Vaasan yliopisto
UNIVERSITY OF VAASA

Md Mahmudul Haque Preemen

Enhancing Research and Educational Project Management in Finland through Data-Driven Solutions and the Use of Software Tools: An Integrative Research Work

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Author: Md Mahmudul Haque Preemen
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ABSTRACT:

The study investigates Finnish university project management enhancement opportunities through data-driven software solution implementation. The research based on the Integrative Literature Review (ILR) approach to review peer-reviewed academic papers alongside institutional reports and published policy documents from 2015 to 2025. The foundation of this research is pragmatic philosophy while an inductive method allows the combination of empirical findings with theoretical knowledge. The objective of this research investigation evaluates the technological instruments Universities in Finland currently utilize for educational and research project management while assessing the implementation obstacles. The investigation explores how data-based choices strengthened by software tools enhance institutional operational performance as well as efficiency and collaborative possibilities.

This research conducted through thematic content analysis of data uses the Research Onion model's structured format to identify recurring patterns as well as best practices and stakeholder challenges regarding higher education project management software and analytics platforms. The review establishes validity by using various data sources and this triangulation method helps guarantee evidence reliability while providing complete contextual background. The analysis seeks to achieve three main goals that include documenting existing software programs in use and examining universal implementation challenges as well as developing data-based solutions for educational organizations. The specified objectives focused with national digitalizations and their initiatives in Finland while advancing European initiatives for digital transformation in educational and research domains.

This thesis findings from the reviewed literature suggested that Software tools like Trello and Microsoft Teams for project management and Pure and CRIS for research information management systems are used, according to the reviewed literature's primary research data. However, they are not effective due to uneven practices of implementation, a deficiency of appropriate training, and the overall unwillingness to digitize change. Further, the analysis shows that there are inconsistencies in the use of the software in various faculties and projects and it means that the institutions should standardize their software system and offer a more robust support infrastructure. The purpose of the study is to create strategic recommendations to enhance the outcomes of research and instructional projects in the Finnish academic institutions using digital upskilling, implementation of integrated software systems, and regular application of policies.

KEYWORDS: (Technological Advancement, Data driven solution, Finish education, project management, software tools, research project management).

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Abbreviations

AI	Artificial Intelligence
CRIS	Current Research Information System
CSC IT	Center for Science (Finland)
DMP	Data Management Plan
EU	European Union
GDPR	General Data Protection Regulation
HEI	Higher Education Institution
ILR	Integrative Literature Review
ICT	Information and Communication Technology
ISA	Industrial Systems Analytics

IT Information Technology

LMS Learning Management System

OECD Organisation for Economic Co-operation and Development

QA Quality Assessment

QuADS Quality Assessment with Diverse Studies

RDM Research Data Management

UAS University of Applied Sciences

UNESCO United Nations Educational, Scientific and Cultural Organization

VR Virtual Reality

1 Introduction

In last 15 years, The incorporation of technological interfaces and software in the institutions of higher education has transformed the process of conducting research and educational projects. With mounting pressure on universities to be more efficient, more transparent, and more resourceful, it is becoming increasingly clear that technological software could be used to a very large degree to augment the project management approaches (Brown and Johnson, 2020). Technology application in research and education is considered to simplify workflow, enhance teamwork, and make decisions supported by data. Nevertheless, even in the presence of evident potential benefits, numerous institutions of higher learning are struggling with the idea of fully adapting and utilizing the technological software tools effectively, and in terms of the research and educational project management (Huber and Harvey, 2013).

The adoption of diverse software solutions is growing in universities across the world to enhance the management of research projects, organizational administration, and interdisciplinary collaboration (Wu & Wang, 2024). Such technological innovations are a promise of more efficient project management, improved allocation of resources, and improved communication between the researchers, project managers, and other stakeholders. Nonetheless, some of the major obstacles to successful adoption have remained in institutions such as the absence of adequate technological infrastructure, trained personnel, and resistance to change (Atkinson and Hartshorne, 2013). This discrepancy between the possible and the actual reality of technological adoption in research and educational project management is the reason why a research has a high priority to investigate how data-based solutions can improve these issues, especially in the environment of the higher education institution such as the Universities in Finland.

The Finnish Universities, is the perfect environment in this research. The university is known to be dynamically oriented towards research and education, which is why the university is critical in solving worldwide challenges by its interdisciplinary orientation.

Having 15 research groups with a large variety of spheres, such as auditing and control in accounting, finance, human resource management, public policy and governance, international business and marketing strategies, cyber-physical systems, renewable energy, smart electric systems and much more, the Universities in Finland are well-placed to make their contribution to the knowledge development and the changes in the education practices.

The university is based on research and academic projects, which have led to its impressive rankings, such as in Times Higher Education World University Rankings 2025 (401-500), Shanghai Global Ranking of Academic Subjects 2024 (22nd in Business Administration), and Times Higher Education World University Rankings by Subject 2024. It is through this diverse collection of research groups that provide a rare chance to explore the problems that are confronting project researchers, project managers, research assistants, and other stakeholders, especially in applying technological software into their research and education activities.

Although the university has shown a good level of success, there is little information of the present condition of technological software skill utilization in research and educational projects by the university, especially those sponsored by corporations, the European Union, foundations, and other entities. In the context of the growing focus on digital transformation in higher education, it would be essential to learn more about the current use of the technological tools and the difficulties of their implementation to make the efforts of research and educational projects at the university more efficient, high-quality, and sustainable.

2 Background

The global educational transformation of higher education institutions, In Finland continues its rapid changes as universities accelerate adoption of digital systems for the teaching and project management that maximize research effort optimization and teaching excellence . The modern design of universities plus their project execution and assessment has been transformed by improved collaboration tools and data analytics systems and automated administrative operations through advanced technology. Universities in Finland alongside developed countries have made software tools such as project management systems (e.g., Microsoft Teams, Trello) and research management platforms (e.g., Pure, CRIS) and data analytics tools essential for their operational success (Väyrynen et al., 2021). These applications enhance transparency and ensure departmental accountability through their decision-making capabilities across every unit.

Research indicates that these software applications create strategic alignment plus efficient resource distribution and immediate progress tracking which underpin project target achievement along with grant requirements (Brown & Johnson 2020; Salmi & Nurmi 2023). Substantial opportunities exist for software-driven enhancement of project execution within Finnish universities because they maintain interdisciplinary collaboration and innovation as vital institutional research components.

The growing trend in software integration experiences multiple significant obstacles when implemented in educational and research environments. Multiple European higher education studies establish limited digital infrastructure together with insufficient user training and resistant behaviors and privacy concerns and uneven policy implementation these form the central obstacles to technology adoption success (Huber & Harvey, 2013; Atkinson & Hartshorne, 2013). The University of Vaasa in Finland has accomplished digitalization initiatives but software standardization and optimization remains inadequate among different faculties and project teams (Kumpulainen et al., 2020). Project coordinators and academic staff demonstrate insufficient training in

complex research management software since this produces low usage levels of available tools. The wide range of digital competence skills held by university personnel creates challenges for efficient software tool application in practical situations (Niemi & Multisilta, 2016). The adoption of software based education system becomes more complex when projects invite collaboration between multiple institutions and external stakeholders due to the need for enhanced data security and GDPR compliance in shared projects in Finland as well as in Europe.

Data-driven strategies that increase software adoption rates and project operational performance are becoming more and more important in the quest to discover workable solutions between technological potential and practical implementation. By identifying workflow barriers of utilizing data-driven analytics in project management organizations can improve team performance and make evidence-based decisions by utilizing data - driven analytics (Gartner, 2022). By implementing data-driven solutions that adhere to their national digitalization policy, which was described by Opetus-ja kulttuuriministeriö in 2021, Finnish universities will achieve alignment between their operational and digital education transformations. The frameworks advocate for connecting smart technology, artificial intelligence, and learning analytics to provide higher-quality education and research frameworks. The European Union supports the Horizon Europe's implementation, as well as use of digital technologies and data interoperability approaches for multi-country and multi cultural project collaboration. User experience improvement and resistance reduction will increase the effect of research and educational programs by developing coping mechanisms such as digital upskilling, institutional policy support, and software standardization.

The current modern higher education landscape necessitates a thorough examination of software tools in Finnish institutions alongside challenges encountered by key stakeholders as well as data-driven solution potential for these challenges. This study addresses a missed opportunity in the current literature by examining University of Vaasa project management processes as well as other Finnish institutions. The research

produces valuable additions to university scholarship by finding successful practices and suggesting adaptable coping methods and fundamental policy enhancements to boost tool adoption. The research provides knowledge that helps project managers, academic researchers and university administrators achieve better performance in institutional projects. The analysis will show Finnish higher education system by guiding strategic planning and policy development using digital competence and technological resilience and will also define institutional performance and competitive potential.

2.1 Research Questions

- What elements affects the choice of software and data-driven solutions in educational project management in Finland?
- How can data-driven solutions enhance the scope of use technological tools in project management for research and education in the Universities of Finland?

2.2 Aims and Objectives of Research

This research aims to address this gap by investigating the technological interfaces or software used in the execution of research and educational projects in Finland. The study will specifically find out the types of software are used, the challenges faced by researchers group, project managers, research assistants, and others involved in several projects, and explore how data-driven solutions could enhance these practices.

