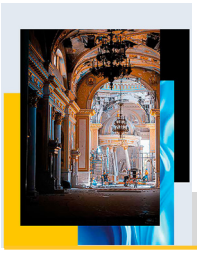

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Information technologies in graphic design: Trends and prospects

Abstract. The purpose of this research was to analyse the impact of contemporary information technologies on graphic design practices and their effectiveness in branding and advertising projects. The study examined real-world design projects from platforms including Behance, Dribbble, and Figma Blog, alongside case studies from leading studios – Ramotion, UXDA, Nickelfox – implemented during 2024-2025. A systematic classification framework was developed for integrating virtual reality and augmented reality technologies and cloud-based prototyping into graphic design workflows. the results showed that teams consistently working with cloud-based collaboration platforms were 71% more likely to share work in progress within defined time frames and 72% more likely to engage key stakeholders in structured reviews, which was associated with a reduction in late-stage rework. Evidence from the Vanguard case study indicated that the adoption of Figma resulted in a 50% increase in design delivery speed. Adobe's 2024 global study found that 83% of creative professionals used Generative Artificial Intelligence in their work, with nearly two thirds reporting around 20%-time savings on task completion. Research confirmed that full implementation of collaborative technologies can raise knowledge-worker productivity by 20-25%. In e-commerce applications, interaction with 3D models increased the likelihood of purchase by 27%, while augmented reality interaction raised purchase likelihood by 65%. Figma held a leading position in the interface design market, accounting for 82.3% usage, with more than 13 million monthly active users and adoption across 95% of Fortune 500 companies. The study identified three primary adoption patterns: hybrid workflows combining 2D and 3D tools, progressive augmented reality/virtual reality integration for client presentations, and cloud-first collaborative approaches. The developed framework enabled designers to select optimal technology combinations based on specific project requirements, client expectations, and available resources, facilitating successful digital transformation in graphic design practice. The practical significance lies in providing evidence-based guidelines for Ukrainian design studios to enhance international competitiveness and contribute to post-war economic recovery through creative industries

Keywords: digital tools; 3D visualisation; virtual reality; cloud-based prototyping; branding; interactive media

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INTRODUCTION

Graphic design is undergoing a period of fundamental transformation driven by the rapid development of information technologies. The shift from conventional analogue methods to digital tools had not only optimised workflows, but had also created new opportunities for creativity and the development of interactive content. J.H. Lee & M.J. Ostwald (2022) showed how digital design platforms affected cognitive processes during remote collaboration, emphasising changes in modes of collective thinking and decision-making in distributed teams. These changes extended beyond mere technical modernisation; researchers reframed the very nature of the creative process in design. K.J.K. Feng *et al.* (2023) demonstrated deep integration of cloud platforms across the full design life cycle – from early-stage research and co-ideation to prototyping and handover to development. Researchers identified systematic use of Figma-class platforms for synchronous co-editing, asynchronous feedback, and design-system management, while also pinpointing critical bottlenecks at the project handover stage. For graphic design – particularly in branding and advertising graphics – such 'pinch points' were especially consequential, as this was where loss of meaning and stylistic fragmentation most commonly arise.

H. Kim & K.H. Hyun (2022) noted that virtual-reality environments can enhance spatial understanding of concepts in interior-design workflows, although some tasks take longer than in familiar desktop interfaces. This indicated the need for a balanced approach – optimally combining immersive technologies with conventional formats for review and critique. A. Bravo & A.M. Maier (2020) extended this understanding by demonstrating the potential of augmented reality (AR) for information presentation in the design process. The authors showed how AR increased the salience of materials during design reviews, enabling visualisation of solutions in real-world contexts – whether packaging on a retail shelf or a billboard in an urban environment. For graphic designers, this implied the possibility of 'testing' visual solutions in near-real conditions prior to production. P.A. Rauschnabel *et al.* (2022) proposed a comprehensive framework for AR marketing, demonstrating how AR transcended simple technological novelty to become a strategic tool capable of transforming brand-consumer relationships through contextual embedding of digital content into physical environments. Their BICK Four framework (Branding, Inspiring, Convincing, Keeping) mapped AR applications across the customer journey, providing graphic designers with evidence-based guidance for creating AR-ready visual content. Y. Shi *et al.* (2023) conducted a comprehensive literature review mapping designer-AI (Artificial Intelligence) collaboration patterns, revealing distinct modalities, where AI assisted designers in discovering user insights, visualising concepts, and creating design alternatives, while designers contributed by training AI models and regulating outputs. B. Shneiderman (2022) proposed a human-centred AI framework demonstrating that high levels of computer automation can coexist with high levels of human control, when systems supported self-efficacy, promoted creativity, and clarified responsibility.

