Enhancing Digital Collaboration Through AI Integration: A Holistic Framework for Sustainable Digital Transformation

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Abstract

The significance of the interplay between digital collaboration and digital transformation is largely recognised. With a rapid adoption of digital tools, but without a systematic framework for doing so, organisations face challenges in utilising diverse technological solutions. This leads to digital fragmentation, tool redundancy and deficient collaboration maturity. Addressing these gaps, the article aims to develop a holistic framework for enhancing digital collaboration while integrating artificial intelligence (AI). The proposed framework includes four phases and 31 factors categorised into four dimensions: business strategy & structure, management & processes, technology, and culture & behaviour. The framework moves beyond diagnostic assessment by guiding the formulation of digital collaboration improvement plans and embedding AI into each phase of digital collaboration improvement management. Although the framework is validated through a case study at an organisation that requested the results to remain confidential, the research design and selected analogous results are presented to demonstrate the flow of the validation and application of the framework. Furthermore, the integration of AI-supported collaboration practices is systematically mapped to specific Sustainable Development Goals (SDGs), offering a structured approach for aligning digital collaboration strategies with broader sustainability objectives. This research contributes a comprehensive tool for assessing and improving digital collaboration maturity while addressing the growing need for sustainable and strategically aligned digital transformation initiatives.

Keywords: artificial intelligence, collaboration maturity, digital collaboration, digital transformation, holistic framework, sustainable

1. Introduction

In recent years, the rapid advancement of digital transformation has changed how organisations collaborate, bringing both opportunities and challenges. Digital transformation is generally understood as the integration of digital technologies into business processes to enhance performance and business operations [1]. This transformation not only reshapes business models, but also alters how collaboration is conducted, particularly in light of new tools and technologies [2, 3].

Scholars largely recognize the pivotal role of digital transformation in collaboration. Historically, collaboration was characterised by teamwork within small, interdependent groups working together towards a shared goal [4]. However, in modern organisations, digital transformation forces a re-evaluation of collaboration practices because traditional methods often fail to adapt to the new, technology-driven landscape [3]. The rapid adoption of digital tools in the workplace has led to a fragmented ecosystem, where different teams often use a variety of tools that may not integrate well. This results in inefficiencies and communication gaps [5], more distant connections, missing trust, and decreased interactions [6]. Without a

structured approach, organisations often struggle to understand and categorise various technological tools at their disposal. The heart of a successful digital collaboration strategy lies in developing a holistic framework that addresses the full range of challenges and opportunities presented by digital tools.

Hence, this article proposes a comprehensive framework for enhancing digital collaboration by harnessing digital transformation to address inefficiencies in collaborative processes. The framework serves to improve internal collaboration through digital means. The specific desired result of the application is the optimised digital collaboration environment that is efficient, effective and well-integrated with the organisation's workflows and culture. This framework is a valuable tool for organisational leaders, IT managers, and collaboration strategists who aim to enhance their company's collaborative practices. To achieve the desired outcome, it is necessary to analyse and evaluate the current collaboration landscape, develop coherent improvement plans, and reflect on the success of implemented improvements to iterate on the process.

AI, in particular, plays a significant role in this process, facilitating new forms of digital collaboration through advanced communication and coordination tools [5], as well as problem-solving and process enhancement [7]. AI is central to this holistic approach, providing the tools and insights needed to manage the complexity of modern collaboration environments [8].

2. Theoretical Background

Digital collaboration tools have been defined as technologies that support collaborative work by improving workflow processes [1]. These tools play a vital role in remote collaboration, offering flexibility and enabling teams to work together in virtual environments [3]. As companies increasingly rely on digital tools for day-to-day collaboration, the importance of understanding different classifications and use cases of these tools becomes even more critical [6].

The first step in building a holistic digital collaboration framework is assessing the existing landscape of digital tools and workflows within an organisation. This involves categorising tools based on their functionality, usage patterns, and contribution to collaboration [2]. Employee initiatives for using certain tools should also be considered [9]. Such initiatives sometimes cannot be supported for financial or confidentiality reasons, but sometimes they remain disregarded despite the widespread usage for job-related tasks.