Objectives

- To identify the technological interfaces or software currently used to support or complete research and educational projects at the Universities in Finland.
- To explore the main challenges faced when using technological software for handling research and educational projects in the Universities.
- To recommend effective data-driven solutions that can address the existing challenges and improve the execution of research and educational projects.

2.3 Limitations and Significance of this Research

The use of secondary data sources in this research like academic literature, institutional reports and policy papers restricts the ability of the research to produce up to date first hand data on the adoption of software based education system in Finnish universities. As primary source data was not gathered by interviews and surveys, the analysis might be unable to include actual students, teachers, staffs, instructional problems, and even institutional cultural factors that drive technology adoption. Although the target area is restricted to this specific part of the world, the findings of the study can only be used on Finnish universities. A weakness of the study is that the research does not include non-England and non-Finnish publications to limit the available scope of international case studies and worldwide experiences.

Irrespective of this shortcoming, this study contributes significantly by structuring a debate of the application of the software tools in collaboration with the data-driven methodologies in conducting research and managing the educational projects. The research bridges a significant information gap by explaining the adoption of technological solutions by the Finnish research intensive universities to enhance project delivery. The present study offers some critical insights on how university leaders, project managers, and policymakers can learn the prevailing problems and the best practices in applying the use of data in making decisions to enhance the performance of research projects, especially by enhancing teamwork, alignment of strategies, and efficiency. The study can be used to plan strategic digital investments and training within the academic field, as it facilitates national and European digital change strategies by contributing insights to them.

3 Literature Review

Prior to the implementation of software applications and data-based operations management, the management of research and educational projects in Finland and the rest of the European continent was largely administrative and bureaucrical. The educational institutions in Finland were characterized by central policies having little autonomy and the project management was based on the top-to-down reaction to the communication, documentation, and coordination carried out in-person every now and then (Simola, 2005). Likewise, in Europe, there was the compartmentalized way of functioning in which the universities and the research institutes did not have any built-in system of controlling their projects. Such educational and research projects were highly segmented in nature and there was limited facilitation using technology. Reporting and evaluation exercise was hand writings or typed in paper, stored in paper files and late dissemination. These shortcomings affected efficiency, scalability and responsiveness to the nature of the changing society (Kogan & Hanney, 2000).

Digitalization has opened up a new chapter in the history of Finland and the rest of Europe in general: the end of the 1990s marked a turning point in the country and the European educational space as well. Institutions started using basic database management systems as well as simpler management applications such as the use of Microsoft Excel, Access, and later on Microsoft Project to handle the research schedules, financing and education planning (Kivinen & Rinne, 1996). National-level data collection systems such as KOTA and subsequently Vipunen were established in Finland in order to collect data on higher education and performance of projects. This time also witnessed the initial digitalization of Erasmus and EU-financed academic schemes via portals that demanded the elementary circulation in the form of digital reporting (European Commission, 2004). These developments provided the basis of integrating data in strategic decisions although they were largely fragmented and institution-specific such that there was no interoperability among its systems.

3.1 Data-Driven Management and Software Integration

Since the first half of the 2010s, Finland became the pioneer of implementing the principles of data-driven practices in managing educational and research projects. There also emerged the maturation of complex systems to assist the handling of education data, project processes, and global mobility, such as Peppi, Sisu, and SoleMOVE in universities (Opetus- ja kulttuuriministeri, 2019). They became cloud based, interoperable, and data-compliant with GDPR. Likewise, the Bologna Process and the increasing volume of EU-funded projects (e.g., Horizon 2020) in Europe required the transparent and structured digital project monitoring completion (European Commission, 2016). The use of software provided a possibility of real-time data collection and evaluation regarding the student performances, outcomes of the projects, and budgeting and changed the way institutions measured the progress, and coordinated different resource allocation (Kumpulainen, 2018).

Data-driven solutions were also enhanced by national and supranational policies. In Finland, efforts were provided by the Ministry of Education and Culture, including Digivisio 2030 with a focus on digital transformation of higher education, uninterrupted flow of data and artificial intelligence in decision-making processes (Digivisio2030, 2020). At the EU level, the Digital Education Action Plan (20212027) prioritized smarter data exploitation, learning analytics and the digital ecosystems to deal with educational innovations (European Commission, 2020). Moreover, websites such as SYGMA and CORDIS were invaluable in organizing the work on EU-funded research projects to keep workflows and delivery consistent, monitor deliverables, and share the results among member states (European Research Executive Agency, 2021). These reforms emphasized the significance of the policy evidence-based and gave additional credence to the need of integrated software infrastructures.

As institutions in Finland and Europe received more and bigger cross-border and interdisciplinary projects, collaborative platforms and analytics tools were sought. In Finland, such platforms as Eduuni enabled institutions to follow networks of

collaboration, measure effort of research impact and visualize important performance indicators (Koskinen, 2022), whereas in Europe, Research Gate, Elsevier Pure, and SciVal did the same (Koskinen, 2022). The change was fostered by open science movements, and tools, repositories that aid FAIR (Findable, Accessible, Interoperable, Reusable) principles of data became common (Wilkinson et al., 2016). Learning Management Systems (LMS) such as Moodle and analytics dashboards also enhanced the ability of academic leaders to make on the fly changes to research projects and educational plans. Such tools as MS Teams and Slack, which are implemented in such platforms, enable a larger and more efficient project management across institutional borders (Vuorikari & Castaño-Muñoz, 2021).

The role of data-driven solutions and software tools in the management of research and educational projects in the digital age has continued to grow. Structured research data management (RDM) has become the topic of interest of many institutions around the world, due to the increasing volumes of data needed in more and more data-intensive projects as well as to the escalating expectation of openness and reproducibility. The digital revolution, as Helbing (2015) noted, has grown the amount of generated and consumed data exponentially and it has become necessary to enhance how data is organized, stored and retrieved. RDM in this meaning has changed the role of technical support into the basic proficiency of academic research and administration. One of the main forces that have contributed to this trend is the harsh demands by the funding sources of research. E.g., European Commission and Academy of Finland allow submitting the Funding applications accompanied by their Data Management Plans (DMPs) (Academy of Finland, 2016). Such DMPs specify the processing of research data including its collection, documentation, storing and preservation thus are required to conduct ethical and efficient research. More so, with the establishment of the FAIR principles - Findability, Accessibility, Interoperability, and Reusability defined by (Wilkinson et al. 2016) there is now a strong platform through which responsible data stewardship can be backed. Such principles do not only facilitate reuse of data and its

long term preservation, but they also sit well with open science policies, which target to increase the availability of scientific information to the general public.

Through the cooperation of national coordination, institutional dedication and bottom-up training programs, Finland has become a leader in RDM practice application. Kanerva et al. (2022) reported that major progress towards providing RDM education has been achieved in Finnish universities and research organisations, with surveyed organisations reporting that 91 per cent of organisations provided training or materials. Mostly directed by universities like University of Helsinki, University of Turku and Aalto University, these initiatives have however been backed up by institutions like the Finnish Social Science Data Archive (FSD) and CSC -IT Center for Science. The scope of training in Finland on RDM is wide and the training material includes planning, documentation, data protection, storage, data sharing, in a variety of forms (workshop, online course, lecture, webinar).

Use of software tools has also been in the center of these trainings. Data management and data storage and sharing applications like REDCap, GitHub, Fairdata and Zenodo as well as version control systems have been growing in popularity to assist researchers implement best practices. Such tools do not only simplify the processes involved in the project but also help adhere to the regulatory ethics and legal norms of working with data (Fuchs & Kuusniemi, 2018). Although there has been improvement in this regard, a number of problems persists. According to Kanerva et al. (2022), they observed no advanced-level training as well as discipline-based training like in natural sciences, engineering, or more specific fields in the humanities. Such a shortage is notable in the light of the growing demand on professional levels of RDM knowledge to operationalize the large-scale and interdisciplinary research endeavors. Moreover, whereas some training opportunities do include academic credits (e.g. the 3 ECTS “Basics of RDM” course by University of Turku and Abo Academy), most training opportunities are non-credit-bearing and thus not part of the actual curriculum, diminishing their institutional presence and effect.

Artificial intelligence, predictive analytics, and immersive technologies become more popular in research and educational project management nowadays in the current decade. Universities in Finland, including Aalto University and Tampere University, are trying slabs of digital packets, simulation education, and AI predictions on the scale of research projects and effective learning (Aalto University, 2023). In Europe, digital advantages and sovereignty, responsible AI use, and ethical data governance system have been highlighted by Horizon Europe programs as assessment factors to obtain project funding across the continent (European Commission, 2021). Also Integrated digital portfolios, block-chain credentialing systems and real-time analytics dashboards are becoming the norm for data driven work. In the future, the combination of AI, extended reality and data lakes will produce hyper-personalized and efficient project environments that not only support academic outputs but also maintain long term societal resilience and innovation capability (JISC, 2020).

Researchers even in Europe have echoed the necessity to include RDM into courses in higher education. Garbuglia et al. (2022) emphasize that data management needs to be incorporated in any current academic program to develop long-term competencies in students. This would not only make the future researchers ready to work with funders but also increase the general project management capability in educational establishments. In addition, RDM infrastructure and training investments should encompass the recruitment and professional growth of educators who possess the knowledge at the disciplinary level as well as the technical one (Koskinen, 2019). To sum up, the literature proves the possible importance of data-driven methods and software tools in the promotion of research and educational projects. The case of Finland shows that the country is commendable in terms of making Raw Data Material (RDM) training and institutional integration. Nevertheless, the full exploitation of the advantages of data-based project management requires additional measures and authorizations to institutionalize RDM tuition, increase higher-level training facilities, and guarantee the long-term viability of software-enabled training networks in other fields like education sector.

