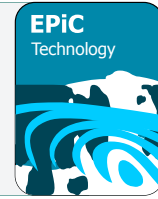




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Beyond Metrics: Ethics-by-Design in Research Information Systems

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Abstract

Current Research Information Systems (CRIS) have become key infrastructures in universities and research organisations, increasingly shaping research evaluation, strategic decision-making, and resource allocation. Despite their growing influence, research has largely focused on technical and organisational aspects such as interoperability and data quality, while ethical considerations remain underexplored. This paper conceptualises CRIS as value-laden socio-technical systems that embed normative assumptions through data models, metrics, and governance mechanisms. Drawing on information ethics and ethics-by-design, it introduces the eFIS (Ethical Research Information Systems) framework to integrate ethical principles into CRIS design and use. The study is based on a qualitative case study of the HISinOne-RES implementation at the FernUniversität in Hagen (FeU), combining document analysis, system analysis, and semi-structured interviews. The findings reveal key ethical challenges, including metric bias, lack of transparency, accountability gaps, and data protection issues. In response, the eFIS framework proposes five core dimensions—transparency, fairness, data protection, accountability, and participation—and operationalises them through practical tools such as checklists, templates, and impact assessments. The paper contributes by positioning CRIS as ethical infrastructures and offering actionable guidance for their responsible implementation.

1 Introduction

Current Research Information Systems (CRIS) have become integral components of the digital infrastructure of universities and research organisations. They aggregate and manage data on researchers, publications, projects, and funding, and are increasingly used to support reporting, evaluation, and strategic planning. In this role, CRIS extend far beyond administrative support: they

shape how research activities are documented, assessed, and ultimately valued within institutional contexts.

Despite their growing relevance, discussions on CRIS have largely been dominated by technical and organisational concerns, such as interoperability, data integration, and compliance with standards like CERIF. While these aspects are essential, they provide only a partial perspective. In particular, the ethical implications of CRIS remain insufficiently explored, even though these systems process sensitive personal data and embed metric-based evaluation logics that may influence academic careers and institutional priorities. Recent research has begun to highlight ethical challenges in research information management and CRIS governance, particularly with regard to transparency, data use, and institutional responsibility (Schöpfel et al., 2020; Schöpfel et al., 2022; Schöpfel & Azeroual, 2023).

This gap is of particular concern. As emphasised in debates on responsible metrics (Hicks et al., 2015; Wilsdon, 2017), the use of quantitative indicators in research evaluation can introduce bias, oversimplify complex scholarly practices, and create unintended behavioural incentives. When such indicators are operationalised within CRIS without sufficient contextualisation or transparency, these risks are likely to be amplified. In addition, CRIS integrate heterogeneous data sources and classification systems that are not always visible or controllable by institutions, raising concerns related to data governance, accountability, and fairness.

From the perspective of information ethics, CRIS should therefore not be regarded as neutral data infrastructures. Rather, they can be understood as socio-technical systems that embed normative assumptions in their design and use (Moor, 1985; Floridi & Taddeo, 2016). Decisions about what data to include, how to structure them, and how to generate indicators are inherently value-laden and have implications for how research is perceived and evaluated.

Building on this perspective, the paper adopts an ethics-by-design approach, which emphasises the proactive integration of ethical principles into system design and governance (Dignum et al., 2018; Stahl et al., 2016). Instead of addressing ethical issues only after systems are implemented, ethics-by-design aims to embed considerations such as transparency, fairness, accountability, and participation throughout the CRIS lifecycle.

The paper introduces the eFIS (Ethical Research Information Systems) framework as a structured approach to operationalising these principles in CRIS environments. Drawing on a qualitative case study of the HISinOne-RES implementation at the FernUniversität in Hagen (FeU), the study identifies key ethical challenges and develops practical instruments to address them.

The paper is guided by the following research questions:

- What ethical challenges arise in the design and use of CRIS?
- How can an ethics-by-design approach be operationalised in CRIS environments?
- How can ethical principles be translated into concrete tools and governance mechanisms?

The remainder of the paper is structured as follows. Section 2 outlines the theoretical foundations. Section 3 analyses ethical challenges in CRIS. Section 4 describes the research design. Section 5 presents the eFIS framework. Section 6 discusses implications and limitations, and Section 7 concludes.

2 Theoretical Background

2.1 CRIS as Socio-Technical Systems

CRIS can be understood as socio-technical systems that integrate technological infrastructures with organisational processes and institutional logics. They not only store and manage research-related data but also structure how research activities are represented, evaluated, and governed. As such, CRIS are not neutral tools but actively shape perceptions of research performance through their data models, classifications, and embedded metrics.