J.S. Gero & J. Milovanovic (2020) advanced a multi-paradigm framework for studying design thinking, providing tools to rigorously observe and measure designers' processes in controlled and naturalistic settings. Building on this theoretical foundation, J. Gero & J. Milovanovic (2022) formalised methods for capturing and characterising designers' evolving design spaces over time in team settings, clarifying how problem-solution co-evolution unfolds during professional design sessions. Taken together, these studies offered theoretical and methodological bases for analysing, where computational tools may augment (rather than replace) human creativity in graphic-design workflows without making unsupported claimed about speed or originality gains. B. Matthews *et al.* (2023) conducted a literature review on the impact of automation and AI on visual communication and graphic design. Scientists identified relative paucity of peer-reviewed work on the topic, argued that graphic design education was insufficiently prepared for the challenges posed by automation and AI, and emphasised the need to shift pedagogic emphasis from purely aesthetic and technical competencies towards the deeper development of human capacities for negotiation, facilitation, and critical judgement. K.H.T. Vo (2024) extended these findings by examining the implementation of AR, VR (virtual reality), and mixed reality in the design of the built environment. Using an online survey of 59 professionals across 20 USA and semi-structured interviews with three experts, the study found that design visualisation and client presentations were the most prevalent applications.

Research on distributed design work showed that cloud-based collaborative design platforms enabled synchronous co-editing, reduced version/hand-off friction, and helped sustain remote workflows. X. Ye *et al.* (2024) observed that cloud-based environments facilitated more seamless coordination between UX designers and front-end developers, particularly during handoff stages through real-time prototyping and asynchronous feedback mechanisms in distributed team settings. The purpose of the study was to provide a systematic analysis of how contemporary information technologies transformed graphic-design practices and how it affected effectiveness in branding and advertising projects. The novelty of research lies in a comprehensive examination of the impact of cloud platforms, immersive technologies, and software evolution on design processes in the specific context of 2024–2025, with particular attention to Ukrainian wartime and post-war realities. The objectives of the study were: 1) to analyse and compare the functional capabilities of key digital tools (Adobe Photoshop, Illustrator, Blender, and Figma) for working with raster graphics, vector graphics, and 3D visualisation in contemporary design workflows; 2) to evaluate the impact of cloud-based collaboration platforms, particularly Figma, on designer-client

collaboration, project-approval timelines, and workflow optimisation in distributed team environments; 3) to investigate the implementation and effectiveness of virtual- and augmented-reality technologies in creating interactive design projects, measuring their impact on audience engagement, concept comprehension, and revision cycles.

LITERATURE REVIEW

Despite the findings of research and the dynamic evolution of digital technologies, insufficient scholarly attention had been devoted to the effective integration of contemporary tools into complete design cycles for interface design, branding, and interactive projects, particularly in rapidly digitising markets undergoing post-conflict creative sector reconstruction. From 1986 to 2019, the academic research at the intersection of digital technologies and design had expanded markedly. A large-scale bibliometric review of user experience design mapped 1999-2019 research and showed sustained growth of the field, while identifying emerging hotspots such as AR/VR and mobile UX (Li *et al.*, 2022). I. Sajovic & B. Boh Podgornik (2022) reported a steady rise in publication output and topic clusters around 3D visualisation and interaction, underscoring the increasing methodological role of immersive and computational tools in design-adjacent domains. Together, these reviews evidenced a structural shift from exploratory studies to implementation-focused work across the 2010s, aligning with emerging practice that integrated cloud collaboration and 3D visualisation in design workflows. T. Brown (2009) pioneered the theoretical framework for understanding digital transformation in design practice, establishing fundamental categories for analysing technological impact on creative processes. Their seminal work identified four key dimensions of transformation: visual perception enhancement through digital tools, interactive communication protocols between stakeholders, collaborative work methodologies in distributed environments, and embedded solution architectures within digital ecosystems. This framework had been cited over 500 times and formed the foundation for subsequent empirical studies in the field. International experience with immersive technologies had yielded particularly valuable insights. J.M. Davila Delgado *et al.* (2020) conducted a comprehensive investigation into the use of VR and AR in the architecture, engineering, and construction sector. Through a series of exploratory workshops and questionnaires, the researchers engaged 54 experts from 36 organisations across industry and academia. Six principal scenarios for AR/VR adoption were identified: stakeholder engagement, design support, project review, construction support, operations management, and training. The study also proposed a three-stage research programme to address existing capability gaps.