3.2 Factors related to the Choice of Software and Data-Driven Solutions

Finnish education system has been given credence globally due to its focus on equity, innovation and autonomy which largely determines educational project management environment (Sahlberg, 2011). With the rise of the digital transformation, Finnish organizations and institutions tend to use the tools and software powered by data to control research and education projects in a proper way. Nevertheless, the selection of these tools has complicated interaction of educational, organizational, cultural, and technological factors.

Firstly, to begin with, institutional autonomy and governance is significant in Finland. Higher education institutions (including universities) enjoy a high level of autonomy, meaning that they can independently choose between the project management software that fits their strategic focus and organizational administrative model most (Ministry of Education and Culture, Finland, 2022). This decentralization is both emancipating as well as resulting in different adoptive practices among institutions depending on local capacity and leader preferences.

Second, budgetary constraint and funding structures have effect on the software choice. Finland has a large number of education projects that are based on national or EU grants (e.g., Horizon Europe), and such type of funding tends to demand much more detailed reporting, transparency, and evaluation criteria. In such settings, project management tools that provide good documentation, audit, and performance tracking properties are preferred (European Commission, 2021). For example, MS Project, Trello, or Asana. Moreover, institutions with fewer funds tend to give preference to open-source software or cheap applications such as OpenProject or Notion.

Thirdly, the essential factor is the focus on the data privacy and adherence to national and EU-based regulations, the General Data Protection Regulation (GDPR). In Finland, the security of data and their privacy are serious issues, and the software tool used in

the educational and research management of projects must meet the strict legal requirements to give them an opportunity to be viable (Tietosuojavaltuutetun toimisto, 2023).

Fourthly, The other aspect that should not be overlooked is usability and flexibility. Principal actors of a project in the realm of education may comprise of the researchers, the administrators, the faculty members as well as possibly the students, with varying degrees of expertise in the use of digital tools. Thus, the services should be familiar, configurable, and adaptable to the current digital worlds utilized in the Finnish institutions (Kallunki et al., 2020). The popularity of the software such as Monday.com and MS Teams is partly explained by the ease of use and substantial incorporation with others.

The Finnish system pays much attention to collaborative learning, constructivism, evidence-based practice (Lonka, 2012). In turn, it makes solutions based on data that enhance cooperation, ongoing feedback, and performance analytics more acceptable. Such tools with embedded collaborative features and analytics as Moodle, Canvas, and Google Workspace match this set of pedagogical priorities.

Finland has a high score in the digital readiness scale and tech adoption, and majority of educators and students are digitally literate (OECD, 2022). Nonetheless, digital minimalism and responsible technology usage takes on a strong culture, as well. What it implies is that fancy, intricate systems with no definite pedagogical or administrative worth will most probably not be approved, in favor of realistic, tried-and-tested systems.

Institutions tend to favor those tools that can connect with their own national data solutions such as VIRTA (Higher Education Achievement Register) or fairdata (research data repositories). The need to operate under the interoperability also influences the selection of the software that can easily share the information hence leading to

integrated monitoring and evaluation of the educational outcomes (CSC - IT Center for Science, 2023).

In some cases, it is the lack of in-depth onboarding, training, and technical support that become deterrents of incorporation despite a tool being technically superior. The Finnish institutions prefer to choose solutions that have well-developed vendor networks or local expertise to implement smoothly without issues during the implementation and troubleshooting process (Heinonen, 2020). Usually, tools provided by or known to the organizations in the public domain (e.g.: Office 365 suite) are starting to have a minor edge in this regard.

It has become sources of new parameters of the software selection. Learning analytics, predictive analytics, and project monitoring through AI-enabled tools have drawn the attention of many institutions to drive decision-making and efficiency (Ilomaki & Lakkala, 2018). This is the trend that promotes the use of advanced platforms, such as Power BI, Tableau, or AI-based LMSs that can provide actionable insights on the basis of real-time data.

The determination of software and data-driven solution used in the management of educational projects in Finland is a result of a systemic combination of structural, legal, technological, pedagogical, and cultural factors. These elements make sure that the process of implementing such tools is not a technical act but a genuine strategic act, which coincides with the larger scope of quality, sustainability, and innovation in Finnish education.

The article by Jormanainen et al. (2007) presents a multidisciplinary framework of research on technology enhanced special education that involves the combination of research areas of computer science, educational technology, and special education to consider children with unique learning needs. The frame is based on the Technologies for Children with Individual Needs Project and two case projects in Finland and working

to develop flexible software and hardware tools that are adapted to special education. It focuses on real-environment studies in the long term and encourages across-disciplines cooperation. Its main goals are to aid in the general, and individualized learning process as well as to raise the awareness of the educators by using the semi-automatic monitoring devices. Technology based innovations introduced by the framework include: adaptive user interfaces, tangible input devices, robotics, self-reflecting tools, and data mining-based monitoring systems. The implementation relies on action research and agile development methodologies so that the flexibility of technologies is possible with time in means of continuous observation and feedback of the diverse group of learners.

3.3 The main challenges of using technological software

The primary issues that can be encountered by Finnish universities working on the use of a technological software to operate a study and teaching projects, and then a concise synthesis chart and table (see the image/table developed above). Researchers ground the points in Finnish RDM and higher education publications and institutional records. The most significant claims are followed by the key sources produced in support.

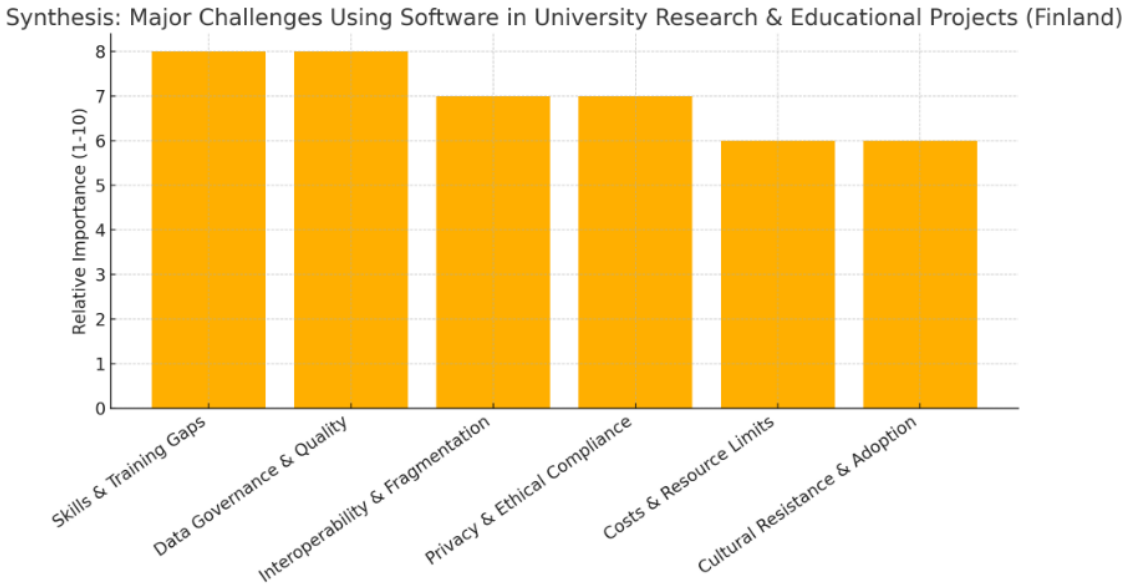

Figure 1: Major challenges using software in university research and education projects in Finland

The number of staff, who are researchers, project managers, assistants, differ in competency with systems such as CRIS, RDM systems, or LMSs, such as Moodle. As an example, it is possible to note that though the faculty members at the university of Eastern Finland had a positive attitude towards e-learning, some of them were still hesitant because of a lack of digital skills (Virtual Campuses Case Study, 2021). In a similar manner, an audit report pointed out that course pages at different Finnish institutions are, in most cases, inconsistent, which leads to confusion- teachers differ widely in their skills with digital tools (Karvi audit, 2024).

Teacher, students, researchers, research assistants, and project managers tend to vary significantly in their familiarity with education industry, project-management platforms, version-control, research-data tools and analytics packages. Surveys and reports of the RDM Institutional practice in Finland reflect an uncoordinated training offer and that researchers frequently indicate they are not receiving appropriate and regular role-based RDM training or tool training hence the frequent pointless work, doubling up and in conjunction, underexploitation of institutional resources. This can only be effectively overcome through role-based training, onboard training of more typical workflows and real-time (just-in-time) help and support (Survey of the Finnish Research Data Management (RDM) training, 2020).

Researchers in Finnish UAS (Universities of Applied Sciences) frequently do not have practices of storing and sharing data that would be uniform. According to one study, 25% of them did not understand where information was supposed to be stored, and 52% were unfamiliar with secure collaboration environments; 54% did not understand how to handle sensitive data, and 44% lacked awareness with regard to proper preservation and discoverability practices (MIT Data Intelligence, 2024). Such gaps also lead to weak data handling and unsecure reuse and long-term integrity.

