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The Study of Digital Transformation and Its Influence on Contemporary Research

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Abstract : *Research is being reshaped by digital systems that change how knowledge is searched, produced, tested and shared. Digital transformation goes beyond using computers or moving documents online. It involves new ways of organising research work, connecting institutions and making evidence available for reuse. This study examines how these changes influence contemporary research across disciplines, with particular attention to digital literature discovery, data-intensive methods, collaborative platforms, artificial intelligence and open science. An integrative, source-based review is used to compare established scholarship with recent evidence published up to 2026. The discussion finds that digital tools can widen access to knowledge, help researchers manage complex material and improve the traceability of research activity. Yet faster work does not automatically mean better work. Unequal infrastructure, opaque automated outputs, weak data management and pressure to publish can reduce the quality of the research process. Two original diagrams explain the digitally supported research cycle and the difference between isolated digitisation and deeper transformation. The central argument is that digital transformation benefits research when technological capacity is matched with careful methods, skilled judgement, transparent reporting and institutional responsibility. The paper concludes with practical recommendations for researchers, universities and research managers.*

Keywords: digital transformation; contemporary research; open science; artificial intelligence; research methods; research integrity; digital collaboration

I. INTRODUCTION

A researcher today can review work from several countries, meet collaborators online, analyse large datasets and share a preprint without leaving an office. A similar project two decades ago might have required physical visits, postal correspondence and a longer route from data collection to publication. The difference is not simply speed. The basic conditions under which research is organised have changed.

Digital technology now affects almost every stage of inquiry. Search platforms influence which studies are noticed. Repositories determine how datasets can be discovered. Software expands the questions that can be addressed. Online networks bring together people who may never work in the same place. These benefits make digital transformation a research issue, not only an administrative or technical one.

The term needs care. Scanning a questionnaire is digitisation. Using an online form to distribute it is digitalisation of a task. Redesigning the whole study around secure collection, documented data, collaborative analysis and reusable outputs represents a deeper transformation. Vial (2019) and Verhoef et al. (2021) make a comparable distinction in their wider discussions of organisational change.

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Digital progress also introduces new choices. A search algorithm can increase the number of papers discovered while hiding less visible scholarship. An automated summary can simplify a difficult text while losing an important qualification. Researchers therefore have to ask whether a new tool changes the quality of a decision or merely its speed.

1.1 Purpose and scope of the study

The study has three objectives: to examine major changes in the contemporary research process; to assess the opportunities and limitations of digital tools in different research activities; and to identify practices that allow institutions to gain useful digital capacity without weakening research ethics. It considers the natural sciences, social sciences and humanities where relevant. It does not assume that all disciplines require the same degree of automation.

II. BACKGROUND AND RELEVANT LITERATURE

2.1 Digital transformation as an institutional change

Digital transformation has an organisational side. Staff need time to learn new methods. Data require secure storage. Research offices must provide support beyond purchasing subscriptions. Castro Benavides et al. (2020) describe how the transformation of higher education extends across technology, people and processes. An isolated software purchase may make one task easier without improving the full research system.

2.2 The movement towards open and connected science

Research depends on the opportunity to question and reuse earlier work. Digital repositories, persistent identifiers and open-access platforms can make that opportunity wider. The FAIR principles emphasise that data should be findable, accessible, interoperable and reusable (Wilkinson et al., 2016). They do not require every dataset to be public; reuse must remain compatible with ethical and legal limits.

UNESCO (2021) places accessibility, transparency, participation and equity at the centre of open science. Paic (2021) similarly identifies reliable infrastructure, skills, stewardship and cooperation as conditions for meaningful sharing. These contributions move the discussion from having digital files to maintaining research resources that other people can understand and assess.

2.3 AI and the changing division of research work

AI can find patterns in complex datasets, assist with coding, suggest search terms and make scientific material easier to navigate. Wang et al. (2023) describe applications spanning hypothesis formation, experimentation and interpretation. Such capabilities are useful when human attention is limited. However, an algorithm may detect an association without explaining the process that produced it.

Messeri and Crockett (2024) warn that scientific tools can create an illusion of understanding when fluent output is mistaken for sound explanation. In research, this risk is especially serious because a persuasive result may be repeated in subsequent work. Strong digital research therefore needs transparent assumptions, validation and the ability to challenge automated suggestions.

2.4 Collaboration and the role of research culture

Digital communication has changed the scale of collaboration. Shared documents, repositories and online meetings allow teams to divide tasks and keep a visible record of decisions. Yet collaboration also depends on authorship rules, trust, access to the same resources and agreement on data ownership. Technology can connect a team, but it cannot settle these questions by itself. Reproducible research practices, such as documented methods and clear reporting, remain essential (Munafò et al., 2017).