2.1 Core functionality and workflow approach

Following the core functionality and workflow approach, tools are categorised based on their most important characteristics and functionalities in relation to collaboration. Some tools are designed for synchronous collaboration, where all parties work simultaneously (e.g., videoconferencing, multiplayer virtual reality (VR)), while others facilitate asynchronous collaboration, allowing team members to contribute at their own pace (e.g., email, Google Docs).

AI is employed to streamline both types of collaboration by automating tasks, such as scheduling meetings or summarising asynchronous discussions, and hence reducing the cognitive load on team members [6]. For instance, Microsoft Teams, which supported remote work for companies like Accenture, saw rapid growth from 44 million daily active users to

115 million in just 8 months during the COVID-19 pandemic. Such AI features as meeting transcription and auto-scheduling eased the transition to digital collaboration. Another example is Gemini for Google Workspace, which helps to create structured documents with tables and images, or refine the content.

Table 1 summarises the categorisation of digital collaboration tools based on their core functionality and workflow. In addition, it illustrates how AI is typically integrated into various types of digital collaboration tools, improving the efficiency and effectiveness of both synchronous and asynchronous workflows [8, 10].

Table 1: Categorisation of digital collaboration tools and AI use cases: Core functionality approach

Tool Type	**Core Functionality**	**Workflow**	**AI Integration**
Videoconferencing tools	Communication	Synchronous	AI-powered scheduling, transcription, summarisation
File sharing tools	Document management and collaboration	Asynchronous	AI-enhanced search, version control, recommendation
Project management tools	Task assignment and tracking	Asynchronous/Synchronous	AI-driven task automation, predictive analytics
Social networking tools	Knowledge sharing and engagement	Asynchronous	AI insights for engagement and network expansion
Email tools	Communication	Asynchronous	AI spam filters, auto-reply generation, task prioritisation

2.2 Contribution approach

The contribution approach categorises the tools based on their level of contribution to everyday work. This includes everything from basic information sharing to active content creation. [11] introduces a coordination dimension ranging from: zero and passive coordination, where mechanisms for coordination are available; to active coordination, where the tool autonomously manages coordination; and social coordination, where the tool incentivises social collaboration. At the intersection of two scales – content creation and coordination – six categories of collaboration tools emerged. Table 2 reflects how AI is integrated into these tools to enhance the contribution of team members.

Table 2: Categorisation of digital collaboration tools and AI use cases: Contribution approach

Tool Type	**Core Functionality**	**Coordination**	**Examples**	**AI Integration**
Digital Host	Provides a platform for interaction without direct contribution or coordination	No coordination	Digital whiteboards	Basic AI features for interaction tracking and facilitation
Digital Team Assistant	Passive coordination mechanisms without contributing content	Passive coordination	Doodle, Skill management tools	AI-based scheduling, reminders, skill mapping
Digital Moderator	Facilitates content creation with active coordination mechanisms	Active coordination	Trello, Ovation VR	AI-driven task suggestions and workflow automation, question generation
Digital Mediator	Combines content creation with social coordination incentives	Social coordination	Slack, Microsoft Teams	AI-enabled real-time collaboration analysis and communication enhancement
Digital	Independently creates	No coordination	Chatbots	AI content generation,

Expert	content without coordination with other tools			automated responses, and analytics
Digital Teammate	Combines high-level content creation with strong coordination capabilities	Active and social coordination	Virtual companions (e.g., AI assistants)	Advanced AI for proactive collaboration, predictive insights, and personalised support

[7] present a high-level approach to AI-human interaction. They categorise AI technologies based on whether they operate in a reactive or proactive mode, and whether they help to solve problems or improve current processes. In this way, a two-dimensional matrix is proposed, paving the way for AI to be social agents. Moreover, AI team members are perceived to have higher ability and integrity compared to human teammates [12], thus contributing to greater resilience and sustainability. However, scholars also highlight the negative effects of employing AI for collaboration purposes [7, 12], suggesting the need for caution in adopting AI.