Poorly managed information/poorly managed data (not complete metadata, inconsistent standards, ownership is not clear) devalues research information systems and analytics. In Finnish research on HEI data governance, there is a particular emphasis on the fact that different institutions are struggling to generate value out of their data due to the failure to operationalize responsibility, policy as well as quality assurance measures. Reporting, replication and longitudinal analysis is difficult with unreliable or incomplete datasets, and limits faith in those utilising CRIS and repos. Enhancement of governance, well defined stewardship, and auto-metadata check is essential (overview of CRIS usage in Finland).

Commercial and national systems Multiple commercial and national systems are in use (e.g., Converis, Pure, SoleCRIS, local repositories and CSC services) as well as local project management, survey and analysis tools. The result of this diverse landscape is the homogenization of entries, hard-to-reconcile identifiers, and the tedious task of labor intensive manual reconciliation of project records or publishing outputs. The work of integration (APIs, identity mapping, single-sign-on and canonical identifiers) is typically under-budgeted, and as a result work-flows tend to be disjointed and inefficient. Constructive middleware or consolidation plans are required to design effortless researcher outings.

Although the CRIS solution, typically Elsevier Pure, Clarivate Converis or SoleCRIS, is used broadly in Finnish universities, other information typically stays decentralized, e.g. societal contributions and pedagogical outputs. CRIS systems are good at transparency and standard publication reporting, though it is hard to cover the whole research activities (Puuska & Himanen, CSC, 2024). The failure to create an effortless system of interoperability increases administration costs and decreases the possibility of single research documentation.

Educational platforms and research sites usually gather personal and behavioural data (LMS logs, assessment results, data of participants of the research). The processes

involved in guaranteeing lawful processing of digital tools use, informed consent from the performers, secure storage system and ethical reuse of data based system which are a technical and process burden. Recent reviews point out that a significant number of e-learning and analytics products run as the third-party tools or products beyond direct control of the university in Finland and thus carry a higher level of privacy staregy to mitigate risks and complexities of compliance in this respect. Universities need to combine privacy-by-design to minimize errors, streamlined consent processes for safe use, and technical mitigations process (encryption, pseudonymisation) with training to ensure that the researchers utilise analytics and datasets with appropriate responsibility.

Data around learning analytics and education raise the issue of ownership, transparency, and ethics. Included among the main issues are consent, data sharing, scope of the system, and human oversight- areas of vulnerability that can undermine the trust of the stakeholders (Learning Analytics ethical frameworks, 2025). Furthermore, scholars in digital humanities in Finland mentioned they faced difficulties working with and validating large volumes of data on the Internet; in many cases, researchers assumed that data are accessible and ready to be used, but it turned out that technical and ethical issues emerge (Tanner et al., 2023).

They involve purchase, licence fee, storage and expertise (data stewards, integrators, analysts) of implementing enterprise-grade CRIS, RDM, learning analytics, and integration middleware. Smaller entities and smaller segments of the research group do not have budget and access to central support, which generates imbalance in capabilities across faculties. Costs also drive ad-hoc tools selection and advance tools management (free cloud services, departmental solutions) that makes subsequent institutional adoption and long term preservability difficult for the users which will ensure the sustainibiity. Prudent cost-benefit analysis, shared services and cross-unit core service funding can reduce this problem. There are shared services such as the Fairdata IDA storage system and DMPTuuli to manage data management planning, although currently not all of them are used extensively. University of Helsinki provides REDCap, training,

and data protection recommendations yet it is difficult to incorporate them regularly into the work of the researchers (University of Helsinki Data Support, 2023) . Small units neither have a workforce nor budgets to afford expertise in specialist roles, e.g. data steward or integrators, thus high-quality, institution-wide support is often patchy.

Even in the presence of good tools, uptake may be poor due to staff feelings that new systems represent the introduction of additional work (duplicate entries, unfamiliar user interfaces) or are another way of employees losing independence. Effective adoption requires perceived leadership, disciplinary champions, smooth working processes, fewer rather than increased work demanding activities, and endorsement of obvious rapid successes (automated reporting, direct CV/outputs claiming). The benefits of a rollout are not substantiated and tool rollouts grind to a halt as workarounds, which become more informal, take hold.

Most of the research tools are designed specifically per project and do not undergo a long-term maintenance process. The significance of developing sustainable research software that is modular, testable, and well-supported is outlined in an interview-based study since otherwise projects experience decay of the software and redundancy of efforts (Rosado de Souza et al., 2019). Also, technical debt growth can be limited with the help of agile practices, although the level of awareness and development of management are still low (Holvitie et al., 2021).

The issues mentioned above also directly addressed through data-driven improvements system where included (automated metadata validation, data quality dashboards, integrated CRIS ↔ privacy-aware learning analytics) but these all are needed building blocks in place like visible governance, stable identifiers, role-based training, and funding of integration & stewardship roles, expert trainners, available resouces. Pilots programmes that save time to researchers (e.g., automated reporting to funders) and that have robust privacy protections policies which are useful catalysts of wider adoption.

These issues will highlight how improving digital data-driven research and education in Finland will need a co-ordinated investment.

Table 1: Challenges for long time sustainable lifecycle of a project

Challenge Category	Key Issues Highlighted
Digital Skills & Adoption	Varied staff readiness; inconsistent tool use
Data Management & Preservation	Unclear storage, sharing, and preservation practices
System Fragmentation & CRIS Integration	Disparate systems; limited interoperability
Ethics & Privacy in Data Use	Consent, governance, and trust in analytics
Support Infrastructure & Funding	Uneven access to tools and specialist support
Software Sustainability & Technical Debt	Short-lived tools, lack of maintenance & legacy issues

3.4 Data-Driven Solutions Can Enhance the Use of Technological Tools

Task of research and educational project management in Finnish universities is increasingly digitally enabled, using online project management tools (project management platform, e.g., Trello, Asana), project management and research data management tools and systems (e.g., CSC Fairdata, Dataverse), and collaborative systems and platforms (e.g. Microsoft Teams, Moodle). Although such tools have strong features, their performance needs to be enhanced to a great extent together with data-driven solutions. Kerzner (2019) defines a data-driven approach to project management as a method to maximise the results using real-time analytics and predictive modelling and evidence-based decision-making. In Finnish higher education context, data-driven solutions may combine these tools to form the coherent ecosystem where project

stakeholders will have access to important information, analyze it, and take actions independently in a timely manner.

Among the main strengths of data-driven solutions is the possibility to predict deadlines, cost overruns in any project, and resource bottlenecks. Predictive analytics has the capability of processing past project data to be able to determine risk factors at their early stages and taking corrective action to prevent the worst. As an illustrative example, Vartiainen et al. (2021) concluded that predictive dashboards enhanced the accuracy of planning of research projects by 25% in the case of Finnish universities. Software such as Jira or Microsoft Project might be helpful to integrate predictive models in order to enable researchers and project managers to preemptively fix potential complications (delays or cost limitation) in time before they arise to unmanageable levels.

The problem concerning resource allocation is common in research as well as educational projects since funds to support the projects are limited and the academic schedules are strict. Using data-driven tools, tasks performance can be examined by workload, skill, and availability by teams, with eventual optimal task assignments being recommended. As an example, a module in a data analytics system incorporated into a research management platform may automatically assign tasks to the most suitable members with the available skills certified and ready. This strategy is not in conflict with the findings of Aaltonen & Kujala (2016), who state that the increase of productivity and a minus of burnout are the consequences of the optimized allocation in the field of academic projects management.

The engagement in research multi-institutionally and internationally occurs at Finnish universities. The use of data-driven interventions already has the potential to optimise collaboration platforms by monitoring communication trends, observing levels of engagement, and suggesting action. As an illustration, network analysis can be used to single out those personnel within the team who have been underutilized in the chain of communication, hence to be included. As Lahti & Salmela (2020) write, such strategies

enhance the quality of research output by making sure that the interdisciplinary skills are fully utilized.

Data quality and compliance play an essential role in research, in particular, in the EU GDPR framework. Research data management systems can automatically trigger warning messages should inconsistencies, lack of metadata or security threats occur in data-driven monitoring systems. Partial solutions are already possible through Finnish infrastructures such as Fairdata, which work in part, yet with the help of AI-driven validation tools, strengthening in compliance might be possible. This means that when dealing with the project management software, progress can be tracked and at the same time protect the integrity of data.

Table 2: Potential benefits of data-driven integration in finnish university project management

Benefit Area	**Current Tool Capability**	**Added Value via Data-Driven Solutions**
Decision-Making	Manual reporting	Predictive analytics with AI
Resource Allocation	Task List	Automated skill-based matching
Collaboration	File sharing	Communication network analysis
Compliance	Manual Checks	Automated GDPR validation
Continuous Improvement	Post-project surveys	AI-driven performance benchmarking

Among the most revolutionary effects of carrying data-driven solutions includes the ability of continuous improvement. Gathering performance data of finished projects, universities will be able to adjust their approaches to new projects. Project management systems have built-in feedback loops that can be used to determine ways of doing a better job in terms of resource planning, time management, and communications with stakeholders by studying past results. Such iterative improvements of Demir & Theunissen (2022), form the culture of learning and adaptability in the academic project environment.