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III. RESEARCH METHODOLOGY

3.1 Research design

This study uses an integrative narrative review. Its purpose is to join findings from digital transformation, research practice, open science and AI governance, rather than to calculate a pooled effect size. The discussion is analytical and descriptive.

3.2 Selection and interpretation of material

Relevant academic articles and reports were examined through targeted searches for combinations of digital transformation, scholarly research, open science, research workflows, generative AI, collaboration, reproducibility and governance. Preference was given to identifiable journal publications, peer-reviewed reviews and materials from recognised bodies such as UNESCO, OECD and NIST. Established sources were included to explain long-standing concepts, while publications from 2023–2026 helped address more recent changes.

The selected material was read in relation to four questions: Which research activity is affected? What benefit is supported or proposed? What new problem may arise? What responsibility remains with researchers or institutions? Statements about published investigations are attributed to those investigations.

Table 1. Evidence sources and how they are used in this review

Evidence type	Use in the paper	Interpretive limit
Peer-reviewed research	Examine research workflows, AI use and university digital change	Results depend on the original study context
International guidance	Clarify open science, integrity and capacity-building principles	Guidance is not a measured impact estimate
Digital infrastructure literature	Explain identifiers, repositories and reusable data practices	Adoption does not guarantee good practice

The review seeks an understandable account of how change happens. It reports connections between existing findings but does not treat those connections as causal proof. This distinction is important when considering broad claims about productivity and innovation.

IV. DIGITAL TRANSFORMATION ACROSS RESEARCH ACTIVITIES

4.1 Identifying questions and reviewing literature

Literature discovery is an obvious point of change. Search engines, citation networks and open metadata services help scholars move beyond one catalogue. Priem et al. (2022), for example, present OpenAlex as an openly available index of scholarly metadata. Such resources can support the mapping of authors, topics and institutions. They may also make unfamiliar research fields easier to enter.

Search convenience has a limit. A platform can rank material according to its coverage and technical rules, not only its scientific importance. Highly cited studies are easier to find, while regional work and research in less widely indexed languages can remain less visible. A careful review therefore combines several search routes, documents its search terms and checks the actual text rather than relying on a headline or summary.

4.2 Research design and ethical planning

Digital planning tools can improve the organisation of a project. Teams can record protocol changes, share instruments and arrange independent review before collecting data. Online surveys and remote interviews may reduce travel and extend geographic coverage. However, convenience does not remove questions about sampling, consent, accessibility or the suitability of an instrument. A large online sample can still be a biased sample.

The practical lesson is to select the method first and the tool second. If a study needs observation of local behaviour, a digital questionnaire may be inadequate. If participants have limited internet access, an online-only approach may

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exclude the very group being studied. Good design asks who can participate, what will be measured and how responses will be protected.

4.3 Data collection and stewardship

Digital instruments can capture measurements, survey responses and research logs with fewer manual transfers. Secure cloud storage can also support collaborative work. These gains depend on accurate metadata, agreed file formats, backups and access rules. Wilkinson et al. (2016) show why the ability to locate and reuse information is a property that must be planned, not assumed. Sensitive data need additional safeguards before any sharing or automated processing.

4.4 Analysis, interpretation and verification

Software makes it possible to examine data that would be difficult to handle by hand. Statistical packages, code notebooks and visualisation tools can preserve analytical steps and reduce repeated manual work. AI-based approaches widen the range of classification and prediction tasks. Wang et al. (2023) describe the scientific value of these methods across fields. Yet results are only as dependable as the data, assumptions and validation procedures behind them.

A model that performs well on familiar data may fail when conditions change. Researchers should document exclusions, missing values, model choices and sensitivity checks. For qualitative work, digital coding can make a record easier to review, but interpretation still requires attention to context and meaning. Numbers and themes do not explain themselves.

4.5 Teamwork and cross-disciplinary exchange

Shared repositories, virtual seminars and online project spaces support faster exchange of materials. A laboratory team can work with a social scientist on the human consequences of its results. A regional researcher may join an international analysis without relocating. But participation is uneven. Access to paid databases, high-performance computing, reliable networks and technical support shapes who can contribute on equal terms.

4.6 Writing, review and communication

Digital publishing can shorten communication time and make research outputs easier to retrieve. Preprints allow early discussion, while data and code repositories can support closer examination of published claims. AI-assisted editing may improve clarity, especially for writers working outside their first language. However, a polished paragraph is not a verified argument. Researchers must check references, numerical values, quotations and any automated interpretation.

