



**Innovate. Integrate. Transform. Run.**

# 2022-2024 Advancements and Predictions for the IT Industry

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As technology continues to advance in a snowball effect, businesses may grow overwhelmed by the constant changes and feel uncertain about what steps they should take. Should they completely restructure their systems and processes? Or should they take a more conservative approach, upgrading a few of their outdated or clunky processes and leaving the rest alone?

In a short response, each business's needs are different. As a result, the first step the business should take is to consider where it is at currently, where the business wants to be in the next few years, what target audience the business is trying to appeal to, and what current processes are in the most dire need of an update (and why).

With this analysis out of the way, businesses can consider the current technologies they have access to, and which technologies will bear maximum return on investment to help the business achieve high profits.

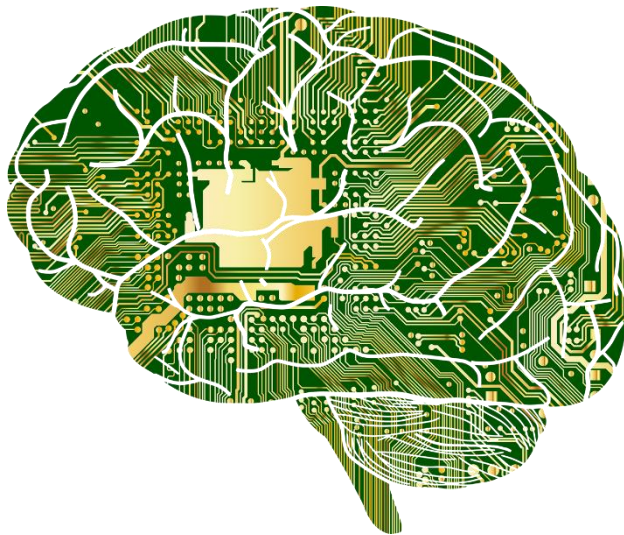
This analysis serves to educate businesses on some of those current technologies, offering insights based on theses, peer-reviewed articles, and other well-researched sources.

## Generative AI

In February 2023, Chuma and Oliveira published an issue to Management Science and Business Decisions about ChatGPT, specifically on whether it works well for making business decisions.<sup>1</sup>

Towards the beginning, the study established that ChatGPT consistently helps with writing and coding. The technology could accurately identify and distinguish different types of businesses and other terminology. Additionally, ChatGPT could arrive at mostly accurate conclusions. While the person leading the study believes that ChatGPT did not provide significant insights for experts, it can still prove useful for those less experienced and provide a starting point from which experts can proceed. In particular, ChatGPT can cut back on research time for fundamental concepts.

As of now, ChatGPT's information is relatively generic. However, if researchers find a way to give ChatGPT the ability to discern accurate, reliable information from faulty information, the technology could prove revolutionary to providing cutting-edge insights even for the experienced.



### A Quick Dive into the Business Innovation Model

In May 2023, Kanbach and several other authors contributed an open access article to the Review of Managerial Science about generative AI's potential contributions to Business Model Innovation, or BMI.<sup>2</sup>

In their approach to exploring generative AI, the study opted to divide the Business Model Innovation types that generative AI impacts into value creation, new proposition, and value capture:

#### **Value Creation**

Software engineering will experience significant transformation through processes that generative AI can automate, such as performance optimization and bug detection. To enable this, generative AI can already automatically find errors and code in a variety of languages—among other things.

In response, developers will likely change their roles from tasks that can be automated to product management, which emphasizes critical thinking and strategy over manual completion of tasks.

#### **Value Capture**

Generative AI can also play a significant role in value capture, or maximizing the financial return from Business Model Innovation. Through the automation, scalability, and efficiency that generative AI offers, businesses can more easily allocate resources and deliver products—all while cutting down on costs.

#### **New Proposition**

Finally, new proposition is the concept of businesses searching for new and upcoming markets, along with finding innovative ways to advertise their products to their target audience. This is one way to combat the ever-increasing app fatigue (which will be discussed in the Phygital Technology section in more detail). Oftentimes, however, these constantly changing strategies also require businesses to regularly change their processes and communication strategies.

To make these frequent transitions easier, generative AI can allow those who are less experienced in coding to aid in software development.