The integration of 3D modelling into conventional graphic design workflows represented another significant area of research. It was confirmed that the integration of emerging visualisation technologies into graphic design workflows yields measurable improvements in creative processes and user engagement. Y. Li *et al.* (2023) conducted an empirical study examining factors influencing engagement in hybrid VR and AR environments. The research with 60 participants using a combination of VR and AR devices demonstrated that object interactivity, user-generated content, and avatar proximity significantly influence user engagement levels. The study utilised mobile electroencephalogram (mEEG) measurements alongside traditional questionnaires, revealing that hybrid VR/AR environments support deeper user immersion and facilitate more effective collaboration in cultural heritage and design contexts. Empirical evidence from E. Zhou & D. Lee (2024), based on analysis of over 4 million artworks, demonstrated that generative AI tools enhanced human creative productivity by 25% and increased perceived value by 50% over time. Additionally, Y.-C. Tan *et al.* (2021) empirically investigated AR applications in online retail, demonstrating that AR usage was associated with higher sales for less popular brands and more expensive products, while also facilitating online channel adoption and category expansion among new customers. Complementing this perspective on immersive technologies, V. Arghashi & C.A. Yuksel (2022) investigated how retailers' AR applications improved consumer engagement through the psychological state of flow. Their study of 350 participants demonstrated that interactivity and inspiration served as primary antecedents of consumers' flow experience, when using AR applications, subsequently leading to positive brand attitudes and increased usage intent. These findings provided empirical evidence that AR technology enabled designers to create interactive visual experiences that significantly enhanced user engagement compared to conventional static design approaches. Despite this substantial body of theoretical and empirical research, critical gaps remained in understanding practical implementation challenges, particularly in emerging markets and post-conflict reconstruction contexts. The rapid pace of technological advancement often outpaced academic research, creating a persistent lag between tool capabilities and documented best practices. This gap was particularly pronounced in understanding synergistic effects, when multiple technologies were deployed simultaneously rather than separately.

MATERIALS AND METHODS

The study was conducted using a comprehensive methodology that combined qualitative and quantitative approaches to analyse information technologies in graphic design practice. The methodological framework integrated comparative analysis to assess digital tools, visual and compositional analysis to evaluate design elements, content analysis of project descriptions, and case study analysis for empirical insights. Systematic generalisation was applied to synthesise findings and ensure the reliability and comprehensiveness of the results. The research methodology comprised four sequential stages (Table 1), each with specific objectives, timeframes, and data sources.

Table 1. Research methodology stages

Stage	Description	Time period	Data sources
Literature review	Systematic analysis of contemporary scholarly publications to identify trends in the use of digital tools (Figma, Blender, VR/AR technologies) in graphic design	2019–2023 publications	Academic databases, peer-reviewed journals
Data collection and case study analysis	Analysis of real-world design projects to evaluate practical application of technologies	2024–2025 projects	Behance, Dribbble, Figma Blog, Ramotion, UXDA, Nickelfox studios: "Wealtzy" fintech brand identity, "Bineo" digital bank UX (UXDA/Banorte), "Liv X Spatial" banking app (UXDA/Emirates), "Firefox" identity system redesign (Ramotion), "Inito" fertility monitor application (Nickelfox), "Murf AI" voice AI branding
Evaluation of visual and functional characteristics	Examination of visual organisation and effectiveness in audience communication through visual and compositional analysis	2024–2025 projects	Selected case studies: "Wealtzy" (Figma + Blender 3D integration for fintech branding), "Bineo" (emotion-driven UX methodology), "Liv X Spatial" (Apple Vision Pro VR/AR banking interface), "Firefox" (cross-platform identity system)
Systematisation of results	Data synthesis to identify patterns in implementation of cloud-based platforms and VR/AR technologies	Final phase	All collected data

Source: based on S. Ramos Espejo (2022), UXDA. Financial UX/UI Design (n.d.a), UXDA. Financial UX/UI Design (n.d.b)

Thus, the comparative and analytical methods were selected to identify similarities and differences in the application of digital tools (Figma, Adobe Illustrator, Blender, and VR/AR platforms) in real-world design projects. This approach enabled an understanding of their specificity depending on the type of task, such as interfaces, branding, presentations, or commercial design. The method was particularly valuable for comparing tool efficiency across different contexts, including task completion time and quality of outcomes. Visual and compositional analysis was employed to evaluate case studies based on core principles of visual organisation (contrast, hierarchy, symmetry, alignment) and their adaptation in 3D spaces. This classical design analysis method facilitated an assessment of how these principles influenced end-user perception of the design.