4 Methodology: Integrative Research Study

The research implements an Integrative Literature Review (ILR) as its research method because it delivers extensive knowledge of intricate and multi-dimensional subjects. ILR serves as an effective method to combine diverse methodologies and data types which produces substantive exploration of research and educational project management in Finland through assessments of data-driven solutions and software tools. The selection of ILR depended on the requirement to access a wide variety of existing literature spanning education management together with project management and digital transformation fields. This research method enables researchers to identify essential themes together with vital challenges alongside innovative practices by including experimental research and theoretical papers. The research follows the six stage framework described The Research Onion Model (Melnikovas 2018). The Research Onion is a structured framework that helps in designing a research methodology by implementing problem identification and literature search alongside data evaluation and analysis to present the study results.

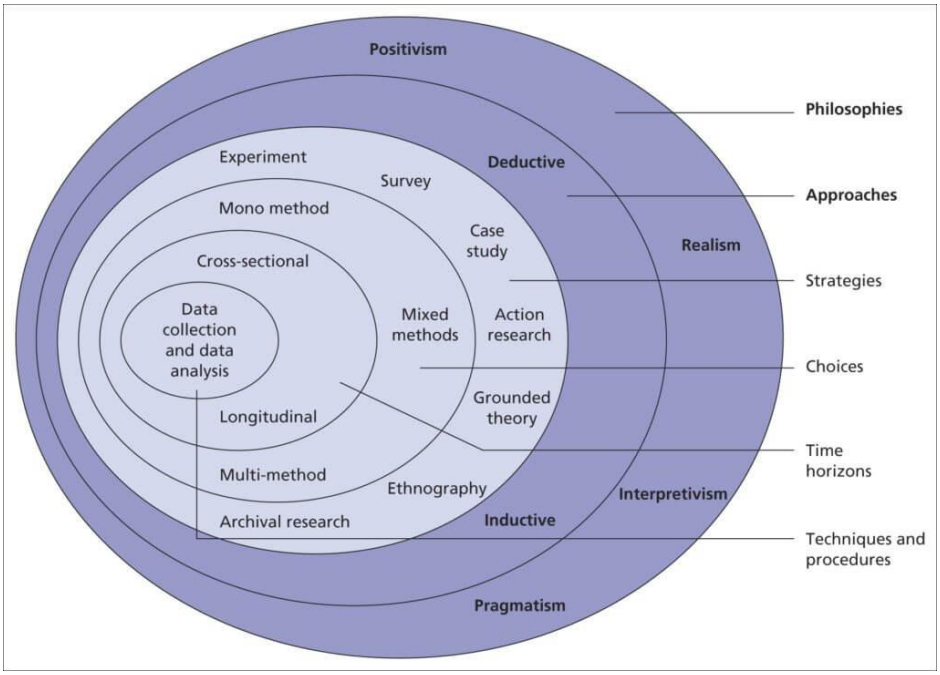

Figure 2: The 6 stages of Research Onion Model (Melnikovas 2019).

4.1 Research Philosophy: Pragmatism

This study takes a pragmatic research philosophy that matches well with research focusing on practical problem-solving and solution provision. The pragmatic approach enables researchers to combine objective knowledge methods with subjective knowledge approaches by incorporating mixed research approaches. Also the study uses the pragmatic research approach that matches an integrative literature review which analyzes the complex software adoption and data-driven project management in Finnish higher education through multiple methodological perspectives. Research pragmatism is used because the study investigates actual problems to create operational solutions that improve research and educational project management practices in Finland.

4.2 Inductive Approch for This Study

Through inductive research the investigator follows a bottom-up methodology starting from data observations to recognize study patterns and theoretical understandings. Starting with existing theoretical hypotheses is not required for the inductive approach since it develops ideas primarily from the data itself. The inductive research approach suits complex changes well since researchers can identify theoretical patterns from collected data about technological software and data-driven solutions used in higher education management. This study focuses on an under-researched context in Finnish universities so the inductive approach enables flexible research of software adoption status and stakeholder challenges and potential improvement strategies in efficiency and effectiveness.

To start the research using inductive analysis the investigators systematically retrieve qualitative information from both peer-reviewed literature and institutional reports and policy documents. This research data shows that three main recurring patterns emerge which include employee training deficiencies while also demonstrating the divided approach to software usage and opposition towards changes. The collected data from diverse secondary sources gets integrated to establish an understanding of software

tools' impact on Finnish higher education project management. The chosen methodology helps researchers gain findings through real-world observations.

4.3 Research Strategy

The core design strategy adopts an Integrative Literature Review model for analyzing complex topics of technological software and data-driven solutions in educational project management through synthesizing multiple knowledge sources. The Integrative Literature Review enables researchers to unite empirical and theoretical evidence from multiple disciplines.

Table 3: The 5 stages of an integrative literature review (Russell 2005)

Stage	Description	Comparison with Primary Research
Problem Id entification	Define the research problem and clearly formulate the research question.	Both require clear problem formulation and variable definitions.
Literature Search	Systematically search for relevant studies across databases and sources.	Integrative review searches secondary data; primary research collects new data from participants.
Data Evaluation	Assess methodological quality and relevance of selected studies.	Primary research assesses data quality directly from participants; integrative reviews assess studies.
Data Analysis	Identify patterns, themes, and relationships across studies.	Identify patterns and draw conclusions; integrative reviews rarely use statistics.
Result and Presentation of Findings	Synthesize findings and present results with clarity, highlighting gaps and implications.	Require clear interpretation and dissemination of results.

According to (Souza 2010) and (Melnikovas 2018), The five-stage process of the ILR system enables this study to detect recurring problems and effective practices by uniting varied research sources through problem definition, literature analysis, data assessment, and data processing and presentation.

Figure 3: The 5 Stages of ILR

Through its characteristics the ILR approach contributes to theoretical progress while ensuring grounded practical findings thereby becoming an valuable source to guide digital transformation strategy development in higher education institutions.

to improve validity of the study the data collection should include adequate sampling, and all the decisions related to the sampling need to be justified and clearly documented in the method section of the ILR. Data collection should involve several strategies, and different available methods should be used to obtain information for the review (Russel 2005.) The author will begin the data collection by defining inclusion and exclusion criteria and the reasoning for including the chosen criteria. Specific information, such as keywords and databases, were discussed with the information analyst from the University of library, and the sources presented in a research table summary of the articles included in the study.

4.4 Time Horizons

This study adopts a cross-sectional time horizon to review data and literature from a distinct specific timeframe that exceeds traditional time-period analysis. The literature analysis includes academic and policy documents from 2015 to 2025 thus ensuring the collection of historical and contemporary perspectives on digital transformation and project management in higher education. The project requires a cross-sectional analysis

because it needs to explore Finnish university software usage together with data-driven solution performance at present time rather than tracking long-term developments. The study establishes results through dealing with a specific research period because this method demonstrates the most present-day practices and challenges involved with digital education in higher education. The research provides time-based research assessments that enables decision-makers to create actionable and sustainable recommendations in line with current digitalization progress and initiatives at national and EU educational institutions.

4.5 Literature Search Strategy

Detailed scientific research will be used by academic search platforms Google Scholar, ScienceDirect, and ProQuest to obtain peer-reviewed articles and scholarly publications from 2015 to 2025. The research design used three sets of keywords: “Project management” AND “higher education” AND “Finland”, “Data-driven” OR “analytics” AND “educational projects”, and “Software tools” AND “academic research management”. The research will focus included English-language peer-reviewed articles and policy papers which are fully accessible through Finnish academic library services. The research includes additional manual document collection and reviewing from UNESCO along with OECD and the Finnish Ministry of Education and Culture to gather supplementary policy-related documentation for proper data analysis and research work.

4.6 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria will be defined before conducting the data search to facilitate collecting the accurate data needed for the research. This research utilizes academic databases including Google Scholar and ScienceDirect and ProQuest together with institutional and government reports that constitute grey literature. The set criteria clearly define which sources meet inclusion and which do not to maintain both relevance and quality of those selected. The publishing date is limited to research publications from 2010 to 2024. The accepted and included data will be peer reviewed, academic

research articles. The methodology used PRISMA guidelines ensure proper transparency in selection protocols. The analysis method will reveal dominant patterns as well as obstacles and established research practices which can be applied to various Finnish academic institutions.

Table 4: Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Publication Date	2015-2025	Before 2015
Type of Studies	Peer-reviewed, full-text research articles, policy papers	Non-academic publications, opinion pieces
Language	English	Other Language
Geographical Focus	Studies relevant to Finland or comparable education systems	Studies unrelated to the Finnish context or higher education

4.7 Data Collection

A systematic academic database search through Google Scholar, ScienceDirect, and ProQuest occurred during data collection for "Enhancing Research and Educational Project Management in Finland through Data-Driven Solutions and the Use of Software Tools: An Integrative Research Work." The research implemented specific keyword searches composed of “project management,” “higher education,” “Finland,” “data-driven,” “analytics,” and “software tools” which specified a time range from 2010 to 2024 for peer-reviewed articles and policy papers that provided full-text content in English language. The search results will be imported into Zotero reference management software for organization. The screening process first evaluated titles and abstracts before moving onto full-text evaluation in line with specified selection and rejection standards. The research team will select relevant materials which focused on project management practices together with data-driven strategies and software tools used by academic institutions. A manual search targeted websites of UNESCO and the Finnish

Ministry of Education and Culture alongside OECD to retrieve grey literature containing policy documents. Working together with an information specialist allowed us to improve our search strategies and validate the scope of gathered information. The selected research will include both empirical research and case studies together with policy documents which provided knowledge about effective data-driven project and research management in Finnish higher education.