### Generative AI in Job Landscape

Generative AI is expected to reduce the need for specialized knowledge, providing easier access to technologies such as coding and design. While it may not yet generate groundbreaking ideas independently, the technology will significantly impact white-collar knowledge workers, reshaping or replacing entire job roles.

In optimistic perspective, generative AI will not take away jobs, but will rather shift jobs from clerical tasks to more creative and strategic ones, both of which will demand strong analytical abilities. In slightly pessimistic perspective, AI might take away those jobs altogether and significantly reshape higher-level ones. Either way, businesses will likely benefit from more streamlined, cost-effective resources.

Overall, the study suggests that Generative AI, particularly ChatGPT, serves as a replacement for manual employee effort, emphasizing tasks related to idea generation and editing.



### Generative AI in Software Engineering

Generative AI will likely impact software engineering as well, promising to not only streamline employees and other resources but also business processes as a whole. As previously described, generative AI can already help significantly with bug detection, documentation, coding, and overall performance improvement.

### Rapid Changes and Potential Misuse

As shown through the study's findings, generative AI, particularly ChatGPT, is changing rapidly. Because of this rapid change, generative AI technologies such as ChatGPT can be used maliciously.

Because of this, we will likely see more restrictions and regulations. Higher capabilities may only be used by verified businesses and/or exist behind a pay wall. We can already see this starting with ChatGPT Plus and ChatGPT API.<sup>3</sup>

### Other Potential Concerns

Unfortunately, with generative AI's many potential benefits are challenges, particularly with the language learning model required for the technology to work. While Nitin Rane's study from July 2023 has provided a comprehensive list of those potential issues, this article will summarize a few of the most pressing points that strongly apply to business operations and IT.<sup>4</sup>

### **Inadequate Industry Understanding**

Often, learning language models do not have specialty knowledge, hindering their ability to provide exact information for the vast sectors within business management. Businesses that rely on generative AI in its current state for specific knowledge may end up making poor decisions.

### **Partiality and Other Potential Ethical Issues**

Language learning models acquire their information from sets of data that may or may not carry bias. As a result, generative AI is prone to partiality, raising ethical concerns in business decision-making. To avoid this potential issue, businesses that use generative AI should manually check through the generated output to ensure there are no biases present.

### **Potential Security Concerns**

Businesses that use language learning models may face security concerns, especially if they input sensitive data. In particular, malicious outside groups could access the language learning model, raising concerns about issues such as phishing. To avoid this, businesses should ensure that the language learning model they use is secure.

### **Compliance for Processing of Customer Data**

Oftentimes, businesses will find that a large potential benefit with language learning models is processing customer data. However, they also need to take into account the many regulations surrounding data compliance (for example, GDPR), which can quickly become challenging.

### **Copyrights and Intellectual Property**

Especially if a business decides to work with external companies, they may find that crediting and protecting that company's intellectual property while using generative AI can be a difficult task.



## **Phygital Technology**

Over the past few years, business and technology has experienced a shift towards a more phygital approach.

A thesis that Eslam Nofal published in 2019 explores the phygital concept, particularly in the context of how it can benefit museums and similar “built heritage.”<sup>5</sup> We can apply many of the concepts found in the thesis to business operations and ERP.

For instance, phygital technology combines tangible user interfaces (TUIs) and tangible

interaction with physical items (such as heritage artifacts) to create a unique, engaging experience. As technology has advanced, many people have gravitated away from standard labeling methods and more towards interactive communications. Some common examples may include websites and applications,

which may be activated by a physical means such as a QR code. This way, even the most mundane objects can contribute to a dynamic network, allowing for improved accessibility and engagement.

Some additional benefits that the thesis mentioned, which can also be applied to the business/IT space for both internal processes and client satisfaction, include the following:

- Easier Access to Information
- Personalized Access to Information
- Physical Aids for Abstract Information
- Augmented Reality
- Immersive Interaction

### “App Fatigue”

On the client and product side, another study done by Sahas Gembali in June of 2023 further explores phygital technology as an opportunity for businesses to fight “app fatigue.”<sup>6</sup>

As more online applications, services, and solutions arise, consumers become overwhelmed by the vast array of choices and may struggle to choose the best one for them. Because of this, many companies employ networking and status rather than trying to directly promote their products’ benefits and quality. While this works well for spreading awareness, it does not keep in mind that each customer’s needs are different, and that even a good-quality product may not be the right choice for them if it doesn’t carry the expected features.

