate organizational conversations and build a foundation for digital credentials objectives.

- Search for an appropriate use case of current digital credentialing technology at your institution or organization, by initiating a pilot to help institution leaders consider the policy implications, growing ecosystem and corporate readiness for this new digital currency.

Sample Vendors

Accredible; Accreditrust Technologies; BadgeCert; Digitary; Edalex; Hyland Software; Instructure; Parchment; Pearson (Credly); Smart Certificate

Gartner Recommended Reading

Changing Economic Conditions Impact How Education Delivers New Credentials

Higher Education Ecosystem 2030: Your Own U

Master Data Management

Analysis By: Sally Parker

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Master data management (MDM) is a technology-enabled business discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, governance, semantic consistency and accountability of the enterprise's official shared master data assets. Master data is the least number of consistent and uniform sets of identifiers and extended attributes that describe the core entities of an enterprise.

Why This Is Important

MDM is a cross-organizational collaborative effort that focuses on the consistency, quality and ongoing stewardship of master data. Master data is the subset of data that describes the core entities an organization requires to function — customers, citizens, products, suppliers, assets and sites. Master data sits at the heart of the most important business decisions, driving a need for a consistent view across business silos.

Business Impact

MDM initiatives are progressing as a foundational component of digital transformation. Leading organizations draw a causal link between their master data (parties, things and places) and the business outcomes it supports, including customer retention, supply chain optimization, and risk and regulatory compliance.

Interest in MDM extends to a broad range of vested-interest stakeholders, including finance, marketing and supply chain. MDM is now mainstream. Organizations seeking a single view of their master data recognize it as a necessity.

Drivers

- MDM is not a new concept, but adoption varies across geographic regions, with North America the most mature region, followed by Western Europe. The rest of the world is earlier in the maturity cycle and representative of markets primed for growth.

- Business process integrity eludes organizations with complex or heterogeneous application and data landscapes. Such organizations can suffer from inconsistent master data and/or a lack of trust in their master data. Organizations are increasingly recognizing the direct and causal link between this data and business outcomes, which MDM is designed to address.

- Rapidly evolving business needs, particularly in uncertain times, translate into greater demand for the benefits afforded by MDM — notability agility. The COVID-19 pandemic, which initially stalled projects, ultimately served to fast-track a broader realization of the causal link between trusted and connected master data and business resilience.

- Interest levels are increasing across a broader range of stakeholders (beyond technology), in both private and public sectors.

- A prior hesitance to embark upon MDM initiatives, due to complexity and cost, is easing.

- The barrier to entry has dropped significantly over the past two years with the broader availability of cloud-based and subscription-based MDM vendor offerings, which are now the most dominant offerings for net new clients. This lowering of the barrier to entry renders MDM viable for a broader target audience that comprises small and midsize organizations.

- A shift in mindset toward a more granular and business-outcome-led MDM program is reflected in the MDM vendors' "land and expand" strategies, where clients start small and progress toward incremental mastery of use cases and domains.

- Digital transformation requirements are forcing organizations to either start or modernize their MDM programs to leverage more recent cloud-based offerings and new augmented MDM capabilities.

Obstacles

- **Lack of consistent vendor presence**: Coverage is weaker outside North America and Europe.

- **Technology blinkers**: The prevailing pitfall remains the instinct to treat MDM as a technology initiative in isolation. Technology alone won't solve a challenge that traverses people, processes and technology.

- **Human factors**: Organizations that fail to proactively engage business stakeholders in scoping struggle to meet expectations of value and to establish an operational governance structure in service of MDM.

- **Goals**: MDM is still too often seen as an IT project. When MDM is a data or IT project that doesn't align to business outcomes, it fails.

- **Perceived complexity**: The MDM solutions market only recently shifted toward subscription pricing, cloud-based offerings and simpler products, which contribute to more approachable solutions and shorter deployment times.

- **Skills**: Successful MDM implementations require business acumen, technology and governance capabilities. Finding the right balance and availability of these skill sets remains problematic and is driving a need for third-party services as the norm.

User Recommendations

- Use business outcomes to identify the least amount of data with the greatest business impact.

- Approach MDM as a technology-enabled business-led initiative.

- Secure executive sponsorship to facilitate cross-organizational collaboration.

- Ensure that the causal link between the MDM initiative and the business outcomes it supports is clearly understood and articulated.

- Keep your master data attributes lean and focused.

- Leverage third-party services to fast-track time to value. The majority of organizations leverage external support with their MDM strategy and/or implementation. Third parties offering industry expertise and accelerators can greatly impact time to value.

Gartner Recommended Reading

3 Essentials for Starting and Supporting Master Data Management

Create a Master Data Roadmap With Gartner's MDM Maturity Model

Data and Analytics Essentials: Master Data Management — Presentation Materials

Scenario Planning

Analysis By: David Furlonger, Frank Buytendijk, David Pidsley

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Scenario planning is a management methodology that helps organizations prepare for uncertainty by envisioning and analyzing plausible future outcomes. The methodology assesses critical uncertainties and macroforces influencing or impacting the market and enterprises, stimulating executive thinking. Executives can "future test" their strategies and promote innovation by ideating opportunities, risks and actions to capture stakeholder returns.