Researcher used Zotero reference software to manage retrieved records while removing duplicate entries after exporting everything into the software. The initial search phase had records from Google scholar, ScienceDirect, and ProQuest databases with automatic duplicate removal leading to manual removal of six remaining duplicate items. The final research compilation totaled 35 records. Through title screening researchers excluded 26 research studies. The author included all potential hits connected to psychosocial well-being and Rohingya crisis contexts although these terms were ambiguously described in the titles. The abstracts were evaluated in the second screening process followed by including research records with relevant information accessible in full text. Where nine records were removed from analysis because of not being relevant to the topic four, wrong settings or population were two, and research method excluded three. The last screening of full texts where 17 papers led researchers to read and evaluate their inclusion and quality potential. Five papers were eliminated after a full text read due to the criteria that excluded them, and one article was excluded for geographic area and literature review. Review of twelve studies concluded based on assessments of inclusion and exclusion criteria and research questions using evidence-based and scientifically valid criteria.

The twelve articles selected in this review demonstrate diverse multidisciplinary analysis about use technological tools in project management for research and education in the Universities of Finland. These academic articles met high methodological standards while offering substantial insights into technological use in education sector conclusions along with descriptive data regarding resilience elements, challenge coping practices and

availability. Different use of technology was on studies that measured beyond educational aspects to understand critical factors. The research focus on use of technology in education sector in Finland The wide-ranging studies collected from various sources provide essential knowledge.

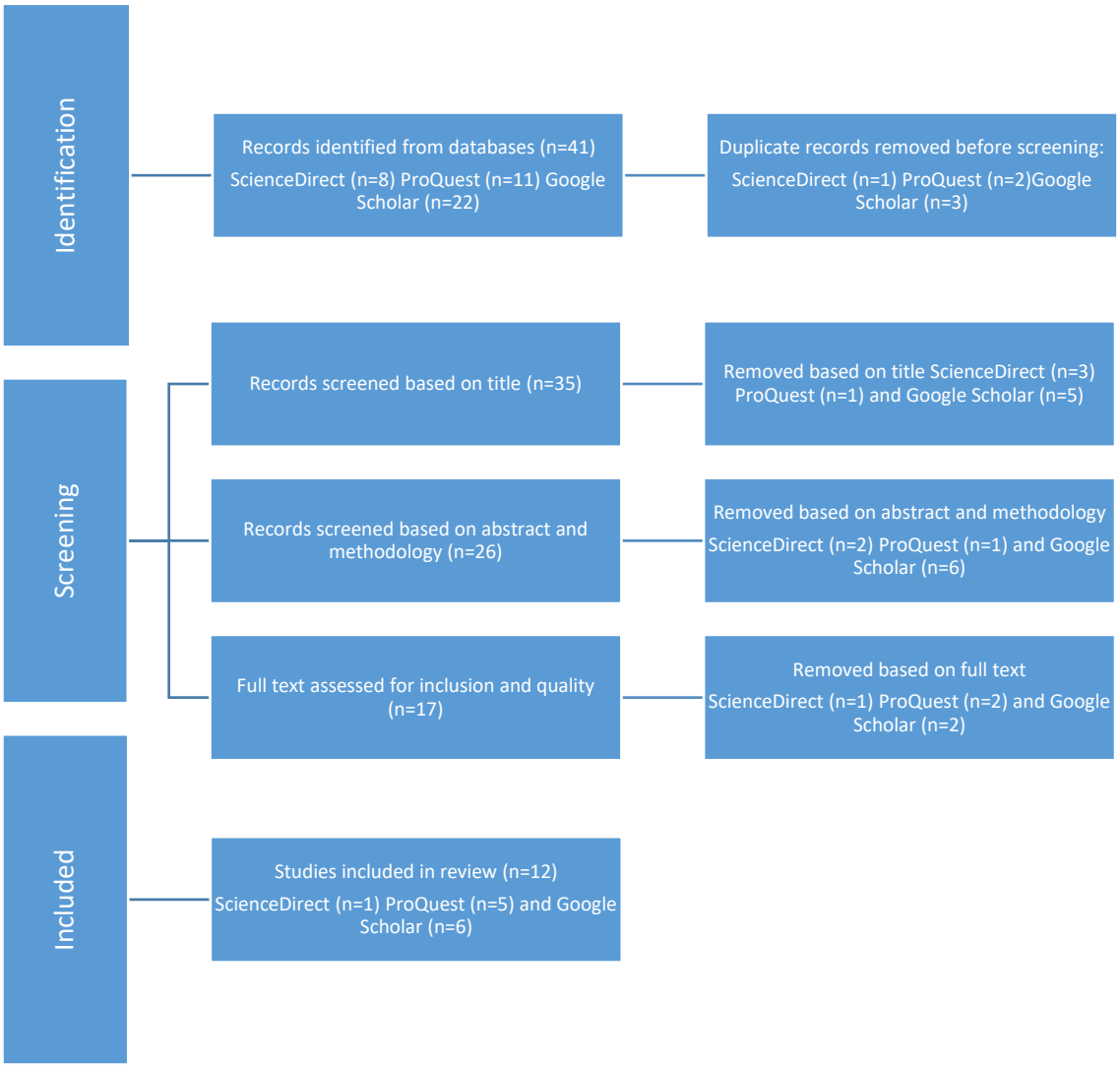

Figure 4: PRISMA, data search and selection process (PRISMA 2020)

4.8 Quality Assessment

The quality assessment of the integrative literature review (ILR) will focus on the research "Enhancing Research and Educational Project Management in Finland through Data-Driven Solutions and the Use of Software Tools: An Integrative Research Work" to guarantee selected study reliability and scientific rigor while maintaining transparency. An evaluation framework which is accounted for diverse methodological approaches and multidisciplinary material bases is required because of the sources that included both empirical studies and policy reports. Harrison et al. (2021) developed the QuADS (Quality Assessment with Diverse Studies) tool for assessment purposes. The QuADS evaluation approach proved optimal for diverse mixed-methods literature reviews by creating an effective system to assess methodological strength and evidence validity and reporting transparency.

The research will include only peer-reviewed publications from reliable scientific journals and official reports produced by established institutions such as the OECD and Finnish Ministry of Education and Culture for achieving high-quality results. An independent evaluation of each selected source took place through the application of the QuADS checklist which carried out scoring assessments using a four-point scale showing how well each criterion was satisfied. The study evaluation will use five criteria: research aims clarity, methodological integrity and relevance to context, data credibility and its impact on educational research and project management knowledge.

The synthesis process will prioritize interpretive weight to findings from the selective articles with higher quality scores accounting without excluding any studies findings because of quality standards. The author will include additional reflections through narrative discussions which will highlight exemplary methodological strengths and transparent limitations across the studies. The quality assessment procedure led to a reliable synthesis of data from the selective sources of knowledge regarding how data-driven methods and digital resources enhance educational improvement and project management and research activities in higher education institutions throughout Finland.

The integrative research quality measurement relies on the systematic review of the different research designs through the standardized approach. Qualitative, quantitative and mixed method studies that form the integrative reviews must be evaluated on a regular basis in order to generate sound information. The tools are referred to as ICROMS and QuADS that primarily attends to the needs with the help of standardized criteria of the paper in enhancing the clarity, methodological accuracy, and cross-study comparability. Researchers have the chance to enhance validity with background information of nonrandomized and qualitative study, and reliability with many expert checks and consistency measures among the raters, which enhances the worth of integrative reviews to evidence-based practice (Zingg et al. 2016, 20-22).

Researchers are recommended to analyze the quality assessment findings narratively and take into consideration regions where reporting is thorough or less so, as well as why, by looking at scores for each individual criterion across the body of work rather than the aggregate scores. (Harrison and others, 2021). Upon counting the scores and percentage of the research the author got scores between 80 and 99 with an average of 89. The quality of the research studies that were incorporated in the study was generally good. The analysis phase of the study did not particularly point out the higher-quality research papers compared to lower-quality research studies (Appendix 1).

4.9 Data Analysis

According to Whittemore and Knafl (2005) four systematic stages of data analysis of integrative research are: data reduction, data display, data comparison, and finally verification. Homogenization of the key insights of articles chosen entails the first step of data reduction, which is the transformation of these insights into uniform evaluation templates. The researchers applied data display matrices in showing results in a way that would allow them to compare thematic issues regarding software tools impacts and data usage habits as well as education outcomes. The analysis will also bring out general trends and other specific findings among different institutions and settings using

systematic systems of data review. The conclusion will draw the process with merging all data into structured themes by verifying those groups with original research documents to confirm accuracy and validity. The research investigators will support their analysis by creating multiple article groupings according to software classifications including project management systems and data analytics applications and will use case collections from educational planning to funding management and examining different stakeholder groups such as universities and research institutions and government agencies (Appendix 2).

4.9.1 Data Triangulation

Data Triangulation and Validation Credibility and reliability will be achieved through the triangulation of multiple sources of data which consists of:

- Academic Literature (Peer-reviewed journal articles).
- The analysis includes Institutional Reports, scientific research papers, which specifically Policies and case studies from Finnish universities.
- Industry White Papers which are maninly software providers' insights on adoption and efficiency.
- Different data sources will be cross-referenced to establish a well-balanced and comprehensive analysis of the data.