2.3 Digital collaboration suites, systems, platforms

Unlike standalone collaboration tools, enterprise collaboration platforms (ECPs) take a broader, organisational-level approach to digital collaboration. Rather than being a single tool, an ECP is a portfolio of collaboration software that supports company-wide teamwork [8]. Since enterprise collaboration systems, which integrate collaboration features into daily workflows, are often used alongside independent digital tools, the combined ecosystem of these components forms an ECP.

[8] argue that ECPs are not one-size-fits-all solutions that cover every aspect of enterprise collaboration. Instead, building an effective ECP requires selecting and integrating different types of collaboration software to create a tailored digital environment. Their research outlines four key layers of an ECP:

- Tools – the foundation level, consisting of individual collaboration tools;
- Applications – standalone software products with multiple collaboration features;
- Collaboration suites – collections of interconnected applications that are designed to work together, though they can still function independently;
- Enterprise collaboration systems – the top level, offering fully integrated applications within a unified interface.

A significant challenge in implementing ECP is digital fragmentation, where disconnected tools create silos within organisations [8]. AI helps overcome this by integrating tools and streamlining data flow across systems [6]. It provides insights into tool usage and thus helps organisations optimise their collaboration strategies [3]. For instance, for PwC, Google Workspace's AI-powered digital tools suite enhanced global collaboration and reduced project delivery time by 15%. Similarly, IBM's adoption of Slack, integrated with AI, streamlined communication and predicted bottlenecks, thus boosting productivity across its 350k employees [13]. Effective enterprise platforms, therefore, need integrated, AI-enhanced features to support smooth and productive collaboration.

Once the digital tools at an organisation are inventoried, the next step is to visualise the landscape. The ECP overview can be visualised by grouping digital tools according to their

classifications as described in the previous sub-chapter. This allows the identification of how the different tools are assembled to build the company's collaboration landscape.

2.4 Digital collaboration maturity

Collaboration maturity describes how teams progress from basic to advanced, efficient practices, enhancing overall performance [14]. Collaboration maturity models assist in defining and prioritising improvement areas by looking at a snapshot of a company's situation. To develop a digital collaboration maturity assessment for the digital collaboration improvement framework, we combined three maturity models and the fragmented collaboration evaluation criteria to offer a comprehensive maturity approach.

The Collaboration Maturity Model proposed by [14] is a framework designed to evaluate team collaboration quality within organisations. It is structured to be flexible and applicable across different types of collaborative settings. The model aims to provide a holistic assessment of a team's collaboration maturity while offering actionable insights for improving collaborative performance. In the model, collaboration maturity is categorised into ad-hoc, exploring, managing, and optimising, thus representing a progression from initial collaboration challenges to achieving optimal collaboration efficiency.

Similarly, the Collaboration for Innovation Readiness Assessment Model, introduced by [15], focuses on assessing social collaboration and innovation maturity within an organisation. This model helps identify key areas for improvement and guides organisations toward a more collaborative and innovative culture. It evaluates seven key dimensions, including organisational culture, leadership, workspace design, supporting technologies, innovation capacity, knowledge management, and business process integration through collaboration tools.

On the other hand, the Intraorganizational Online Collaboration Maturity Model by [16] is tailored toward enhancing organisations' ability to collaborate effectively across teams and departments using online collaboration tools. It is applicable to a wide range of organisations, offering a structured approach to evaluating and improving online collaboration capabilities. The model is built around four dimensions: strategy and change, processes and structure, technology and infrastructure, and employees and culture.

In addition, various collaboration evaluation criteria are not included in the indicated models. Since maturity models can be customised to fit specific organisational needs, Table 3 provides an overview of additional collaboration assessment criteria.

