
Business Automation Opportunities to Enhance Collaboration in Automated and Virtual Environments

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ABSTRACT

Allocating automation can be challenging. There are many instances where humans perform better than automation. However, businesses have many opportunities to automate and support humans to achieve more. There are many reasons why enterprises automate. Researchers have found that automation makes sense for tasks that are impossible or hazardous, difficult or unpleasant, and to extend human capabilities. Sometimes, people automate just because it is technically possible. Automation only makes sense when it is supporting the human. Different levels of automation, transitions, or reskilling of the workforce with environments that facilitate their work can benefit the business and the employee's well-being. As technology evolves, it is essential to understand areas where companies will benefit from some of these technologies. Retaining humans in the loop is a crucial factor in enhancing automated systems. One of the existing challenges is the required involvement in the workflow or process. Sometimes, there needs to be a group collaboration of humans when there are events that are unexpected and need adjustment. Dealing with abnormal situations would require innovative ways to unite people within the automation flow through virtual environments, digital twins, and other spaces supporting instantaneous remote collaboration. This paper provides examples of business opportunities to automate and make processes more efficient, effective, and satisfactory. It includes business case examples for digital twins, digital humans, generative AI, and metaverse. It will also mention future challenges with automation and possibilities for reevaluation of its function allocation. In particular, it will refer to the importance of user-centred research in supporting business automation delivery of future systems.

Keywords: Business automation, Digital environments, Immersive experiences

INTRODUCTION

Business automation has significantly impacted society, with different levels of autonomy ranging from manual control to autonomous control (Vagia, Transeth & Fjerdingen, 2016). Endsley (2017) illustrated how at the different levels of automation, there are various user roles for which designing for situation awareness is critical. Humans have better flexibility, inductive reasoning, and data storage skills, while automation has fast and accurate computational abilities. Digital technologies, such as digital twins, digital humans, generative AI, and metaverse, are trending across industries

(August 10, 2022). Although, they are not new concepts. They have significantly evolved over time. The pandemic has led to the optimization of digital processes to enhance immersive environments, enhance user-centric solutions, and transform the way businesses operate. In this article, you will learn more about those technologies, their advantages and disadvantages. In addition, it will identify various use cases and opportunities for research as the technologies continue developing.

Digital Twins

The digital revolution has introduced technologies like cloud computing, big data, smart cities, machine learning, and artificial intelligence, creating the digital twin (Batty, 2018). Adoption is expanding to help improve business decisions (Maciejewski, 2023). This technology enables real-time processes and simulates social and economic systems, streamlining intelligent automation across various industries. Digital twins are created by combining and simulating data from physical assets, providing an immersive view of an object's life and evolution. They use various technologies, such as the Internet of Things, artificial intelligence, cloud computing, and extended realities, to help with decision-making (Attaran & Celik, 2023). There are many companies and start-ups that are working on digital twins (IBM, 2023; Siemens, 2023; Microsoft, 2023; PTC, 2023; Ansys, 2023; ABB, 2023; Dassault Systems, 2023; Bentley, 2023; Honeywell, 2019; Matterport, 2023; Insidemaps, 2023; The Metaverse insider, 2023).

Digital Humans

Digital humans are lifelike avatars created using scanning, motion capture, and advanced rendering capabilities. They have a sophisticated virtual nervous system, allowing them to see, hear, and interact with AI-powered chatbots and voice assistant services. Recent reports indicate that digital humans are enabling new ears of intelligent software (Maciejewski, 2023). There are many organizations working on digital human software (Sourceforge, 2023). Digital human aims to assist real humans. They allow people to pursue valuable task rather than spending time answering repetitive tasks. Digital humans may not fit all the different business models. A report from the Harvard Business Review illustrated four types of digital humans that are focused in task, experience, ongoing personal relationships and intermittent business relationships, along with a process to help business decide if digital twins are the right choice (Seymour et al., 2023).

Generative Artificial Intelligence (AI)

The concept of AI exist since many decades ago (Stanford News, February, 2019). Generative AI is a subfield of artificial intelligence that uses computer algorithms to create content resembling human-created content. By learning from training data, generative AI models analyse patterns and structures to produce authentic, human-like content. Generative AI models, like ChatGPT4, Google Bard, WatsonX, and Stable Diffusion, have revolutionized various sectors by performing tasks like question and answer systems and automatically creating artistic images. Researchers have described the main

generative models and provide a taxonomy of these models (Gozalo-Brizuela & Garrido-Merchan, 2023). There are multiple classifications of AI tools (Aydin & Karaarslan, 2023), including: text to image, text to video, text to audio, text to motion, text to code, text to 3D, audio to text, audio to audio, brain to text, and image to text.