Businesses can use phygital technology to stand out while still providing informative outreach about quality products to their target audience. At the same time however, businesses that want to use phygital technology need to put user experience at the forefront, prioritizing phygital as a way to meet needs that the customers have expressed while still benefiting the business. This way, they can not only avoid but combat the negative effects of app fatigue.

Unfortunately, businesses will likely not see any standardized methods for using phygital technology, or quality ways to apply phygital technology to business processes, for the next few years. However, there are a few potential ideas that may work for some:

1. Provide visualizations of the correct way to approach a simple hardware project or troubleshooting, and then inform user whether they have done the correct input. This way, even employees who are less experienced can complete tasks successfully if the IT team is not around.
2. Find ways to combine phygital technology with generative AI, which can already respond to dialog and provide output.

## Sustainability

*(Side note: While people and businesses should primarily promote sustainability because of ethics and not profit, this paper’s focus is on current or upcoming technologies, focuses, and innovations that can benefit business. As a result, we will be focusing on potential benefits of a sustainable focus, and why it is an ongoing trend for businesses.)*

Holzmann's and Gregori's study from February 2023 states that digital sustainable entrepreneurship carries transformative potential as it benefits society and the environment.<sup>7</sup> In particular, it encourages stakeholder involvement and demonstrates care towards ethics and customers. As a result, projects and other ventures the business undertakes are much more likely to be met with acceptance.



As a stronger benefit for startups, businesses that demonstrate sustainability can gain from crowdfunding. They can show the causes they support and ask for funding to further those causes. Additionally, businesses of all sizes can receive the attention of investors that are searching for entrepreneurs with a sustainability focus.

The study states that an example of a business model that could impact social sustainability is a software that tracks and monitors people in crisis. This way, the business can provide prompt support. Additionally, digital technology can allow businesses to provide connections to innovations, services, education, and government information—particularly to people in unfavorable circumstances. This not only demonstrates the business' care for people, but also gives those people resources to work and engage in other opportunities that might benefit the business.

The study also points out that while social and environmental entrepreneurship are separate concepts, they are often referred to interchangeably. There is often overlap, but businesses need to distinguish between the two in both their approach to finding sustainable causes to support, and demonstrating to customers and investors that they have genuine knowledge and interest.

## Cyber Security

As technology continues to rapidly advance, cyber security will also continuously develop to fight back against cyber threats and attacks.<sup>8</sup>



In particular, this review done by Filiz Mizrak in June 2023 discusses how evaluating potential threats is an important part of developing a successful business strategy. When they integrate this evaluation into their overall strategy, businesses can quickly spot vulnerabilities and avoid disruptions, which allows them to continue developing stably. This way, even if a security event does come up, the business is able to respond to any threats or attacks promptly,

and if a breach does occur, they can minimize and/or mitigate damage. Additionally, businesses can more efficiently conduct resource allocation, allowing them to properly prioritize and conduct risk management while still highlighting growth.

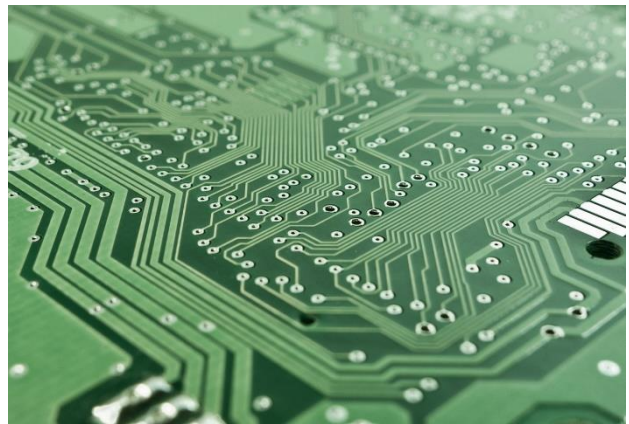
Along with completing this assessment strategically, businesses need to remain constantly vigilant. As new technology and corresponding cybersecurity threats constantly emerge, the businesses that spot those problems first will be able to not only continue operations smoothly and remain compliant, but also maintain a positive reputation with stakeholders and the general public.