4.9.2 Ethical Considerations

Secondary data forms the basis of this study which raises important ethical matters about:

- The research must properly acknowledge and correctly cite every source which contributed to the study.
- This research validity stems from working with peer-reviewed and official information resources.
- The research maintains accuracy in findings presentation to prevent misinterpretations.

5 Result

5.1 Description of study included

Out of the chosen databases twelve studies were selected which covered various methodological approaches, including both qualitative and quantitative research and mixed methods research. The studies are within the period of 2015-2025, which can be regarded as the increasing academic interest in the field that develops over recent years. One of the significant clustering point was in 2019 (n=2), which could indicate an increase in the activity of research at this time. Moreover, one of the studies was published in 2021 and another one in 2023, which denotes a further topicality of the issue and a new direction of interest in the topic over the next few years. The remaining papers were spread out as the following 2024 (n=4), 2025 (n=4), and it can be noticed that there is an overall persistent interest in the subject over the years (table 5).

Table 5: Included studies by publication year

Publication Year	Number of Studies (n=12)	References
2025	4	• Gkintoni, E. et al. 2025 • MB Jelodar, 2025 • hummala, V.R. 2025 • Papuraj, X et al. 2025
2024	4	• Wang, S. et al. 2024 • Rahman, M.A. et al.2024 • Cujba, A., & Pifarré, M. 2024 • Umar, S.B. et al. 2024
2023	1	• Lee, E. Y. F., & Lee, E. L. S. 2023
2021	1	• Benia, F, 2021
2019	2	• Himanen, L. et al. 2019 • Nouri, J. et al. 2019

This study has examined the way Finnish universities embrace technological software and data-based solutions as a means to enhance management of research and educational projects. It analyzes the opportunities, challenges, and barriers to software adoption using an integrative literature review, which includes problems in infrastructure, training and standardization. The study uses pragmatism to come up with effective solutions, which is informed by the systematic collection of data, quality evaluation using the QuADS model, and thematic analysis. The results are expected to help the university leaders, project managers, and policymakers to improve the efficiency, cooperation, and alignment to the national and EU digital transformation agendas.

5.2 Present situation of software use in Finish Education

Technology in Finland is a topic that is valued as a means of providing inclusive education and as a way of offering more learning opportunities to every student especially the ones with special needs. To achieve more balanced learning environments, the study points out that there is an increase in the integration of digital equipment, specialized software, and assistive technologies by Finnish schools (Umar S.B. et al. 2025) . Technology is not a point of view but a component of the more comprehensive object of inclusion. It encourages personalized education, and it allows educators to customize learning to various student requirements. Digital solutions are text-to-speech, screen readers, and communication software to enable students with disabilities to use the same curriculum as other students. There are many educational software platforms utilized in Finnish schools such as digital learning environments, assessment tools and communication applications (Umar, S.B. et al. 2025 ; Thummala, V. R., & Saxena, S. 2024). On these platforms, collaboration among students, teachers and parents is possible. Progress tracking and support adjustment are also done with the help of software and based on data-driven insights (Appendix 2).

Table 6: most popular software used in Finnish education (covering schools, universities, and research project management).

Category	**Software / Tool**	**Purpose in Education**
Learning Management Systems (LMS)	Moodle, Google Classroom, Canvas	Course delivery, assignment submission, grading, and teacher-student interaction.
Collaboration & Communication	Microsoft Teams, Zoom, Google Meet	Online classes, group projects, virtual meetings, and teacher-parent communication.
Data & Research Tools	SPSS, R, Python (Jupyter), MATLAB	Data analysis, research, and statistics in higher education and research projects.
Educational Content Platforms	Edmodo, Khan Academy, Sanoma Pro Digital	Access to digital textbooks, self-learning modules, and interactive exercises.
Assessment & Testing	Exam.net, Wilma, Digiexam	Secure online exams, student assessments, and progress tracking.
Project Management Tools	Trello, Asana, MS Project	Organizing research projects, task management, and collaboration among staff.
AI & Learning Analytics	Smart Learning Analytics, Turnitin	Personalized learning, plagiarism detection, and performance monitoring.
Productivity & File Sharing	Google Workspace, Microsoft 365	Document creation, cloud storage, and collaborative editing.

Learning Management Systems (LMS) like Moodle and Itslearning are most popular in Finnish education. The most recent surveys have shown that more than a third of the institutions use these platforms to arrange courses, distribute materials and to administer tests. LMS systems facilitate flexible learning, particularly in institutions of higher learning where hybrid and online models of teaching are becoming typical. In addition to LMS, such collaboration tools as Microsoft Teams, Zoom, and Google Meet

are key. Approximately 30 percent of these institutions emphasize them as tools used on a daily basis to provide lectures, group projects, and communication between teachers and parents. These tools were especially significant in the conditions of the pandemic and have become a part of the teaching process ever since, helping local and international cooperation. Also, projects management and data-driven tools have increased in Finland. Approximately 15 percent of institutions use Trello, Jira, or MS Project as a way of organizing research and educational projects. Data dashboards (12% now) are becoming popular to identify the progress of students and institutional performance; assistive technologies (8% now) such as text-to-speech and screen readers are also helping provide inclusive education (Cujba, A., & Pifarré, M. 2024 ; Benita F. et al. 2021).

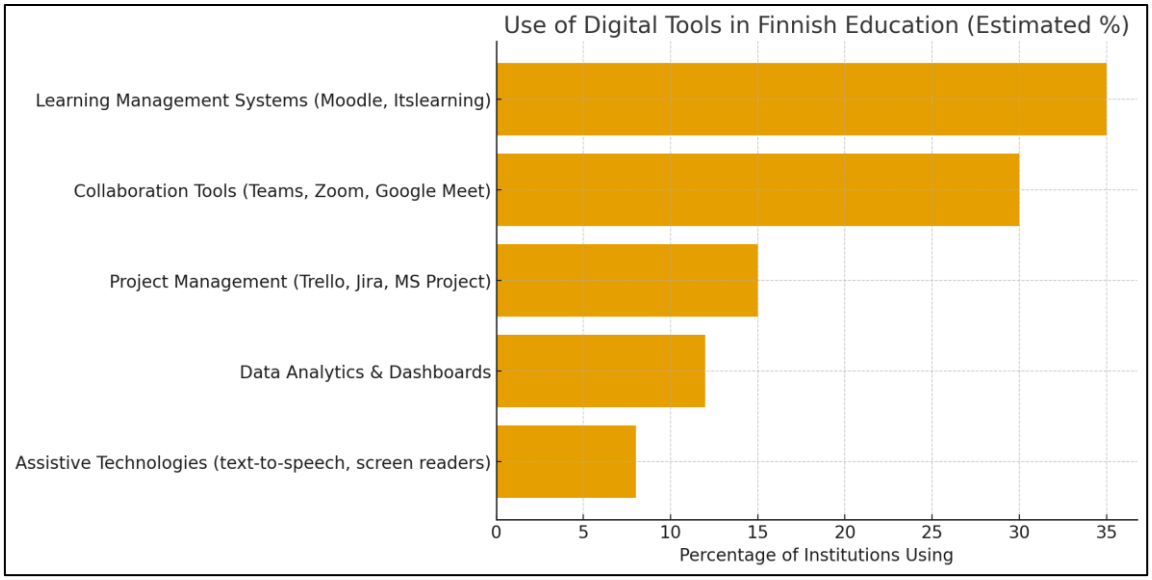

Figure 5: Use of digital tools in Finish Education

These article emphasizes that technology can only improve education whereby, teachers are equipped with the skills on how to use it efficiently. Finland teacher education is not limited to technical skills, but it also focuses on the pedagogical approaches towards the use of technology in classrooms that are inclusive (Benita F. et al. 2021 ; Umar, S.B. et al. 2025). Although it has improved, the study identifies several difficulties like the disparities in access to devices, the necessity to use more-specialized software in the

Finnish language context, and the ability to make digital tools meet the educational objectives. The future development involves enhancing cooperation among schools, municipalities and technology providers. The national curriculum in Finland promotes the use of digital competence as one of the lifelong learning skills. This is in line with the fact that the nation highly upholds equity, and no students, irrespective of their ability, should be left behind in the wake of technological innovations (Cujba, A., & Pifarré, M. 2024 ; Gkintoni E. et al. 2025).

5.3 Factors that Influence the Software and Data-Driven Solution

implementing the data-driven solutions and software in the management of the Finnish educational project are not predetermined by any one factor but are shaped by the combination of the data quality, usability, human possibility, economic assistance, policy compliance, and sustainability. All these factors have a role in the adoption and further use of digital tools in institutions. The Finnish experience brings out the fact that the technology process adoption is not only about design and management of the ecosystem, but also about the tools (Cujba, A., & Pifarré, M. 2024; Umar, S.B. 2025).

The data quality and standardization are one of the key issues that define the uptake of data-based solutions in the Finnish education. In the case of project management within the higher education and research sectors, the usefulness of the software is contingent upon the accuracy, consistency and comparability of the data across the institutions. Research institutes and universities in Finland tend to work in a collaborative context, and therefore interoperability is necessary. The absence of standardized formats and metadata might complicate the integration of the project outcomes and diminish the trust in the software. This problem is a reflection of the scientific world at large seeking ontologies and systems to facilitate meaningful data sharing and comparison (Umar, S. B. et al. 2025; Nouri J. et al. 2023; Lauri Himanen et al.2019).