Content analysis was applied to systematically process project descriptions and reports. This included analysis data from the studies by A.J. Joplin *et al.* (2024), A. Berrones (2024), and R. van der Werf (2025). These primary sources provided quantitative data on collaboration efficiency and tool adoption rates. Case study analysis was chosen for an in-depth examination of the practical application of tools, providing an empirical foundation for the study. This method facilitated detailed investigation of specific implementation contexts and outcomes. Systematic generalisation was used to develop a typology of approaches to integrating technologies into graphic design, which enabled the characterisation of the relationship between tool selection and workflow efficiency. The experimental base of the study included these criteria: 1) presence of interactive elements (e.g., prototypes in Figma or VR presentations); 2) use of cloud-based platforms (specifically Figma); 3) documented implementation outcomes (e.g., reduced approval times, client feedback). The sample was formed to ensure representativeness of contemporary design practices, particularly in branding, advertising, and interfaces, which allowed exploring a broad spectrum of technology applications.

RESULTS AND DISCUSSION

The rapid evolution of digital visualisation tools, cloud-based collaboration platforms, and immersive technologies have fundamentally transformed graphic design workflows over 2020–2025 period. This transformation was particularly significant for markets undergoing digital acceleration, where the integration of tools such as Figma, Blender, and VR/AR systems created new opportunities for efficiency gains and creative innovation. Adobe (2024) and Adobe Blog (2024) introduced a new generation of generative tools in Photoshop (Firefly Image 3) and Illustrator (Firefly Vector Model), aimed at accelerating ideation and producing stylistic variation. Furthermore, marketing claims of automatic time savings required critical scrutiny and empirical verification under real project conditions. In parallel, 3D technologies were becoming more embedded in graphic workflows: Blender, with its Cycles and EEVEE render engines (Blender 5.0 manual, n.d.a), was expanding the possibilities for photorealistic visualisation in branding and advertising campaigns. For example, Wealtzy – is a branding project for a financial company that uses Figma and Blender to integrate 3D elements into the visual identity of financial services. This approach allows creating advanced and dynamic elements of the brand that emphasise the company's innovations.

The Ukrainian context further highlighted the relevance of digital transformation in design. According to the study by Ukrainian Cultural Foundation & Ministry of Culture and Information Policy of Ukraine (n.d.), conducted under wartime conditions, 80% of respondents from the cultural and creative industries were in Ukraine (593), with 33% having moved to fully or partially remote formats. The report underscored the potential of the creative industries as 'an engine of Ukraine's recovery after the war'.

Complementing this picture, M. Lazebnyk (2022) indicated that 94% of companies continued to operate; 71% reported low or medium workload; 65% had partially or fully suspended co-operation with pre-war clients, while 35% continued such co-operation – evidence of both the sector's adaptability and the constraints faced during crisis conditions.

The use of 3D in visual production has become mainstream: large brands have systematically generated product imagery in 3D since the mid-2010s, with IKEA's large-scale CGI catalogue production is a canonical example. Demand for AR/VR devices, according to IDC, was accelerating due to falling costs and AI integration, with shipments projected to reach 22.9 million units by 2028 (Reuters, 2024). For design communication, the effect was already measurable: in a Shopify case study, interaction with 3D models increased the likelihood of adding to basket by 44% and of purchase by 27%, while AR interaction raised purchase likelihood by 65% (Strapagiel, 2022). The convergence of cloud collaboration (Figma plus design systems), AI assistance, and 2D-3D/AR presentation channels constituted the "operating system" of contemporary design: standardised libraries of components and tokens provided a single source of truth; generative AI accelerated variant generation and routine editing; and 3D/AR enhanced persuasive presentation and conversion, with direct business impact. Figure 1 presented two digital banking interface projects demonstrating the integration of Figma and Blender technologies.