This perspective highlights that design decisions in CRIS—such as which indicators are used, how data are categorized, and how outputs are visualized—carry implicit assumptions about what constitutes valuable research. Consequently, CRIS influence academic behaviour and institutional priorities.

2.2 Information Ethics and Value-Laden Systems

Foundational work in computer and information ethics argues that information systems inherently embody normative assumptions (Moor, 1985; Floridi, 2013). Technologies shape and constrain human action by embedding values into their architectures and decision-making processes. In this sense, CRIS can be seen as value-laden systems that reflect specific understandings of performance, quality, and accountability.

From this perspective, ethical concerns in CRIS are not external issues but are embedded within system design itself. Questions of fairness, transparency, and responsibility arise directly from how data are selected, processed, and used for evaluation purposes.

2.3 Ethics-By-Design

The concept of ethics-by-design proposes that ethical considerations should be integrated into the design and development of information systems from the outset, rather than addressed retrospectively (Stahl et al., 2016; Dignum et al., 2018; Schöpfel et al., 2025). This approach emphasises the proactive incorporation of ethical principles such as transparency, fairness, accountability, and participation into system architectures and governance structures.

In the context of CRIS, ethics-by-design implies that ethical reflection must be embedded in decisions about data collection, metric selection, system functionality, and user access. It also requires the involvement of multiple stakeholders, including system developers, administrators, researchers, and data protection officers.

2.4 Responsible Metrics and Research Evaluation

The increasing reliance on quantitative indicators in research evaluation has led to critical debates about the responsible use of metrics. The Leiden Manifesto (Hicks et al., 2015) and subsequent work on responsible metrics (Wilsdon, 2017) emphasise that metrics should support, not replace, expert judgment and must be applied in context.

CRIS play a central role in operationalising these metrics, as they provide the data infrastructures through which indicators are generated and disseminated. However, when metrics are embedded uncritically into CRIS, they can reinforce biases, oversimplify complex research activities, and incentivise strategic behaviour. This highlights the need to align CRIS design with principles of responsible and context-sensitive evaluation.

3 Ethical Challenges in CRIS

The increasing centrality of CRIS in research governance introduces a range of ethical challenges that arise from their role as data-intensive and evaluation-oriented systems. These challenges are not isolated issues but emerge across the entire lifecycle of CRIS, from data acquisition and modelling to analysis, reporting, and reuse.

3.1 Metric Bias and Misrepresentation

A primary ethical concern relates to the use of performance metrics embedded in CRIS. Quantitative indicators such as publication counts, citation metrics, or funding volumes are often used as proxies for research quality. While these metrics enable comparability and standardization, they can oversimplify complex research activities and fail to capture disciplinary differences.

As highlighted by the principles of responsible metrics (Hicks et al., 2015; Wilsdon, 2017), the uncritical use of indicators may lead to biased evaluations and unintended incentives. For example, researchers may prioritize quantity over quality or focus on easily measurable outputs. When such metrics are embedded in CRIS without contextual interpretation, they risk reinforcing structural inequalities and misrepresenting research performance.

3.2 Data Integration and Lack of Transparency

CRIS typically integrate data from multiple internal and external sources, including bibliometric databases, funding systems, and institutional repositories. These sources often rely on different classification schemes, quality standards, and update mechanisms.

As a result, inconsistencies, gaps, or inaccuracies may be introduced into the system. Moreover, the origin and transformation of data are not always transparent to users, making it difficult to assess data reliability. This lack of transparency raises concerns about accountability, particularly when CRIS data are used for decision-making processes with significant consequences. These challenges are closely related to issues of explainability in data-driven systems, where understanding how outputs are generated is essential for trust and accountability (Ribeiro et al., 2016).

3.3 Data Protection and Privacy

CRIS store and process extensive personal data about researchers, including career trajectories, affiliations, performance indicators, and collaboration networks. This concentration of sensitive data creates significant ethical and legal challenges, particularly in light of regulatory frameworks such as the GDPR.

Key issues include informed consent, purpose limitation, data minimization, and the right to access and correct personal data. Beyond legal compliance, there is an ethical obligation to ensure that individuals understand how their data are used and how it may affect their evaluation and career development.

3.4 Accountability and Governance

Another critical challenge concerns accountability in CRIS-based decision-making. As evaluation processes become increasingly data-driven, it is often unclear who is responsible for the outcomes derived from CRIS data. Responsibility may be distributed across system developers, data providers, administrators, and decision-makers.