Table 3: Overview of fragmented collaboration maturity criteria

Category	Criteria	Description	Authors
Organisational collaboration structure and strategy	Goal congruence and organisation-wide collaboration	Alignment of vision across departments and ease of information sharing	[17, 18]
	Coupling of Work & Collaborative Process Automation	Extent of required communication and process automation through digital workspaces	[18, 19]
Collaboration management	Organisational managerial aspects and collaboration at execution	Managerial role in supporting collaboration and recognising collaborative behaviours	[19, 20]
	Facilitating conditions and	Integration of collaboration tools by	[17, 21]

	shared responsibility	managers and joint performance evaluation	
Collaboration technology adaptation	Collaboration technology readiness and use of tools	Alignment of digital tools with workflows and frequency of usage	[19, 22]
	Communication in virtual teams and e-collaboration perception	Importance of digital tools for virtual communication and employee perceptions	[22, 23]
Collaboration effectiveness	Collaboration Readiness & Trust	Willingness to collaborate, share knowledge, and trust in other teams	[17, 19]
	Common ground, social interaction and cross-functional collaboration	Shared knowledge base, informal communication, and effectiveness of cross-departmental collaboration	[17, 19]

These criteria are considered as supplementary for assessing collaboration maturity. Similar criteria are grouped into four categories based as shown in Table 3.

3. Research design and methods

To develop a digital collaboration maturity assessment for the digital collaboration improvement framework, we combined the three identified maturity models [14, 15, 16] and the fragmented collaboration evaluation criteria (Table 3) to offer a comprehensive maturity approach.

To validate the developed framework, a qualitative approach was employed. A qualitative interview is a well-established and methodologically reliable approach for gathering qualitative data [24]. Taking into account the need for specialist knowledge, five expert semi-structured interviews were conducted to collect the qualitative data and validate the framework. Following [25] guidelines, the interviews were examined through Mayring's approach to qualitative content analysis, with iterative categorisation to ensure reliability.

Fig. 1 illustrates the four phases of the empirical research, each progressively building upon the previous step.

Figure 1 here

To identify the digital collaboration inefficiencies and assess the collaboration maturity, a quantitative survey was performed. This data was collected through the employee questionnaire based on the validated framework to obtain a representative understanding of how collaboration maturity was perceived internally. Quantitative data analysis (n=96) included a sampling accuracy test and correlation analysis, thus revealing the interconnections between collaboration dimensions. A Kruskal-Wallis test identified significant regional differences in perceptions of these dimensions. The findings were structured using the CARL framework (Context, Actions, Results, Learnings) for comprehensive analysis and actionable insights [26].

To build a comprehensive collaboration improvement plan, we followed the monitoring benefits change framework [27]. This framework enables the comparison of long-term projects by capturing, analysing, and visualising the evolution of outcomes and benefits over time. Its value lies in addressing the dynamic nature of collaboration tools and practices, which continuously evolve through usage and adaptation. By offering a structured approach to

monitoring these changes, the framework helps organisations refine their collaboration strategies, allowing them to respond effectively to emerging challenges and opportunities.

4. Results

4.1 Exemplary digital collaboration landscape results

The first step in applying the designed digital collaboration improvement framework was to map the digital collaboration tools landscape as shown in Fig. 2. The tools were categorised by their core functionalities, levels of contribution and coordination [11], and tools' affiliations with digital collaboration suites, systems and platforms [8].

Figure 2 here

In this way, the organisation was attributed to a certain digital collaboration configuration, e.g.: concentration, where a core collaboration system or suite is used alongside a limited number of additional tools; diversity, which involves a core system or suite supplemented by a broad range of extra tools; and dual core, where two central systems or suites operate in parallel, each with a few supplementary tools [8]. Each approach presents distinct benefits, allowing organisations to tailor their collaboration setup to their needs and working styles. Due to the aforementioned confidentiality requirements, the established configuration of the studied organisation is not reported in this article.

4.2 Digital collaboration maturity dimensions

To perform the digital collaboration maturity assessment for the digital collaboration improvement framework, we combined the three identified maturity models [14, 15, 16] and the fragmented collaboration evaluation criteria to offer a comprehensive maturity approach which resulted in 103 factors for assessing collaboration maturity, with 73 of which relevant to collaboration and digital tools. After the inductive categorisation and a final check for applicability in the framework, 31 factors, with three of them suggested during the semi-structured interviews, were configured as demonstrated in Fig. 3.