Metaverse

The concept of metaverse involves human experience migrating from physical to immersive virtual world (Maciejewski, 2023). The metaverse presents three paradigm shifts: experience, identity, and ownership (Stackpole, August, 2022). Moioli (August, 2022) explains that the metaverse differs significantly from traditional virtual worlds in that it is based on open platforms, offers rewards for content creation, and is a network of interconnected virtual worlds. Users can create and share content and applications, enabling unprecedented levels of interaction and collaboration. The metaverse is highly customizable, allowing users to modify and enhance the environment and avatars. In addition to its immersive nature, the metaverse also includes a more driven concept of communities, which will characterize its success in the present and future. As people spend more time online, the metaverse and its online life are becoming increasingly relevant. However, the “two lives” (online and physical) will become increasingly intertwined in the future, with the Internet of Things integrating the physical world with the virtual world through sensors and connected devices. This integration of physical and digital experiences is a significant difference between the metaverse and virtual reality worlds. In the metaverse, there are various markets that use non-fungible token to complete virtual to virtual transactions, or virtual transactions that become physical assets.

METHOD

This systematic literature review will focus on key digital technologies that support business automation, such as digital twins, digital humans, generative AI, and metaverse. Through this review, we can gain a better understanding of the current state of each technology, and how businesses can incorporate it into their existing operations. It will identify the potential advantages and disadvantages of each technology (Table 1). In addition to assessing user research and user experience needs.

RESULTS AND DISCUSSION

The following present a not exhaust list of use cases and applications in digital twins, digital humans, generative AI, and metaverse.

Digital Twins

Digital twins have numerous applications in various industries, including manufacturing, materials, medical and health, smart city support, transportation, aerospace, automation, architectural and animal husbandry, and cyber

security environments. In manufacturing, digital twins enable faster execution, increased efficiency, and cost savings (See more: Cimino et al., 2019; Guerra-Zubiaga et al., 2021; Augustine, 2020, Zhang et al., 2022; Kalidindi et al., 2022). In medical and health, digital twins improve patient care, hospital navigation, equipment management, and financial processes (See more Augustin, 2020; Romero et al., 2021; Falkowski et al., 2023). In transportation, digital twins enable product development, prototyping, and training for autonomous operators (See more: Augustin, 2020; Kampcsyk & Dybet, 2021; Zhang et al., 2022). In agriculture and animal husbandry, digital twins enable real-time monitoring and simulations, enabling real-time optimization of resource availability and wildlife health (See more: Zhang et al., 2022; Purcell et al., 2023; Warren et al., 2023). In cybersecurity environments, digital twin technology can help identify points of attack, malicious behavior, and vulnerabilities, enabling quicker security intervention (See more: Eckhart & Ekelhart, 2019; Pokhrel et al., 2020). In electric and power plants, digital twins support dynamic updates, optimizations, and intelligent inspections. Overall, digital twins have the potential to revolutionize various industries and improve overall efficiency and effectiveness (See more: Bortolini et al., 2022; Zhang et al., 2022; Palensky et al., 2022). Marketing initiatives and retail digital twin improve product availability, customer value, and sales strategies by analyzing customer needs, geographical data, and inventory, ensuring up-to-date personal pricing and customer satisfaction (See more: Augustin, 2020; Huang, 2022).

Digital Humans

Digital humans are rapidly evolving in various aspects of human care, including customer services, media and entertainment, health and fitness, research and design, and manufacturing. They are integrating into customer service to offer personalized products and services, improving efficiency, speed, and customer satisfaction. AI-based relationship management enables meaningful exchanges and complex conversations, making the experience more human (See more: Kerdvibulvech, 2023; Le et al., 2023). Digital technology can improve character performance in movies and video games, engaging viewers longer, resulting in superior products (See more: Wenmin, 2019; Sung et al., 2022). Digital humans can also support interaction with those who prefer human interaction, optimize workplace design, and predict performance and safety. Digital humans play a crucial role in health and fitness by supporting interaction with users who prefer human interaction. They enable social and emotional satisfaction through gestures and lip sync expressions. The healthcare sector has focused on ergonomics, but traditional assessment methods are time-consuming and costly. Digital humans can also serve as fitness management support, tracking fitness-related measurements and supporting smart fit activities (See more: Samson et al., 2009; Barricelli et al., 2020; Sun et al., 2023). Researchers have utilized digital humans to optimize workplace design, identifying hazards, providing ergonomic insights, and generating data, ensuring safer, more productive environments for everyone (See more: (Chaffin, 2007; Lamkull et al., 2009; Ma et al., 2011; Ficher

et al., 2023; Buonocore et al., 2023). In addition, digital humans are utilized in manufacturing for studying human behaviour, collaborating with robots, optimizing workplaces, and predicting performance and safety (See more: Wenmin, 2019; e-spin, Jun, 2022).