This diffusion of responsibility can lead to accountability gaps, especially when decisions are justified based on system-generated indicators. Ensuring clear governance structures, defined responsibilities, and traceable decision processes is therefore essential for ethical CRIS use.

3.5 Ethical Implications of System Design

Finally, ethical challenges are embedded in the design of CRIS themselves. Choices regarding data models, classification systems, and system functionalities reflect implicit assumptions about research and evaluation. These design decisions shape what is visible, measurable, and valued within the system.

Consequently, CRIS design is inherently normative. Without explicit ethical reflection, systems may unintentionally privilege certain research practices, disciplines, or career paths. Addressing these issues requires a shift from viewing CRIS as neutral infrastructures to recognising them as systems that actively shape academic realities. These challenges are further intensified by the increasing integration of artificial intelligence into CRIS, particularly in automated evaluation, recommendation systems, and decision-support functionalities. While such developments can enhance efficiency, they also introduce additional ethical risks related to bias, opacity, and accountability, reinforcing the need for robust ethical governance frameworks (Azeroual et al., 2024).

4 Methodology

4.1 Research Design

This study adopts a qualitative case study approach to explore the ethical dimensions of CRIS in a real-world institutional context. Given the exploratory nature of the research questions and the focus on understanding socio-technical and normative aspects, a qualitative design is appropriate for capturing complex interactions between system design, organisational practices, and ethical considerations.

The study is embedded in the eFIS (Ethical Research Information Systems) project, which aims to develop an ethics-by-design framework for CRIS. The case study approach enables an in-depth analysis of how ethical challenges emerge and are addressed during the implementation and use of a CRIS.

4.2 Case Context

The empirical setting of the study is the FernUniversität in Hagen (FeU), Germany, where the research information system HISinOne-RES is being implemented as part of a broader institutional transformation. The system is designed to integrate research-related data across faculties and administrative units, supporting reporting, evaluation, and strategic decision-making.

This context is particularly suitable for the study, as the implementation process involves multiple stakeholders and requires the integration of diverse data sources, governance structures, and regulatory requirements. It therefore provides a rich environment for analysing ethical challenges and design decisions in CRIS.

4.3 Data Collection

Data is collected from multiple sources to capture different perspectives on CRIS implementation and use:

- Document analysis, including project documentation, system specifications, policy documents, and data governance guidelines
- System analysis, focusing on the architecture, data models, and functionalities of HISinOne-RES
- Semi-structured interviews with key stakeholders, including:
 - research administrators
 - IT staff and system developers
 - data protection officers
 - ethics representatives
 - members of academic leadership

This multi-perspective approach allows for a comprehensive understanding of both technical and organisational aspects, as well as the identification of implicit normative assumptions.

4.4 Data Analysis

The collected data is analysed using a thematic coding approach. The analysis combines deductive and inductive elements. Deductive categories are derived from the theoretical framework, particularly from ethics-by-design principles and identified ethical dimensions such as transparency, fairness, and accountability. Inductive coding allows for the identification of additional themes emerging from the empirical material.

The analysis focuses on identifying:

- Recurring ethical challenges
- Tensions between technical functionality and ethical requirements
- Implicit assumptions embedded in system design
- Governance gaps and accountability issues

This approach enables the development of a structured understanding of ethical issues across the CRIS lifecycle.

4.5 Methodological Limitations

As a single case study, the findings are context-specific and cannot be generalised without caution. However, the aim of the study is not statistical generalization but analytical insight into ethical challenges and design principles in CRIS.

Furthermore, qualitative analysis involves interpretative judgment. To mitigate bias, multiple data sources and stakeholder perspectives are considered, enhancing the robustness and credibility of the findings.

5 The eFIS Framework: Ethics-by-Design for CRIS

5.1 Conceptual Foundation

Building on the identified ethical challenges, this paper introduces the eFIS (Ethical Research Information Systems) framework. The framework conceptualizes CRIS as ethical infrastructures that require the systematic integration of normative principles throughout their lifecycle.

Rather than treating ethics as an external constraint or compliance requirement, eFIS adopts an ethics-by-design perspective. This approach embeds ethical considerations directly into system design, governance structures, and operational processes. The objective is to ensure that CRIS are not only technically efficient and legally compliant but also ethically robust and socially responsible.

The framework links theoretical insights from information ethics, responsible metrics, and socio-technical systems theory with practical implementation requirements in CRIS environments.