Table 2. Research-stage benefits and the checks that should accompany them

Stage	Potential benefit	Necessary check
Literature review	Faster discovery and mapping	Verify source identity and full text
Data collection	More consistent digital records	Consent, coverage and security
Data analysis	Repeatable calculations and coding	Assumptions, diagnostics and replication
Writing and sharing	Wider access and clearer communication	Disclosure, provenance and source checking

V. THE DIGITALLY SUPPORTED RESEARCH CYCLE

Figure 1 brings together the main stages discussed in the previous section. It is an original explanatory diagram, not a validated predictive model. It shows that digital transformation changes the links between stages as much as the stages themselves. An issue found during analysis may require a change in the design. A question raised during publication review may lead researchers back to the source material.

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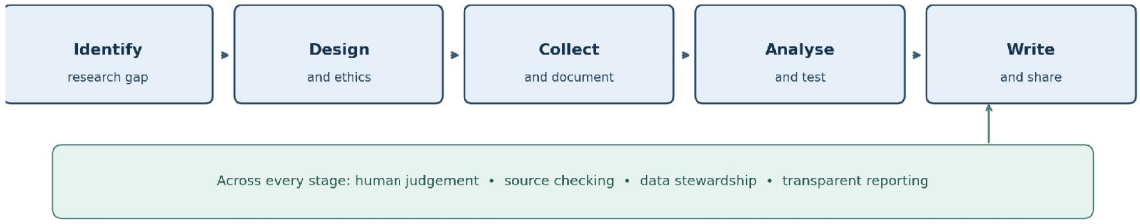


Figure 1. Digitally supported research cycle with continuous human verification (author-created illustration)

5.1 Why the cycle remains human-centred

The diagram places human judgement beneath the complete process rather than at the end. This is intentional. Researchers decide whether an answer is relevant, whether data were collected fairly and whether an interpretation can be defended. Technologies can support each decision, but responsibility cannot be transferred to the software. The same principle applies when tools are used for generating research questions or drafting explanatory text (van Dis et al., 2023; Miao & Holmes, 2023).

5.2 From isolated tools to connected practice

A common weakness of digital projects is fragmentation. A researcher may use one platform for recruitment, another for data storage and a third for analysis, without shared documentation. This creates extra work and makes errors harder to trace. A connected process needs naming conventions, version histories, permission settings and a record of who made important decisions. These habits are modest, but their effect on traceability can be significant.

VI. DEPTH OF DIGITAL TRANSFORMATION IN RESEARCH

An institution does not become digitally mature merely because its staff use many applications. Figure 2 distinguishes four practical stages. The stages are analytical categories developed for this paper, not scores assigned to universities. They help separate the introduction of a tool from a durable change in research practice.

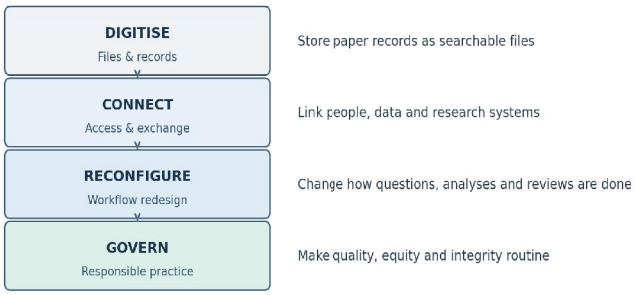


Figure 2. Four levels of change in digital research practice (author-created illustration)

6.1 Digitising and connecting

At an initial level, records are stored electronically. This preserves access but may leave the old process unchanged. A second level connects documents, people and systems so information can pass reliably between activities. These improvements can remove repeated entry and help teams maintain one dependable record. Their value is limited when no one is responsible for updating information.

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6.2 Reconfiguring research work

The more important shift occurs when researchers change how studies are designed and checked. A transparent workflow may be written so that others can reproduce an analysis. A collaboration may invite outside expertise early rather than at publication. More data can be collected, but stronger review points may also be needed. Technology is most useful when it changes a weak process into a better one.

6.3 Governing quality and access

Digital maturity also involves fair access, staff training and rules for privacy and authorship. A tool that helps one department but excludes another creates uneven capability. Fernández et al. (2023) found that many digital initiatives in their university sample were isolated from an overall strategy. Their study concerns institutions, not research quality directly, but it illustrates why coordinated planning matters.

VII. INTERPRETING THE PUBLISHED EVIDENCE

7.1 One institutional evidence snapshot

A multivocal review by Fernández et al. (2023) examined 184 digital transformation initiatives from 39 universities. In that source, advanced analytics accounted for 23% of the initiatives, cloud technology 20% and AI 16%. Figure 3 reproduces only these three reported percentages in a new chart. The values describe the review's selected university initiatives; they are not estimates for all universities and should not be interpreted as the adoption rates of individual researchers.