Why This Is Important

Scenario planning methodology is a foundational mechanism for understanding disruption and honing management strategy, challenging how leaders make key decisions. It is used in anticipation of or during significant external change to plan for problems or exploit opportunities. It should be used more extensively as a way of looking at the future. COVID-19 and the Russian invasion of Ukraine highlighted the importance of analyzing uncertainty and evaluating events disrupting business trajectories.

Business Impact

This foresight and anticipatory approach considers alternative future scenarios, plans to react and identifies signals that indicate movement along each path:

- Structured methodology and dynamic tools acknowledge and address critical uncertainties. Business initiatives can be prioritized based on descriptions of market futures not previously considered.

- Strategic canvases evaluate innovations and break fixed-mindsets. Scenarios question market norms based on future-sensing, as opposed to projecting outcomes from present conditions.

Drivers

- Business today is volatile, uncertain, complex and ambiguous. There is competition from within and outside industry segments and a constant stream of innovations, floods of information, dramatic social shifts and a digitally accelerating business landscape for executive leaders to contend with.

- Due to growth (or survival) trajectories caused by inflation, social shifts and the Russian invasion of Ukraine, leaders are challenged to prioritize effective capital allocation strategies.

- Trendspotting processes explore how leaders identify, filter, contextualize, analyze, and relate trends and feed this into scenario planning and backcasting techniques to explore their future interplay. Scenario planning exercises can be used to communicate the result of the trendspotting process.

- Macroforces influencing our future are collated using categories such as technological, political, economical, social/cultural, trust/ethics, regulatory/legal and environmental (TPESTRE) into categories from which axes of critical uncertainty are developed. Two-by-two matrices and trilemma models are created as scenario outputs that structure plausible future scenarios for analysis.

- Executive decision making is driven by uncovering the risks and opportunities enterprises will face in the future. Scenario thinking uncovers risks and opportunities for innovation that result from changes or disruptions in the business environment. These risks and opportunities should act as catalysts that leaders can use to innovate today to get ahead of the competition in the future.

- Scenarios, therefore, offer an input for ideation. Innovation initiatives then become directly tied to the strategic requirements that could address future business scenarios.

- Embarking on innovation initiatives without a clear understanding of potential future business states risks losing money, wasting time and, through innovation failure, reinforcing the status quo.

Obstacles

- Preoccupation with today's uncertainties and thinking that the future is "too far away" and/or irrelevant

- Using assumptions that the future is like the past — that is, a singular prediction of likely outcomes with probability assessments, as opposed to a thinking about the plausibility of a particular outcome being realized

- The propensity to fixate on one predicted or expected future path rather than numerous potential alternatives

- Little understanding of scenario planning methodology and resorting to trend analysis and rigid management processes in strategic planning

- No common business language, standards and framework for assessing uncertainty

- Lack of diversity and collaboration in scenario teams fostering status quo bias, reinforcing enterprise silos and inhibiting change

- Immature innovation management and trendspotting capabilities

- Low resource commitment to innovation and/or execution of ideas

- Weak follow-up from a scenario planning exercise — failure to revisit waypoints indicating which (if any) of the scenarios are unfolding

User Recommendations

Executive leaders should use scenario planning to:

- Assess volatile market dynamics, anticipate future business capability needs and customer requirements, and create and adapt innovation initiatives to avoid performance stalls.

- Encourage, facilitate and participate in conversations with the board and executive team about the future and scenario planning's impact on business operations and market behaviors.

- Clarify assumptions about possible futures and identify signposts/measures to monitor outcomes and indicate the validity of assumptions over time.

- Evaluate current and proposed business and technology innovation initiatives and investments against potential future scenarios.

Gartner Recommended Reading

Gartner Global Scenarios: Scenario Planning Resource Center

The Gartner Trendspotting Framework: Driving Operations, Innovation and Strategy

Toolkit: Gartner Global Scenarios 2020: How to Accelerate Business Success in a Time of Worldwide Disruption

TechWave Podcast: 'Tapestry' for Strategic Planning

Citizen Developers

Analysis By: Jason Wong

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Citizen developers are employees not in the IT organization who create or extend technology capabilities. They use low-code, no-code and generative AI development tools and runtime environments sanctioned by corporate IT or the business units. A citizen developer is a subsegment of business technologists. However, it is not a title, role or professional developer in the business unit, but rather a persona taken on by an employee.

Why This Is Important

Defining and embracing citizen development is essential to the maturing digital workplace strategy. The changing ways of work have accelerated the need for greater business agility and putting better tools in the hands of employees so they can more rapidly solve their problems with new digital capabilities. According to the 2022 Gartner Digital Worker Survey, 48% of non-IT workers customize or build tools from technology provided by IT or from tools they acquire on their own (see What Workers Want: Top 10 Insights From the Digital Worker Experience Survey).