5.2 Core Dimensions of eFIS

The eFIS framework is structured around five core ethical dimensions that address key challenges identified in CRIS:

- **Transparency:** CRIS should ensure that data sources, processing steps, and evaluation mechanisms are visible and understandable to users. Transparency includes traceability of data flows and clear documentation of how indicators are generated and used.
- **Fairness:** Systems should avoid bias and ensure that evaluation processes do not systematically disadvantage individuals, disciplines, or research practices. This requires careful selection and contextualization of metrics.
- **Data Protection:** CRIS must comply with data protection regulations and ensure responsible handling of personal data. This includes principles such as data minimisation, purpose limitation, and secure data management.
- **Accountability:** Clear responsibility structures must be established for data quality, system design, and decision-making processes. Accountability mechanisms should enable traceability and auditability of CRIS-based decisions.
- **Participation:** Relevant stakeholders should be involved in the design and governance of CRIS. This includes researchers, administrators, IT staff, and data protection officers. Participation supports legitimacy and trust in the system.

Together, these dimensions provide a structured basis for integrating ethical considerations into CRIS development and use.

The overall structure of the eFIS framework is illustrated in Fig.1.

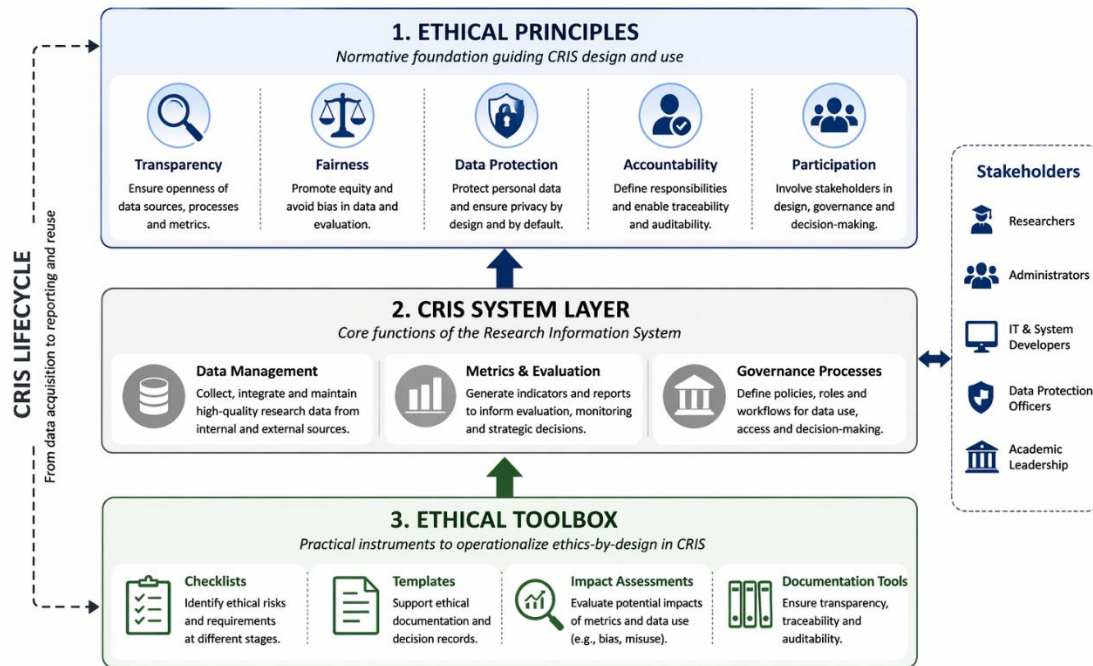


Figure 1. The eFIS Framework: Ethics-by-Design for CRIS.

5.3 The Ethical Toolbox

To operationalize these principles, the eFIS framework includes a practical ethical toolbox. The toolbox translates abstract ethical concepts into actionable instruments that can be integrated into CRIS projects.

Key components include:

- Checklists for evaluating ethical risks during system design and implementation
- Templates for documenting decisions related to data use, metrics, and governance
- Metric impact assessments, aligned with principles of responsible metrics, to evaluate potential biases and unintended effects
- Data governance guidelines addressing data quality, provenance, and access control
- Documentation tools to enhance transparency and auditability of system processes

These artefacts support different stakeholders in applying ethical principles in their specific roles and responsibilities.

5.4 Prototype Concept: eFIS Module

In addition to conceptual and procedural elements, the framework includes the outline of a technical prototype in the form of an eFIS module. This module illustrates how ethical requirements can be embedded directly into CRIS environments.