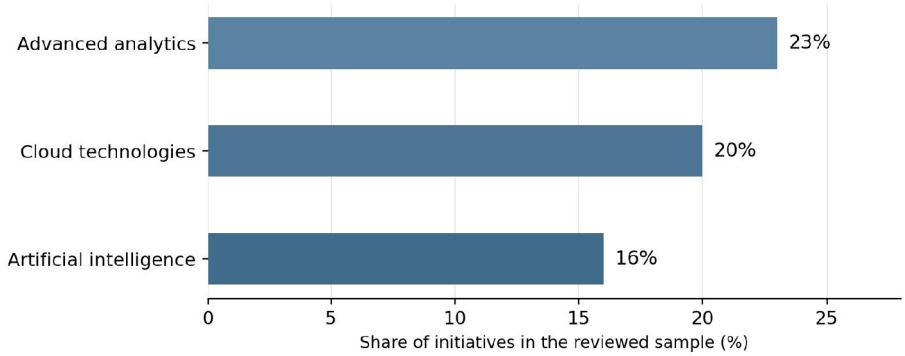


Figure 3. Technologies reported among 184 university digital initiatives; published percentages from Fernández et al. (2023)

The same study reported that only about one quarter of the universities had a digital strategy and 56% had launched initiatives not integrated into a plan. It examined a sample of universities before the COVID-19 pandemic, so its results should not be read as a current global census. The more useful message is the distinction between acquiring technology and integrating it into institutional practice.

7.2 What more recent AI studies add

Andersen et al. (2025) surveyed 2,534 researchers in Denmark about 32 generative-AI use cases. Respondents were generally more comfortable with language-related assistance than with some higher-stakes research activities. Their views differed by discipline and career stage. The study shows that acceptance of AI cannot be reduced to a single percentage. The task being delegated matters.

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7.3 Productivity is not the whole outcome

Hao et al. (2026) examined 41.3 million scientific papers and reported an important tension: AI-related work was associated with advantages for individual scientists, yet the collective focus of science became more concentrated in data-rich areas. This large-scale result does not prove that every field will follow the same path. It does, however, question the idea that more output automatically gives society a wider range of discoveries.

Messeri and Crockett (2024) approach a related problem from the standpoint of understanding. An apparently precise model can conceal missing context or difficult assumptions. The two studies suggest that research systems should reward meaningful explanation and independent scrutiny, not only speed, output volume or technical novelty.

VIII. RESEARCH RISKS AND RESPONSIBLE PRACTICE

Table 3. Common risks and possible controls in digitally transformed research

Risk	How it affects research	Practical control
Data privacy	Sensitive participant or institutional information can be exposed	Consent; access restrictions; minimisation
Invented AI output	Unverified sources and claims may enter a manuscript	Check originals; keep an audit trail
Method opacity	Others cannot trace a result or repeat the analysis	Document data, code and decisions
Unequal access	Some researchers lack tools, bandwidth or training	Shared infrastructure and skills support
Automated bias	Patterns can reflect incomplete or skewed data	Independent testing; subgroup review

Research integrity needs visible responsibility. COPE (2023) states that AI tools cannot be credited as authors and that their use in research manuscripts should be disclosed. The NIST AI Risk Management Framework (2023) offers a broader approach to identifying and managing risks. Neither source removes the need to follow a particular institution's ethics requirements.

IX. IMPLICATIONS, LIMITATIONS AND FUTURE DIRECTIONS

9.1 Implications for researchers

The strongest immediate action is to build verification into ordinary work. Researchers can preserve search strategies, document the origin of a dataset, maintain version histories and review outputs before making claims. AI can assist with language or exploration, but primary sources and data checks remain indispensable. Teams should agree in advance on secure storage, disclosure and authorship responsibility.

9.2 Implications for universities and research managers

Institutions should treat digital literacy and research integrity as connected needs. Investment is required in repositories, technical assistance, accessible software and specialist training. Support must extend beyond well-funded laboratories. Policies should explain acceptable AI uses in different research tasks rather than simply banning or encouraging all tools. UNESCO (2021) and Miao and Holmes (2023) provide useful direction for human-centred and equitable practice.

9.3 Limitations and further research

This is a selective integrative review, not a meta-analysis or a field investigation. Its sources differ in their methods, countries and research disciplines. The published figures belong to the studies that reported them and have not been reanalysed. Future research can compare research teams before and after workflow redesign, assess the effect of digital

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infrastructure on small institutions, examine participation in regional languages and test whether AI assistance improves the accuracy of final research reports.

X. CONCLUSION

Digital transformation is changing contemporary research at both the practical and institutional levels. Discovery is faster, data can be managed on a larger scale and collaboration is less limited by distance. Yet research quality still depends on credible evidence, sound methods and responsible interpretation. The present review finds no reason to treat digital tools as substitutes for those foundations. Their real value appears when they help researchers ask clearer questions, preserve trustworthy records, challenge results and share knowledge more fairly. The future of research is therefore not a choice between human scholarship and technology. It is the careful design of research practices in which both are used for the right purposes.

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