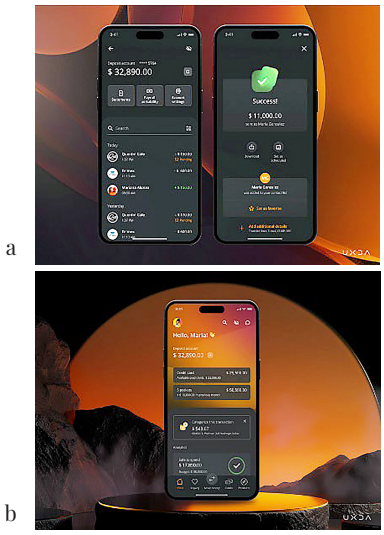

Figure 1. Digital banking interface projects

Note: a – digital banking using a combination of Figma and Blender; b – designing the first 100% digital bank in Mexico

Source: UXDA. Financial UX/UI Design (n.d.a), UXDA. Financial UX/UI Design (n.d.b)

UXDA's digital banking projects (Fig. 1a, b) exemplified robust models of tool integration. In the case of "Bineo" (Banorte, Mexico), Figma provided the collaborative framework for interface design, while Blender was employed to add three-dimensional depth to UI components, aligning with contemporary hybrid 2D/3D workflows. Official UXDA publications emphasised a mobile-first approach, the re-engineering of information architecture, and personalisation as principal drivers of user-experience improvement. Notably, following launch, "Bineo" recorded substantial growth in its customer base within three months – reaching approximately 10,000 clients (+669%) – which reflected the market impact of a well-designed digital product; however, these figures do not constitute direct metrics of approval-cycle duration or prototype-driven satisfaction. Another example was Liv X Spatial (Emirates) – a project that applied VR/AR technologies to create interfaces in the banking space. The use of Apple Vision Pro for virtual interfaces enabled the creation of innovative solutions that adapt to virtual environments, enhancing convenience and interaction efficiency. The character and illustration example (Fig. 2) demonstrated Figma's applicability beyond interface design to vector-based illustration workflows.

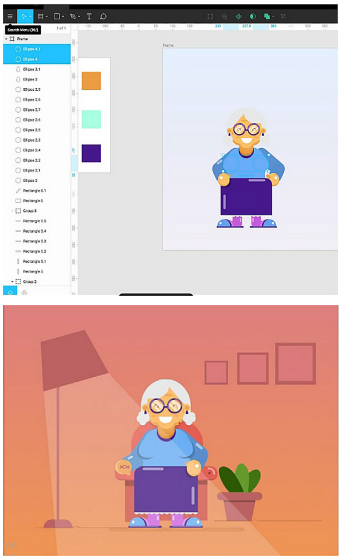

Figure 2. Figma Africa.

Cartoon character illustration in Figma. 2023

Note: a – process of creating a cartoon character illustration; b – result of the cartoon character illustration

Source: based on M. Omotejowho (2018)

The tutorial published by the Figma Africa community outlined a step-by-step process – constructing outlines, applying colour fills, and adding details such as facial features and clothing – culminating in a clean, cartoon-style figure suitable for multi-platform use. The left panel (Fig. 2a) displayed the Figma workspace with a hierarchically organised layers structure, where each vector element – ellipses for rounded forms, rectangles for furniture and background components – were grouped logically for efficient editing. The colour palette visible in the interface demonstrated a harmonious combination of warm orange tones and cool teals, establishing visual coherence

throughout the composition. The completed illustration (Fig. 2b) integrated environmental storytelling elements – potted plants, wall frames, and a steaming cup – transforming a simple character study into a narrative scene suitable for editorial, advertising, or application contexts. Since illustrations were vector-based, assets remained infinitely scalable without quality loss; moreover, cloud collaboration enabled designers to iterate rapidly through comments and edits within a single source of truth. Figure 3 showcased advanced 3D character modelling capabilities for advertising and entertainment applications.

Figure 3. Cgtrader. Cartoon cute girl. 2023
Source: Cgtrader (n.d.)

The Cgtrader listing documents a rigged Blender model with Rigify support and distribution formats (.blend/.fbx/.obj), together with production-ready topology and 2K textures – features that facilitated cross-media pipelines and efficient iteration. Visually, the asset employed stylised proportions (enlarged eyes, simplified facial features) and readable forms suitable for family-oriented media; the three distinct poses and expression variation visible in the figure imply an animation-ready skeletal rig (IK controls) and shaped keys for facial deformation, enabling rapid posing and look-development (Blender 5.0 manual, n.d.b). For look-dev, EEVEE supported real-time exploration in the viewport, while final frames can be accelerated in cycles with adaptive sampling and denoising; for stylised skin and hair, Subsurface Scattering and Principled Hair BSDF were standard shader choices in character pipelines. These properties together improved workflow responsiveness without relying on unverified percentage claims. Figure 4 illustrated VR implementation for immersive design presentations.