Figure 3 here

The results of the quantitative analysis indicate that the utilised scale is generally reliable and well-constructed as shown in Table 4. The level of internal consistency for the first three dimensions is high, and still acceptable for the fourth dimension. No negative correlation coefficient values were found, and the deletion of items would not increase the total Cronbach's alpha coefficient in any case.

Table 4: Reliability analysis

Variable Dimension	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Business Strategy & Structure	0.832	0.838	7
Management & Processes	0.878	0.882	6
Technology	0.861	0.862	11
Culture & Behavior	0.721	0.724	7

Further, the maturity of digital collaboration factors was measured on a scale ranging from 1 (low maturity) to 4 (high maturity). The general results are presented in Fig. 4. In addition, the

data was also analysed dimension-wise for collaboration maturity scoring, improvement plan implementation and tracking, and benchmarking purposes.

Figure 4 here

The obtained results were integrated into the monitoring benefits change framework as shown in Fig. 5. This analytical framework serves as a tool for strategic planning and tracking the outcomes and benefits of collaboration systems [27].

Figure 5 here

Due to the confidentiality requirement, the results provided in Figs. 4 and 5 serve as examples and do not reflect the truly obtained results. However, the methodology and analysis described can be similarly applied in other organisations to achieve comparable insights in contexts of interest.

The progress of each element's implementation is assessed through subjective evaluations provided by the employees responsible for them. These evaluations are then visualised within the framework using a four-level progress bar. Except capabilities, all elements are categorised into different organisational dimensions, each represented by a distinct color. This classification provides a clear and structured way to track progress across various levels of the organisation while ensuring alignment with its broader goals.

4.3 Managing digital collaboration improvement projects

Once the weaknesses in digital collaboration have been identified, the next step is to formulate a plan for improving digital collaboration. This plan should be tailored to the specific needs of the organisation and based on the insights gained from the previous steps. AI plays a significant role in this process by providing predictive analytics that help organisations forecast the potential impact of different improvement strategies [10]. In this way, AI tools model various scenarios and recommend the most effective approaches for enhancing collaboration. Organisations are then able to prioritise their improvement efforts by identifying the areas that will have the greatest impact on overall productivity and performance. By focusing on these key areas, organisations ensure that their collaboration improvement plan delivers tangible results [2].

4.4 AI for sustainable digital transformation through improved collaboration

The integration of AI into the framework for enhancing digital collaboration brings a number of benefits from the sustainability point of view. In this section, we present these benefits and reveal their relevance to SDGs at each phase of the digital collaboration improvement framework.

AI in inventorying digital collaboration tools

At the phase of inventorying tools for digital collaboration, AI scans and maps all digital collaboration tools in use, thus identifying must-have, duplicate, underutilised, and redundant digital tools. In addition, AI can be leveraged for detecting unauthorised tools used by employees or identifying unused licenses – for example, employees having a Zoom license, but using only MS Teams. AI uses natural language processing (NLP) and network analysis to find hidden software dependencies, such as a small team using a niche tool outside of the primary suite.

Then, switching between varied collaboration tools makes employees waste time and feel more exhausted than otherwise [6, 8], also leading to excess cloud storage and unnecessary digital processing. By identifying meeting frequency and duration, message frequency, cloud storage use, AI provides valuable insights for the comparative analysis of the digital tools in use, thus paving the way for better work-life balance, and enabling cutting cloud storage energy consumption and licensing costs. AI-powered agents, as revealed in the previous sections, also contribute to improved work-life balance by increasing employees' productivity and freeing them from routine tasks.

In addition to categorising the tools based on their usage patterns and types (e.g., synchronous vs. asynchronous), AI analyzes the sustainability footprint of collaboration platforms. For example, while some data centers may run on fossil-fuel energy, others run on renewable-powered cloud providers. AI is also employed for tracking carbon emissions from video conferencing vs. chat/email-based collaboration. Hence, such insights, when properly addressed, contribute to greener alternatives of digital collaboration.