The prototype concept includes:

- Dashboard functions that visualise data provenance and metric construction
- Audit features that document data flows and evaluation processes
- Decision support tools that highlight potential ethical risks in metric use
- Role-based interfaces tailored to different user groups

By integrating such functionalities, ethical considerations become part of the system's operational logic rather than external guidelines.

5.5 Contribution of the eFIS Framework

The eFIS framework contributes to both theory and practice. Conceptually, it extends the discourse on ethics in information systems by focusing on CRIS as a distinct and highly influential class of systems. It emphasises that ethical issues in CRIS are not peripheral but embedded in system design and use.

Practically, the framework provides actionable guidance for institutions implementing or operating CRIS. By combining ethical principles with concrete tools and system design considerations, eFIS supports a shift from reactive compliance to proactive ethical governance.

6 Discussion, Implications, and Limitations

The findings of this study highlight that CRIS should be understood not merely as technical infrastructures but as socio-technical systems that embed normative assumptions and actively shape research evaluation and governance. By integrating ethical considerations into the design and use of CRIS, the eFIS framework addresses a critical gap in current research and practice.

6.1 Theoretical Implications

From a theoretical perspective, this paper contributes to the discourse on information systems ethics by conceptualising CRIS as ethical infrastructures. While prior research has addressed ethical issues in data-driven systems more broadly, CRIS represent a distinct class of systems due to their direct influence on academic careers, institutional strategies, and research evaluation.

The eFIS framework extends existing approaches to ethics-by-design by applying them to the specific context of research information systems. It demonstrates that ethical considerations are not external to system use but are embedded in data models, metrics, and governance structures. This perspective supports a shift from viewing ethics as compliance toward understanding it as an integral component of system design.

6.2 Practical Implications

For practitioners, the results emphasize that CRIS implementation should be approached as an ethical and governance challenge rather than solely as a technical project. Institutions need to move

beyond focusing on interoperability and data quality to explicitly address issues such as fairness, transparency, and accountability.

The eFIS framework provides actionable guidance by translating ethical principles into concrete tools, including checklists, templates, and impact assessments. These instruments can support different stakeholders—such as system developers, administrators, and decision-makers—in identifying ethical risks and making informed design and governance decisions.

In addition, the findings suggest that organisations should establish clear responsibility structures for data management and evaluation processes. This includes defining roles, ensuring traceability of decisions, and integrating ethical review mechanisms into CRIS-related workflows.

6.3 Implications for Research Governance and Policy

At a broader level, the study highlights the importance of aligning CRIS with principles of responsible research evaluation. As CRIS increasingly support performance measurement and strategic decision-making, they must be designed in a way that avoids reinforcing biases and promotes context-sensitive evaluation practices.

For policymakers and institutional leadership, this implies the need to develop governance frameworks that ensure transparency, data protection, and accountability in CRIS use. Regulatory requirements, such as GDPR, provide a baseline, but ethical governance must go beyond compliance to address broader societal and institutional responsibilities.

6.4 Limitations

This study is subject to several limitations. First, the empirical analysis is based on a single case study at the FernUniversität in Hagen (FeU). While this allows for an in-depth exploration of ethical challenges in CRIS implementation, the findings are context-specific and cannot be generalized without caution.

Second, the study adopts a qualitative research design, which relies on interpretative analysis of documents, system structures, and stakeholder perspectives. Although this approach is appropriate for exploring socio-technical and ethical dimensions, it does not allow for quantitative validation of the proposed framework.

Third, the eFIS framework represents a conceptual and practice-oriented model that has not yet been fully implemented or evaluated in multiple institutional settings. Further research is needed to assess its applicability and effectiveness across different organisational contexts and CRIS environments.

7 Conclusion

This paper has argued that CRIS should be understood not only as technical data infrastructures but as ethical infrastructures that shape research evaluation, governance, and academic practices. By embedding metrics, classifications, and decision-support mechanisms, CRIS actively influence how research performance is represented and assessed.

To address the ethical challenges associated with these systems, the paper introduced the eFIS framework, which applies an ethics-by-design approach to CRIS. The framework integrates five core dimensions—transparency, fairness, data protection, accountability, and participation—and operationalizes them through a practical ethical toolbox and a prototype concept.

The findings suggest that ethical considerations must be embedded proactively into CRIS design and governance rather than addressed retrospectively. This requires a shift from viewing ethics as compliance toward understanding it as an integral part of system development and use.

Overall, the paper contributes to a more reflective and responsible approach to research information management. By moving beyond metrics and emphasizing ethical governance, it provides a foundation for developing CRIS that are not only efficient and compliant but also trustworthy and socially responsible.

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