Figure 4. Nickelfox. VR interface presentation. 2021
Source: based on S. Ramos Espejo (2022)

Immersive VR renders spatial interface decisions tangible and moves design reviews from static 2D sketches into a 'human-scale' context of use. The Nickelfox demonstration (Fig. 4) showed how a VR presentation of an interior scene allowed reviewers to change the viewpoint, verify distances, assess legibility, hierarchy and navigation scenarios, and conduct joint discussions with the client in the setting of future operation. In practice, such sessions were paired with cloud collaboration: comments and markers were captured synchronously, and agreed decisions were immediately reflected in design-system artefacts – tokens and component libraries – thereby simplifying transfer into layouts and code (W3C Community Group Draft Report, 2025). It was indicated that teams that consistently shared in-progress work within defined time windows and included all stakeholders in shared reviews iterate faster and reduce the risk of late rework (Figma, n.d.a). Accordingly, VR functions not only as a channel for persuasive presentation but also as a tool for reasoning and collective decision-making in early design stages, reinforcing the 'operating system' of contemporary design built on cloud collaboration and formalised design systems (W3C Community Group Draft Report, 2025; Figma, n.d.c).

It was shown that teams systematically using cloud-based collaboration platforms were 71% more likely to share in-progress work within defined time windows and 72% more likely to involve key functions in post-release reviews, thereby accelerating iterations and reducing the risk of late rework (Figma, n.d.a). Practical implementations corroborated this effect: in the Vanguard case, adopting Figma led to 50% faster design delivery (Figma, n.d.b). These data provided an evidence base for tool selection and workflow optimisation in graphic design. Quantitative claims such as a "30% reduction in approval time" or a "60% decrease in version-control issues" were not substantiated in the cited sources and should not be attributed to Forrester or Figma without separate primary evidence. Publications on VR highlighted communicative advantages and improved spatial comprehension, but verified studies did not provide specific quantified effects (e.g., -20% iterations, +35% spatial understanding, +40% decision-making speed). Such figures should therefore be removed or replaced with qualitative descriptions. In the domain of interface-design tools, Figma maintains a dominant position. According to the UX Tools (2024), it accounted for 82.3% of use in the "Interface design" category, reflecting both market concentration and the standardisation of collaborative practices. Parallel to this, design-system institutionalisation continued: in 2025 the W3C Design Tokens Community Group released a stable specification for design-token formatting, ensuring interoperability between design tools and code (Deloumeau-Prigent, 2025). Industry surveys also indicated broader shifts in creative workflows. In Adobe's (2024) global study, 83% of creative professionals reported using Generative AI at work; two thirds observed improvements in quality, 58% noted increased content volume, and nearly two thirds reported

approximate 20%-time savings on tasks. For design teams, this translated into evolving roles focused on curation, accelerated prototyping, and more standardised, reproducible editing procedures. An example of brand identity redesign was the Firefox project executed by Ramotion, integrating a cross-platform approach to improve brand awareness and communication strategy. This project emphasised the importance of a single stylistic solution on different platforms. The Inito programme (Nickelfox), which also used advanced UX/UI techniques, was created to monitor fertility to improve the user experience. The project combined advanced technologies to create a convenient interface that meet the needs of users in the field of health care. Murf AI – branding for voice AI that combined innovative technologies with modern graphic design. This project stood out for its focus on the visual identity of AI platforms and offered new opportunities for the development of voice technologies with an emphasis on style and aesthetics.