AI in creating the landscape of digital tools in use

The successful inspection of the digital tools in use leads to a data-driven inventory report which includes all collaboration tools, their usage levels, sustainability impact, and recommendations for consolidation. Since businesses often struggle to decide how many digital collaboration platforms they need, AI is useful in predicting how each digital landscape model – single core, dual core, or diverse – affects sustainability and efficiency. AI can also simulate sustainability impacts: for instance, switching to cloud links instead of large file attachments would decrease digital storage footprint by 20%. The recommendations regarding carbon-neutral data centres and the reduced number of active collaboration platforms are also valuable. The right digital tools architecture prevents unnecessary cloud computing loads and improves efficiency [6, 8]. In this way, AI helps organisations ensure that they use the most efficient digital collaboration tools and avoid over-complex collaboration ecosystems that generate unnecessary digital waste.

In addition, AI identifies where manual processes slow down digital collaboration and detects bottlenecks, such as too many approvals in a workflow, causing delays. AI replaces excessive emails with automated workflows, thus minimising communication loops. AI ensures interoperability between collaboration tools: for instance, it connects Asana tasks to Teams. AI's contribution to reducing duplicate emails, redundant meetings, versioning chaos and alike not only leads to lower energy use, but also contributes to decreased digital noise and workload.

AI in assessing digital collaboration maturity

AI contributes in the evaluation of an organization's digital collaboration maturity level by assessing key collaboration key performance indicators, identifying where manual processes slow down digital collaboration, and assigning maturity score across the four dimensions indicated in Fig. 3. Whenever performance-based indicators are not available, reminders to employees to fill in a survey may be sent, and the obtained data is analyzed to provide insights. In many cases, generative AI is used to generate surveys and interview questions, which are then further enhanced by humans.

In interviews or focus group discussions, AI is typically used to summarise the discussions, pinpoint key arguments or inefficiencies that lead to wasteful collaboration practices. In addition, in combination with VR, AI might be used to simulate certain situations to assess

how employees would collaborate in certain fabricated scenarios designed to assess specific collaboration maturity aspects. In addition to assessing intra-organisational digital collaboration maturity, AI compares collaboration maturity against industry benchmarks and evaluates whether the company operates at a sustainable digital efficiency level.

AI is also beneficial for long-term collaboration and sustainability monitoring. While continuously tracking collaboration habits, measuring if employees actually use the provided collaboration tools, flagging areas where efficiency is declining, detecting employees' digital fatigue levels, and analysing carbon footprints, AI helps ensure that businesses not only have the right digital collaboration tools composition, but also use them effectively and sustainably.

AI in managing digital collaboration improvement projects

To ensure compliance with sustainability policies, AI helps monitor and enforce collaboration rules. Next, tracking sustainability metrics and continuously adapting workflows based on changing employee habits leads to sustainable collaboration in the long term, preventing the return of inefficient or unsustainable collaboration habits. By comparing the metrics over time, AI also provides customised insights based on the roles to whom dashboards or insights are addressed. In addition, recommendation systems are often used to make employees' learning journeys towards more sustainable and mature digital collaboration individual, i.e., based on individual preferences and needs rather than, for example, common department-wide trainings.

In Table 5, we summarise AI's contribution to more sustainable digital collaboration and indicate AI use cases' relations to specific SDGs.