Generative AI

Generative AI has potential applications in various industries, including prototyping, innovation management, education, health, marketing, operations, risk and legal, human resources, and employee utilization. Large language models (LLMs) like GPT can enhance early phases of innovation, such as exploration, ideation, and digital prototyping (See more: Qadir, 2023). AI can also be used in education, healthcare, marketing, operations, risk and legal, human resources, and employee utilization (See more: Chui et al., 2022). Generative AI can help with drafting, reviewing, summarizing, highlighting changes, and answering questions on lengthy legal documents, while also improving communication and efficiency in employee utilization. Overall, generative AI has the potential to revolutionize various industries and drive growth in various sectors. For example Ebert & Louridas (2023) showed how medically interpretable picture of machine-learning-based medical image AI, using a generative model to render “counterfactual” medical images and translate them into medically meaningful features.

Metaverse

The metaverse offers numerous applications, including commerce, virtual tourist experiences, social gatherings, educational experiences, and educational experiences. Augmented reality shopping allows customers to browse and purchase products using their phone’s camera, eliminating the need for traditional online stores (See more: Mystakidis, 2022). Virtual tourist experiences allow users to visit cities from their armchairs, allowing them to touch and explore structures from a distance (See more: Gursoy et al., 2022). Social gatherings involve virtual avatars interacting with one another (See more: Stefanic, nd; Petkov, 2023), while educational experiences allow students to access virtual versions of classrooms and lecture halls, offering enhanced curriculums and greater convenience (See more: Inceoglu and Cilogluligil, 2022). The metaverse’s potential for these applications is vast and expanding.

Advantages and Disadvantages

Digital technologies can heavily impact the success or failure of business automations. Table 1 presents some of the advantages and disadvantages of digital twins, digital humans, generative AI, and metaverse.

User Centred Research Needs

User-centered research practices are crucial for business automation, decision support systems, and predictive analytics. It is essential to understand applications, user interfaces, legal and ethical implications, and digital twins to enhance system trust and awareness. Research on resilience, personalized digital twins, and security and privacy implications is also necessary.

Table 1. Advantages and disadvantages of key digital technologies supporting business automations.

Name	Advantages	Disadvantages
<p>Digital twins (Honeywell, 2019; Adamenko et al., 2020; Yin et al., 202; IBM, 2023; Siemens, 2023; Microsoft, 2023; PTC, 2023; Ansys, 2023; ABB, 2023; Dassault Systems; 2023; Bentley, 2023; Matterport; 2023; Insidemaps; 2023; The Metaverse insider, 2023)</p>	<ul style="list-style-type: none"> • Optimization of operations and processes with real time data • Cost reduction and improved efficiency • Accelerates and improve innovation • Facilitates decision making • Improved quality control and reduce risk • Help with planning and training for maintenance and safety • Increased reliability and availability • Maximizes the product lifespans • Helps to stay competitive in the digital age 	<ul style="list-style-type: none"> • It could be difficult to create a data driven model due to the unknown volume of data that is necessary to build a realistic model • Difficulty in capturing timely dynamic data • High costs of development and maintenance • Vulnerable to cyber-attacks, so it can put security at risks • Lack of transparency • Uncertainty in simulation accuracy in novel scenarios
<p>Digital humans (Jaxel, 2022; Trulience, 2023; Cramer, 2023; Jiang, Jun, 2023; Cramer, 2023; Seymour et al., 2023; Yuan, 2023).</p>	<ul style="list-style-type: none"> • Provide faster response times to customer inquiries at any time of the day or week • Generate cost savings • Reduce manual labor and increase automation • Streamline customer service processes • Enhance personalization and empathy • Never seek for a raise and always follow company policies • Provide consistent message across geographical locations • Enhance business multilingual and multicultural accessibility • Allow immediate feedback from customers • Atomicity and reliability on sensitive topics for customers' needs • They do not get tired • Anticipate customers' wants and needs • Prediction help product management, prices for more accurate revenue estimations • Generative AI can be used to train machines to understand and efficiently translate foreign languages with accuracy and cost-effectiveness. • Improve decision-making • Increase productivity, efficiency, creativity, customization • Reduce cost and streamline research and development • Enhance data analysis and data augmentation • Enable chatbots and virtual assistants, and digital humans • Finish faster than humans • Less errors and defects • Less space and less size 	<ul style="list-style-type: none"> • Cost: Expenses associated with creating and maintaining the infrastructure for this technology • Lack of Detection and Movement • Complex Programming • Human trends and evolutions may not sync with outdated specifications of the technologies • Impact on User Privacy, Ethics, and Human Interaction • Unrepresentative Diverse Identities in Digital World: Not all types of users may be accurately depicted • Unreal Words and Actions: Realism can be lost when robots behave in unrealistic ways, potentially leading to mistrust • Digital humans may not understand people with special needs
<p>Generative AI (Martino et al., 2020; Khanzole and Sarode, 2020; Speak, 2022; Hughes, 2023; Bell, 2023; Houde, et al., 2023; Qadir, 2023)</p>	<ul style="list-style-type: none"> • Improve decision-making • Increase productivity, efficiency, creativity, customization • Reduce cost and streamline research and development • Enhance data analysis and data augmentation • Enable chatbots and virtual assistants, and digital humans • Finish faster than humans • Less errors and defects • Less space and less size 	<ul style="list-style-type: none"> • Excessive trust leading to unreliable information • Limited knowledge of copyright • Potential for misuse • Job displacement and unintended learning and amplification of biases • Ethical concerns, legal and regulatory issues • Require a huge quantity of electricity to run • Require a large amount of data to work properly • Plagiarism • Overreliance • False or misinformation • Privacy concerns • Lack of human touch • Creativity depends upon programmer or existing work • Technology dependency increases • Requires a lot of time and money