To ensure that cyber threat detection is properly aligned with business strategy, teams from across the company need to collaborate. For instance, those who work with cybersecurity need to keep in touch with not only the innovation and strategy-based teams, but also those working in legal, compliance, and even front-end areas such as marketing.

As shown through the need for intensive collaboration, this study finds that the combination of cyber threat detection and business strategy is not just a new approach—it is a cultural shift. The business will also need to consider the people side of this change, shifting deeply ingrained perspectives and educating teams about how cyber security integrates throughout all aspects of business.

## Quantum Computing

A versatile technology that promises to transform various business processes and industries, quantum computing uses quantum bits, or qubits, to operate at unforeseen speeds and solve unusually complex issues.<sup>9</sup> As a study done by P. S. Aithal in September 2023 states, quantum computing will likely change the way businesses approach optimization, logistics, supply chains, and much more. With artificial intelligence on the rise, researchers can combine the technology with quantum computing to create even more cutting-edge solutions.



Throughout 2023, quantum computing has experienced some significant advancements. For example, researchers and companies have explored how quantum computing hardware can superconduct trapped ions, qubits, and topological qubits. As a result, they have been able to increase how many qubits a quantum processor can carry. Additionally, many researchers have prioritized improving stability within the quantum computing technology, creating error-correcting codes and finding other ways to avoid quantum decoherence. They have also worked to improve the overall algorithms to optimize speed, along with further developing programming languages and software.

To ensure that businesses are educated on how to use quantum computing well, many groups have been creating training programs and other educational materials.

Unfortunately, quantum computing is still experiencing some challenges. For instance, malicious attackers can use the technology against many encryption techniques (for example, RSA and ECC), which will require researchers to find ways to combat this security threat. Additionally, quantum computing is prone to interference and decoherence (but researchers are working to combat this through error-correcting code as previously described).

## How Do You Approach These Innovations?

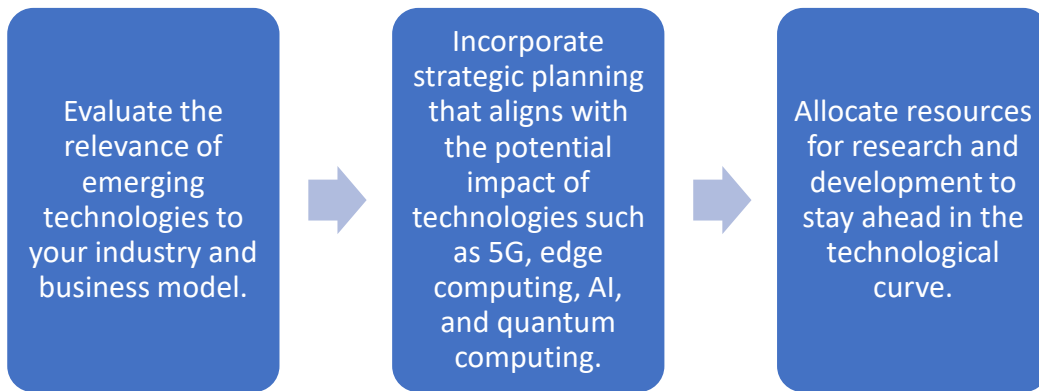
With these and more technologies that businesses have at their disposal, you may understandably feel overwhelmed. How do you know which technologies are right for you? How do you go about a strategy that maximizes those technologies' full potential? How do you create a learning organization so your employees know how to work with these advancements?

Below is a jumping board for digital transformation research, from which you can explore different technologies that may work best for your business. Additionally, you can break down your own approach to current technologies into specific steps, which is also discussed below.