Table 5: AI contribution to more sustainable digital collaboration

Collaboration improvement framework phases	**AI use cases**	**Sustainability impacts**	**Relevant SDGs**
Inventorying digital collaboration tools	Identifying all collaboration tools in use	At this stage, AI only provides insights for decision-making, while actual sustainability impact happens later. However, AI saves time and cherishes human effort while performing the extensive analysis and providing insights, thus: Allowing employees to focus on higher-value tasks; Optimizing digital workflows and increasing productivity.	SDG 8, SDG 9
	Identifying redundant and underused tools		
	Identifying key digital collaboration tools		
	Sustainability impact analysis of each tool		
	Detecting shadow tools		
	Identifying niche software		
Mapping the landscape of digital tools	Predicting collaboration model efficiency	Unnecessary cloud computing loads prevention leads to lower energy consumption and greater efficiency	SDG 9, SDG 12
	Digital tools consolidation recommendations	Less digital clutter, fewer redundant files, lower cloud storage energy use	SDG 9, SDG 12
	Automating collaboration workflow improvements	Reduced manual interventions decreased digital noise and workload, lower energy use	SDG 8, SDG 9, SDG 12
	Simulating sustainability impact for varied tools,	Reduces carbon footprint when the optimal alternative is implemented	SDG 7, SDG 12,

	suites, platforms		SDG 13
	Pinpointing underutilized and unnecessary licenses, premium accounts, etc.	Cost reduction, digital waste reduction	SDG 9, SDG 12
	Recommendations regarding carbon-neutral data centers, routing workload	Reduced carbon footprint	SDG 7, SDG 12, SDG 13
Digital collaboration maturity assessment	Collaboration tool usage analysis	Prevented unnecessary energy consumption and software sprawl	SDG 9, SDG 12
	Identifying collaboration inefficiencies	Reduced digital waste	SDG 9, SDG 12
	Benchmarking against the industry's best practices	Evaluation of digital efficiency and sustainability level	SDG 9, SDG 12, SDG 13
	Simulations to assess collaboration maturity in certain scenarios	Proactive decision-making for sustainable collaboration	SDG 9, SDG 12, SDG 13
	Monitoring and enforcing collaboration rules	Compliance with sustainability policies	SDG 8, SDG 12, SDG 13
	Analysis of the energy impact of collaboration habits	Reduced carbon footprint	SDG 7, SDG 12, SDG 13
Managing digital collaboration improvement projects	Sustainability metrics in real-time	Continuous tracking and measurement of sustainability in digital collaboration	SDG 9, SDG 12
	Dynamic collaboration optimisation	Maintained efficiency and sustainability, increased resilience to internal and external changes	SDG 8, SDG 9, SDG 12, SDG 13
	Sustainable digital governance	Ensures ongoing responsible digital consumption	SDG 12, SDG 13

Leveraging AI for more sustainable and effective digital collaboration is purposeful. However, it is always important to not blindly rely on the technology, but analyse numerous risks associated with AI usage and ensure it is trustworthy – robust, responsible, and explainable.

5. Conclusion

The article contributes to the academic literature by integrating theories of digital transformation and practical business needs into a unified framework. By aligning digital tools with collaborative processes, the article addresses a critical gap in the scholarly literature concerning the application of digital transformation in real-world business settings. The findings offer a significant refinement of existing models of digital collaboration, emphasizing the dynamic interplay between technological innovation and organisational behaviour.

The designed framework integrates the dimensions of strategy and structure, technology, culture and behaviour, and management and processes. The framework was validated, providing practical insights and tangible improvements in digital collaboration practices leading to greater sustainability. The application of the framework demonstrated its relevance and adaptability to real-world corporate challenges. In addition, its scalable approach allows for adaptations in varied business settings.

AI further supports the effectiveness and sustainability of digital collaboration by using network analysis, recommendation systems, simulations, machine and deep learning techniques, as well as generative features to optimise strategies, reduce tool redundancies and digital clutter, lower carbon footprint, track sustainability metrics, ensure compliance to sustainability policies and automate tasks, decreasing workload and digital fatigue, and increasing digital collaboration sustainability and effectiveness. In the article, we also present a solid number of AI use cases to enhance digital collaboration, which serve as a roadmap towards sustainable AI integration into digital collaboration management and practices.