Continued

Table 1. Continued

Name	Advantages	Disadvantages
Metaverse (PWC, 2022; Gursoy, 2022; Mystakidis, 2022; Maciejewski, 2023)	<ul style="list-style-type: none"> • Enable augmented and immersive access of information • Allow users to explore virtual places and interact with others • Facilitate product and brand purchases, content creation, and brand discovery • Enable users to use a digital wallet and meet new people • Allows for low cost of dispatching, sharing and receiving information • Facilitates, immediate and ubiquitous access to information • Enables virtual mobility, remote collaboration and real-time information access 	<ul style="list-style-type: none"> • Cybersecurity • Cybersickness • Privacy Risk • Technology Constraints • Regulatory Uncertainty • Intellectual Property Concerns • Memory Risks • Manipulation • Deepfake Technology ° False Memories ° Cyberbullying ° Sexual Harassment ° Catfishing ° Hate Speech

New developments of digital humans offer opportunities for research, ensuring they represent values such as trustworthiness, reliability, authenticity, and concern for the end user. User research helps develop products, content, and user experiences from a user-perspective, examining user wants, expectations, and feedback on the digital human's appearance and behavior. It also helps refine the digital human's characteristics to be more trustworthy and believable.

Generative AI has the potential to revolutionize interactions with humans, but it requires user input. User-centered research for generative AI helps developers understand users' needs, identify gaps, and address potential issues with implementations. This research can explore topics such as user appeal, trust issues, potential applications, and the impact of technology on humans. Bringing users' voices into AI systems' development, training, interpretation, and analysis ensures they are designed and developed to meet users' needs.

The metaverse presents research opportunities for user-centred optimization, user interface analysis, accessibility assessment, social psychology investigation, and user journey mapping. This research aims to enhance the virtual environment's accessibility, social psychology, and overall user experience. User research helps identify pain points, understand preferences, and identify areas of interest. Developers can track user satisfaction, engagement, and churn to prioritize product and user experience improvements. User research could inform product decisions, reaching larger user audiences and growing communities.

CONCLUSION

Digital Twin solutions, digital humans, Generative AI, and the Metaverse revolutionize business operations by providing digital tools and experiences. Digital twins enable faster execution, increased efficiency, and cost savings in various industries, while digital humans are rapidly evolving in various

fields. Generative AI has potential applications in prototyping, innovation management, education, health, marketing, operations, risk and legal, human resources, and employee utilization. The metaverse offers numerous applications, including commerce, virtual tourist experiences, social gatherings, and educational experiences. User-centred research practices are crucial for business automation, decision support systems, and predictive analytics. However, challenges such as cost, limited knowledge, ethical dilemmas, security, privacy, and environmental concerns persist across digital technologies. Further research is needed to understand user expectations and create more efficient tools for these advancements.

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