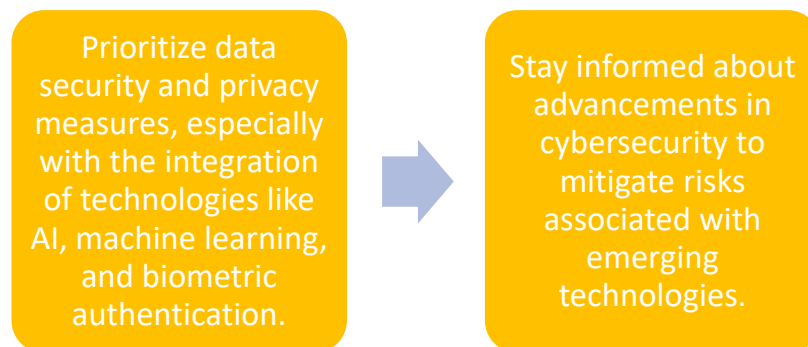




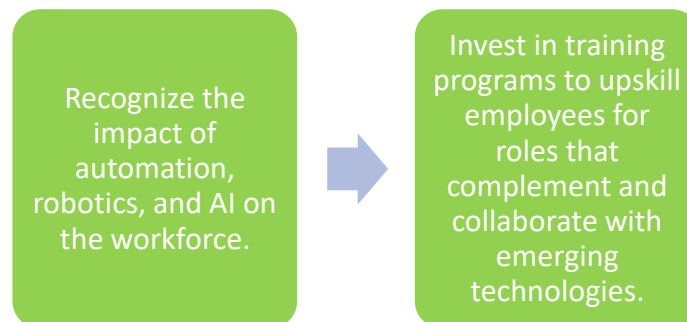
## Strategically Plan and Invest



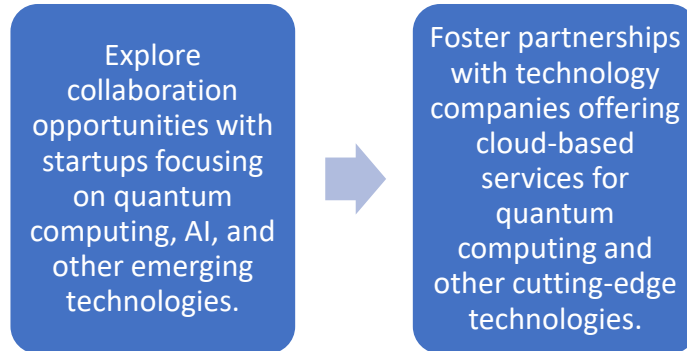
## Maintain Data Security



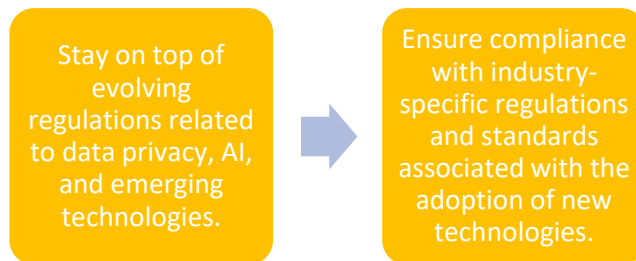
## Create a Learning Organization



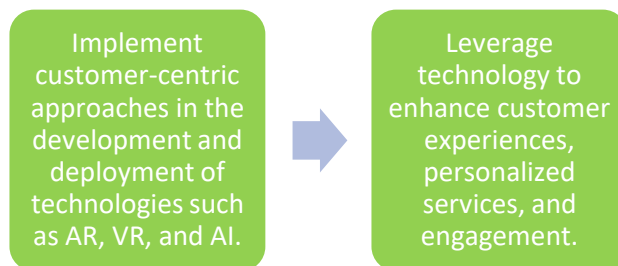
### Encourage Collaboration and Partnerships



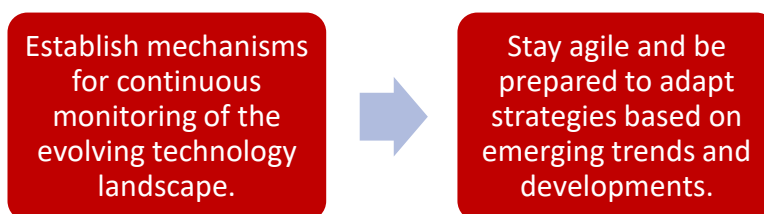
### Ensure Regulatory Compliance



### Maintain Customer-Centric Approaches



### Continuously Monitor Technology Landscape





*We recognize that with these constantly arising technologies, processes, and compliance requirements, you may need a second opinion. Feel free to contact us with any questions!*

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