To achieve successful and sustainable collaboration, companies must ensure that their strategy, structure, and culture are harmoniously aligned. The ever-evolving nature of collaboration requires organisations to be designed for widespread collaboration, rather than relying on traditional, static models. This dynamic interaction requires flexibility and an understanding of both technical and social components of collaboration. AI plays a crucial role in enabling this dynamic approach to collaboration and helps us bridge the gap between social and technical aspects of digital collaboration by facilitating communication, automating repetitive tasks, or acting as a professional coach.

6. Limitations

This study, while comprehensive in its approach and valuable in its scientific and practical contributions, is subject to several limitations. Scholars largely agree on the fact that the digital collaboration configuration should be limited to one or two cores with several additional digital tools, and the proposed framework follows this approach. However, we assume that in certain contexts, for example, small companies, using scarce digital tools might be more financially and sustainably beneficial than creating a digital platform or suite. This peculiarity is not addressed in the article and presents an intriguing opportunity for further research.

Another limitation is related to the proposed ways of AI integration into the digital collaboration improvement framework. The proposed use cases remain largely theoretical, while the actual data suggest that, more often than not, organisations do not reduce unintended bias, do not track data provenance, do not monitor AI across cloud, do not track performance variations or sustainability metrics [28, 29]. Hence, we invite further comparative research of outcomes to digital sustainable collaboration when specific AI use cases, as well as their suites, are in place and out of place.

Lastly, but probably most importantly, the analysis of AI implementation-related risks is out of the scope of this article. In the article, we focus on opportunities presented by the integration of AI to enhance digital collaboration for greater sustainability and effectiveness, but we do not analyse the related risks in detail, even though we acknowledge the significance of such research and call for science to further contribute to this aspect.

Conflict of Interest

None of the authors has a conflict of interest to disclose.

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Declaration of generative AI in scientific writing

During the preparation of this work, the author(s) used R Discovery in order to search the topic-relevant literature, Grammarly in order to improve the readability of the article, and ChatGPT 4o in order to write the captions of the figures. After using this tool/service, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the published article.

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Enhancing Digital Collaboration Through AI Integration: A Holistic Framework for Sustainable Digital Transformation

Captions

Figure 1. Research design

This diagram illustrates the step-by-step process used to validate, refine, apply, and evaluate the proposed framework. It includes systematic testing through expert interviews, qualitative content analysis using Mayring's inductive categorisation, and iterative refinement based on interview feedback. The framework is applied in a case study using questionnaires from 96 respondents, followed by quantitative data analysis including sampling accuracy, correlation, and the Kruskal-Wallis test.

Figure 2. Mapping the digital collaboration landscape

This figure maps digital roles (e.g., Digital Expert, Digital Moderator, Digital Mediator) across two axes: Content orientation (own, content-related, organisational) and Coordination (none, passive, active, social). It illustrates how different functionalities (A–E) are distributed within digital collaboration suites (Suite A and Suite B) and how these roles interact within the core enterprise collaboration platform. The legend identifies each functionality by shape and role-specific allocation.

Figure 3. Collaboration maturity dimensions with maturity factors

This conceptual framework outlines the key dimensions impacting digital collaboration maturity: Technology, Management & Processes, Culture & Behaviour, and Business Strategy & Structure. Each dimension includes subcomponents, e.g., user experience, leadership support, collaboration trust, alignment with corporate strategy. AI integration and tool-related aspects (e.g., cybersecurity, tool readiness) are also addressed, highlighting their role in supporting or enhancing collaboration maturity across organisations.

Figure 4. Overall digital collaboration maturity level results

The stacked bar chart visualises the distribution of maturity levels (ML1 to ML4) across five key digital collaboration dimensions: Business Strategy & Structure, Management & Processes, Technology, Culture & Behaviour, and Overall.

Figure 5. Monitoring benefits change framework [27]

This diagram presents a structured logic model that connects drivers to strategic objectives through a series of elements: outputs, capabilities, outcomes, and benefits. Each element is categorised (e.g., technical/functional, cultural/organisational, strategic) and colour-coded accordingly. The framework also includes a progress indicator showing levels from "not achieved" to "high success." It helps assess how well specific drivers lead to measurable and strategic outcomes via organisational capabilities and benefits.