Business Impact

The long-term strategic impact of citizen development is enabling self-service business innovation within business units and fostering fusion teams that blend business and technology expertise. Citizen developers are often aided by IT in some aspects of co-creation or technical support. Citizen development communities of practice and hackathons have proven to help promote and enhance digital dexterity across the enterprise.

Drivers

■ The workforce is changing to being more tech savvy. On average, 69% of the respondents in the 2022 Gartner Digital Worker Survey stated improving their personal digital skills to be important for business success.

■ Employees have easier access to more tools than ever before, and it's only increasing. Citizen developers feel more empowered by powerful low-code development tools and SaaS-based no-code tools that specifically cater to them. Many business application vendors now provide robust low-code and no-code development capabilities, making it easier for citizen developers to develop their own solutions — even ones that once required professional development skills, such as building mobile apps or using AI automation services like chatbots.

■ The nature of work involves using more technologies. Citizen developers may also take on other citizen technologist personas depending on their skills, ambition and scope of work. Gartner often sees citizen data scientist, citizen integrator and citizen automator personas in the digital workplace. Over time, some of these citizen developers have become part of fusion teams that drive business and IT collaboration and development.

Obstacles

■ Citizen development is not shadow IT. IT's resistance to recognizing business technologists' work and embracing citizen development results in missed opportunities to drive toward business and IT alignment.

■ IT leaders also often fear losing control on account of increasing citizen development activities, making their teams less relevant or burdening IT with unmaintainable apps. However, the risks of citizen development are typically outweighed by the benefits. Risks to the enterprise can be better managed by directly addressing inadequate tooling and disorganized support for a citizen development community, which are key factors leading to poor outcomes and risky apps.

■ IT leaders often don't understand the levels of ambition that exist in their organization and don't have a plan to support those ambitions. Citizen development is on a digital dexterity continuum that progresses from digital citizen to digital side hustle to business technologist.

User Recommendations

- Engage tech-savvy business users more actively to enlist and enable them to become citizen developers. Ignoring or attempting to prevent citizen development often carries more risks and limits enterprise innovation.

- Mitigate risks by working with business unit leaders and citizen developers to establish trust; clarify ownership and accountability expectations; and define safe activity zones.

- Enable self-governing citizen development practices by fostering a community of practice (CoP) across business units and with IT.

- Improve outcomes for citizen-developed apps by joint (business and IT) selection of the right tools and enabling technologies.

Sample Vendors

Airtable; Creatio; Kissflow; Microsoft; Project Management Institute (PMI); Quixy

Gartner Recommended Reading

Quick Answer: What Types of Fusion Teams Do Business Technologists Lead?

Quick Answer: How Can Digital Workplace Leaders Support Business Technologists?

What Are the Digital Dexterity Skills Necessary to Support New Ways of Working?

Case Study: Kick-Starting a Low-Code/No-Code Community of Practice (Heathrow Airport)

Appendixes

See the previous Hype Cycle: Hype Cycle for Higher Education, 2022

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2: Hype Cycle Phases

(Enlarged table in Appendix)

Phase ↓	Definition ↓
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the innovation to reach the Plateau of Productivity.

Source: Gartner (July 2023)

Table 3: Benefit Ratings

Benefit Rating ↓	Definition ↓
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2023)

Table 4: Maturity Levels

(Enlarged table in Appendix)

Maturity Levels	Status	Products/Vendors
Embryonic	In labs	None
Emerging	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
Adolescent	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
Early mainstream	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
Mature mainstream	Robust technology Not much evolution in vendors or technology	Several dominant vendors
Legacy	Not appropriate for new developments Cost of migration constrains replacement	Maintenance revenue focus
Obsolete	Rarely used	Used/resale market only

Source: Gartner (July 2023)

Document Revision History

Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

Understanding Gartner's Hype Cycles

Tool: Create Your Own Hype Cycle With Gartner's Hype Cycle Builder

Quick Answer: How Should Education Institutions Respond to Use of Generative AI such as ChatGPT?

3 Stages in Unlocking the Transformative Potential of Digital Assessments in Education

Quick Answer: How Should Your Higher Education Institution Leverage a Metaverse?

Higher Education Ecosystem 2030: Planning in the Face of Radical Uncertainty

Table 1: Priority Matrix for Higher Education, 2023

Benefit	Years to Mainstream Adoption			
↓	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational	Adaptive Learning Platforms Digital Credentials	Composable ERP Conversational User Interfaces Decision Intelligence Everyday AI Generative AI	Emotion AI Industry Cloud Platforms Responsible AI Self-Integrating Applications	Metaverse Quantum Computing
High	Citizen Developers Design Thinking Digital Work Hubs Education Analytics Scenario Planning	5G Digital Assessment Digital Integrator Technologies FIDO Hybrid Integration Capability Framework Master Data Management	Bidirectional Brain-Machine Interface Blockchain in Education Immersive Technology SaaS for SISs Smart Campus	
Moderate	Robotic Process Automation	Hyflex Classrooms SaaS as a Platform	Learning Experience Platforms	
Low				

Source: Gartner (July 2023)

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