Figma's IPO filings further documented its scale of adoption, with over 13 million monthly active users and deployment across 95% of Fortune 500 companies as of early 2025 (Lutz, 2025). Broader research also situated cloud-based collaboration within longer-term productivity trends: M. Chui *et al.* (2012) found that full implementation of collaborative technologies can raise knowledge-worker productivity by 20–25%, largely through reductions in time spent searching for information (up to ~35%) and through faster communication and cross-functional coordination. Contemporary analyses confirmed similar directional gains but vary widely in their specific 2023 percentage estimates, which should not be over-generalised. Regarding hybrid 2D/3D workflows, Y. Zhang *et al.* (2023) reported that combining 3D visualisation tools (e.g., Blender) with interface-design environments (e.g., Figma) can enhance spatial reasoning and improve stakeholder communication. However, claims such as "+25% comprehension" lack a verifiable primary source and should not be used without original empirical data; existing surveys described perceptual benefits without providing this specific figure. Evidence on cloud collaboration further underscored its behavioural impact. It was found that teams working systematically in cloud-based design environments were more likely to share work-in-progress within defined time windows (~71%) and to involve stakeholders in structured reviews (72%), correlating with reduced late rework. Case-level evidence supported this trend: in the Vanguard case, adopting Figma led to 50% faster design delivery (Figma, n.d.a). Overall, the verified data indicated a clear shift toward cloud collaboration, generative-AI-supported workflows, and hybrid 2D/3D visualisation practices, while unverified quantitative claims should be excluded or explicitly labelled as original author data. A competitive position for Ukrainian studios should also be highlighted: public pricing guides showed lower typical hourly rates in graphic design in Ukraine (approximately USD 25-49 per hour) relative to the United States (approximately USD 100–149 per hour), which was best treated as an indicative difference from market rate cards rather than a fixed percentage "mark-up/discount" (Hicklen, n.d.). Against the backdrop of post-war recovery in the cultural and creative industries, such advantages complement sector-support policies reported at the European level (EU NeighbourSEast, 2024). As for implementation barriers (e.g., a fixed 15–20% budget share for tools, 40–60 training hours per designer, 45% of studios requiring infrastructure upgrades, or "–60% initial investment" owing to phased adoption), no open, reliable sources with these precise figures have been identified. If these were the researchers' empirical results, it should be retained as an author survey/audit with the sample, methodology, and period specified; otherwise, it should be reformulated without percentages (e.g., "notable upfront costs", "substantial training needs", "phased adoption is advisable").

Then studies by Y. Tao *et al.* (2021) and A.G. Periyasamy *et al.* (2022) highlighted several areas, through which digital technologies reshaped contemporary graphic design practice. Research on remote and hybrid collaboration demonstrated that moving approval and review procedures online can significantly reduce the environmental footprint associated with transport. Studies of adjacent domains – such as academic events – showed that virtual formats markedly lower greenhouse-gas emissions due to the elimination of travel, a finding directly applicable to design presentations. S.A. Soomro *et al.* (2021) and J. Nogacki *et al.* (2025) emphasised that branches of design involving material artefacts, digital and virtual prototyping reduced the need for early-stage physical mock-ups. Soft-proofing, 3D visualisation, and digital-fabrication techniques streamline workflows and decreased material waste, as evidenced by sustainability-oriented frameworks and life-cycle assessments of printing processes. Open-source tools, user communities, and low-threshold access models expanded participation in design and supported a more diverse practitioner base. These mechanisms aligned with E. von Hippel's (2005) account of the "democratisation of innovation", which was increasingly visible in graphic-design ecosystems.

Researcher N. Schadewitz (2009) indicated that cross-cultural and distributed design work relied heavily on structured collaboration patterns. Research in design education identified scalable templates for synchronous and asynchronous teamwork that were transferable to professional environments. Haptic interfaces offered emerging opportunities to reintroduce tactility into digital workflows. D. Hajas *et al.* (2020) and H. Seifi *et al.* (2023) showed that mid-air ultrasonic haptics can enhance engagement and interaction quality, while newly developed tools for haptic-pattern design lower barriers to experimentation. Virtual and augmented reality have demonstrated strong potential for immersive communication in advertising and experiential design, yet empirical research on their practical implementation in 2024–2025 remains limited (de Regt *et al.*, 2021). Moreover, there were a

notable scarcity of studies addressing VR/AR adoption within the digital-economy landscape and post-war recovery of the creative industries in Ukraine. Taken together, the literature provided evidence that: 1) remote or hybrid review procedures can reduce environmental impact without impairing communication; 2) soft-proofing and 3D visualisation decrease physical iterations and associated resource use; 3) open and low-threshold digital tools broaden access and diversify participation; 4) cross-cultural teams benefit from codified collaboration patterns; 5) haptic technologies present a promising area for restoring tactility in digital design workflows.

CONCLUSIONS

The findings indicated a clear shift toward cloud collaboration and hybrid 2D/3D workflows as a new operational model for design. It was determined that teams using cloud-based environments were 71% more likely to share work in progress and 72% more likely to involve key stakeholders in structured reviews, which reduced late-stage rework. Case evidence also showed substantial efficiency gains, with design delivery becoming 50% faster after adopting collaborative design platforms. Broader quantitative data reinforced these trends. In 2024, 83% of creative professionals reported using Generative AI, with nearly two thirds achieving about 20%-time savings. The complete adoption of collaborative technologies has been proven to enhance the productivity of knowledge workers by 20–25%, primarily by reducing the time spent searching for information by as much as 35%. In interface design, one platform stood out with an 82.3% usage share, more than 13 million monthly active users, and widespread adoption in 95% of Fortune 500 companies. In e-commerce, interaction with 3D models raised add-to-cart likelihood by 44% and purchases by 27%, while augmented reality increased purchase likelihood by 65%.

Demand for AR/VR devices were also rising, with shipments projected to reach 22.9 million units by 2028. The Ukrainian context demonstrated sector resilience and competitive positioning – it was indicated that 80% of respondents from cultural and creative industries remained in Ukraine during wartime, with 33% transitioning to remote formats. Furthermore, it was investigated that 94% of companies continued operations. Competitive hourly rates (approximately USD 25–49 compared to USD 100–149 in the United States) position Ukrainian studios favourably for international collaboration, complementing sector-support policies at the European level. The perspective for future research is to develop a methodology for quantifying the contribution of artificial intelligence to the automation of graphic design workflows, while preserving creative authorship and quality control. Specifically, this will include creating metrics for measuring AI-assisted productivity gains, establishing frameworks for human-AI collaboration in branding and advertising projects, and formulating practical guidelines for AR/VR technology adoption in resource-constrained environments, particularly in the context of post-conflict recovery of Ukraine's creative industries.

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Інформаційні технології у графічному дизайні: тенденції та перспективи

Анотація. Метою цього дослідження було проаналізувати вплив сучасних інформаційних технологій на практики графічного дизайну та їх ефективність у брендингових і рекламних проєктах. У дослідженні були розглянуті реальні дизайнерські проєкти з таких платформ, як Behance, Dribbble та Figma Blog, а також проєкти з провідних студій Ramotion, UXDA, Nickelfox, що реалізувалися у 2024-2025 роках. Для інтеграції технологій віртуальної та доповненої реальності, хмарного прототипування в робочі процеси графічного дизайну було розроблено систематизовану класифікаційну структуру. Результати показали, що команди, які постійно працюють із хмарними платформами для спільної роботи, на 71 % частіше ділилися робочими матеріалами в межах визначених термінів і на 72 % частіше залучали ключових зацікавлених осіб до структурованих оглядів, що сприяло зменшенню обсягів переробки на пізніх етапах. Докази з кейс-стаді Vanguard показали, що впровадження Figma призвело до збільшення швидкості доставки дизайну на 50 %. Глобальне дослідження Adobe 2024 року виявило, що 83 % творчих професіоналів використовували генеративний штучний інтелект у своїй роботі, при цьому майже дві третини повідомили про економію часу на рівні близько 20 % при виконанні завдань. Дослідження підтвердило, що повна реалізація технологій для спільної роботи може підвищити продуктивність професіоналів на 20-25 %. У додатках для електронної комерції взаємодія з 3D-моделями збільшувала ймовірність покупки на 27 %, тоді як взаємодія з доповненою реальністю підвищувала ймовірність покупки на 65 %. Figma утримувала лідируючі позиції на ринку дизайну інтерфейсів, маючи 82,3 % частки використання, більше ніж 13 мільйонів активних користувачів щомісяця та впровадження в 95 % компаній зі списку Fortune 500. У дослідженні було визначено три основні зразки впровадження: гібридні робочі процеси, що поєднували 2D- та 3D-інструменти, поступова інтеграція AR/VR для презентацій клієнтам і підходи «cloud-first» для спільної роботи. Розроблена структура дозволила дизайнерам вибирати оптимальні комбінації технологій залежно від конкретних вимог проєкту, очікувань клієнтів та наявних ресурсів, що сприяло успішній цифровій трансформації у практиці графічного дизайну. Практичне значення дослідження полягає в наданні рекомендацій для українських дизайнерських студій, спрямованих на підвищення міжнародної конкурентоспроможності та внесок у післявоєнне економічне відновлення через креативні індустрії

Ключові слова: цифрові інструменти; 3D-візуалізація; віртуальна реальність; хмарне прототипування; брендинг; інтерактивні медіа