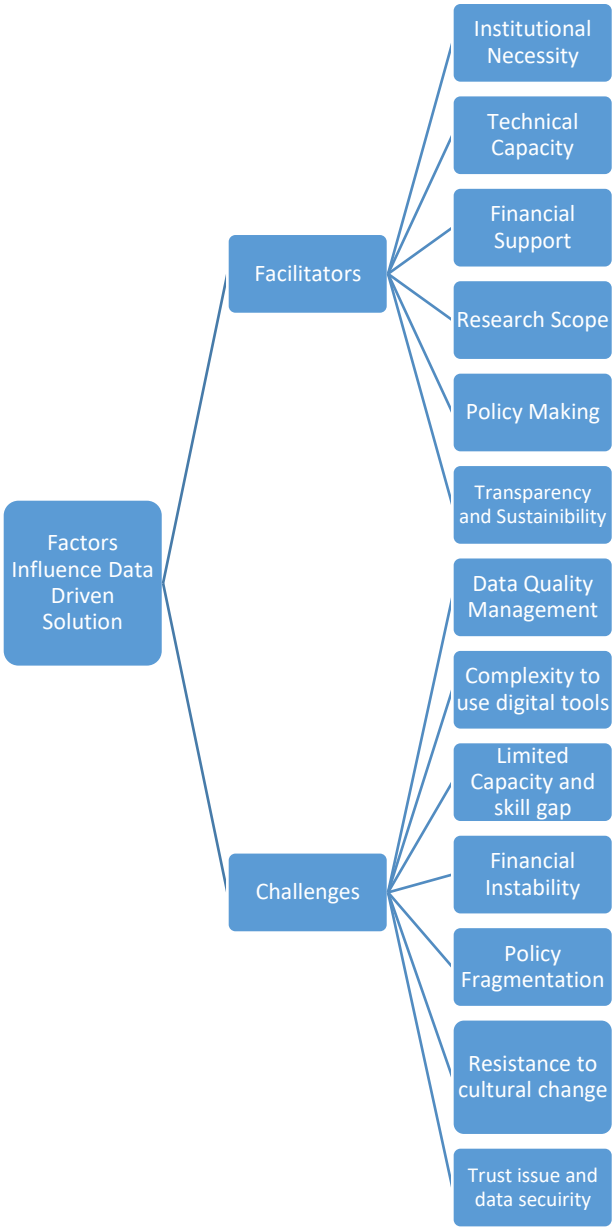

Figure 6: Factors related to software use and data driven solution in Finish education and project management (Jelodar M.B. 2025; Nouri J. et al. 2023; Lauri Himanen et al.2019 ; Lu Liang ,2025 ; Venkata Thummala, 2025 ; Rahman M.A. et al. 2024)

Usability and acceptance by end-users is a second key consideration. Even the most sophisticated tools may fail when being not user-friendly and/or user-oriented. Finland teachers, researchers, and project managers would prefer solutions which are easy to operate, easily integrated with the learning systems already in place, and do not need much technical skills. It is also very important in the education sector of Finland where

teachers and administrators are already overburdened with various duties. The softer the software is to implement, the higher the chances it has to be incorporated in the daily project management processes (Gkintoni E. et al. 2025; Jelodar M.B. 2025; Benita F. et al. 2021).

Skills and institutional capacity availability is another factor that determines the adoption to use the advanced data-driven tools, knowledge of analytics, data visualization, and even machine learning knowledge can be required. In Finland, universities are well-equipped, but still there is a gap between highly specialized IT personnel and general educators who should be able to deal with project data. Capacity-building based on professional development and training programs and cross-institutional cooperation is therefore a major factor. Most educational projects run the risks of not exploiting the available software tools without such investments in human resources (Jelodar M.B. 2025; Lauri Himanen et al.2019 ; Lu Liang ,2025 ; Venkata Thummala, 2025 ; Rahman M.A. et al. 2024).

The financial and institutional support is also an important role. Although Finland enjoys the advantage of high government funding on education, a significant influx of sophisticated software needs long-term investment (both in purchase or license as well as in long term use and maintenance). Open-source solutions or cloud-based systems are typically preferred, as they reduce the costs, however, the use of temporary project-based financing can lead to a disjointed adoption. There is therefore a need to move towards long-term financial approaches and institutional policies to make sure that the use of software will not fail the moment external funding is stopped to avoid what some researchers have dubbed as digital ruins of failed systems (Nouri J. et al. 2023; Rahman M.A. et al. 2024).

The Policy framework and ecosystem alignment have also significant aspects to align with digitalization of finish education. The high scores of Open Science, digital learning strategies, and open governance of Finland predispose it to the use of data-driven tools.

Institutions are more eager to conform to the national policies of data sharing and digital integration when the policies encourage the integration of the practice. In addition, integrating government, higher education and technology vendors makes the ecosystem stronger, as there is no isolation of solutions but a greater national education policy (Thummala, V. R. 2024; Papuraj, X et al. 2025; Benita, F.,2021).

Lastly, integrity, long-term, and sustainability are some of the factors that drive the selection of data-driven software in Finnish project management. Institutions are not keen on investing in the tools that might end up becoming outdated or those ones that might not be supported in the near future. The reliability of the software provider, safety of the stored data and assurances on long usage is thus a major factor. Secure storage, data curation, and continuous updates are some of the sustainable solutions that are likely to be accepted. These factors become very important in the acceptance of adoption in the system of Finland where stability and continuity is highly prioritized in the education system (Papuraj, X et al. 2025; Lauri Himanen et al.2019; Gkintoni E. et al. 2025; Lu Liang ,2025).

5.4 Challenges to use software and data-driven solution

When computers and other basic digital tools first entered classrooms in Finland in the early 2000s, the primary issue was the lack of infrastructure and disparities between urban and rural schools, in addition to these developments, there were challenges that could arise, such as a lack of skills in data analysis by teachers, unequal infrastructure access in rural schools, fragmentation of policies between schools, and continuing concerns about data privacy and security (Lauri Himanen et al.2019; Gkintoni E. et al. 2025). At present, as the Finnish education is investigating AI-based and learning analytics solutions, the issue of skill gaps, cultural opposition, and fiscal sustainability remain obstacles to the full achievement of the benefits associated with the data-oriented solutions (Jelodar M.B. 2025; Benita F. et al. 2021).

Data quality management

The quality of the data is one of the most prominent issues of the implementation of data-driven solutions in Finnish education. Learning institutions and schools gather immense amounts of data regarding students, teachers, and the Internet, which usually lacks consistency, completeness, or standardization. Poor quality of data may result in inaccurate analysis, incorrect decision making and inefficient intervention. The quality of insights is dubious without powerful data validation and data cleaning mechanisms (Thummala, V. R. 2024; Gkintoni E. et al. 2025; Lauri Himanen et al.2019).

Complexity of using digital tools

The rapid growth of digital platforms and analytical tools has introduced complexity and using issues in their adoption and use in finish education system as well as world's education system. Many educational stakeholders in Finland, including teachers and administrators, project staffs and students may find advanced data-driven tools difficulties to operate without proper training and resources. Complex interfaces, diverse functionalities, and integration requirements with existing systems create barriers and complex situations for digitalization of educational industry and project works. This complexity can discourage adoption and limit the ability to fully utilize digital tools for educational improvement and sustainability. It can be make a long time barrier in policy management (Gkintoni E. et al. 2025; Lauri Himanen et al.2019).

Limited capacity and skill gap

Despite the fact that Finland has a good education system, it has certain gaps in technical knowhow among educators and administrators as far as data-driven solutions are concerned. The teachers might be ineffective at analyzing, visualising, and interpreting data. Equally, organizations will have challenges hiring or keeping employees possessing experience in educational data science. This is a form of skill deficit that limits the promise of data-driven solutions because decisions can continue to be made based on hunch instead of sound data analysis (Papuraj, X et al. 2025; Benita, F.,2021).

Financial instability

Financial instability may affect the sustainability of data-driven solutions in the long-term even regardless of governmental funding and backing of education. The software licenses, maintenance of the infrastructure and training programs demand regular funding. When there is a slump in the economy or a re-allocation of budgets in schools and universities, data solutions might be disadvantaged due to financial limitations. This instability is liable to lead to disjointed implementation, where those institutions that are well funded are the only ones that are advantaged (Jelodar M.B. 2025; Rahman M.A. et al. 2024).

Policy fragmentation

The policies should be coherent at institutional and national levels to be able to develop data-driven solutions. The absence of harmonized policies in educational institutions is a problem in Finland at times. Whereas one university or school can embrace high-tech data platforms, other universities can be left behind by ambiguous regulations or lack of cohesiveness in policy. This unequal access, consumption and efficacy of data-driven tools in the education sector result due to this lack of uniformity (Rahman M.A. et al. 2024; Gkintoni E. et al. 2025; Lauri Himanen et al.2019).

Resistance to cultural change

Another issue in Finnish education system is cultural resistance. Educational leaders and instructors, who were used to the traditional approach towards teaching and administration, might be reluctant to accept data-based practices. This resistance is based on the fear of work overload, autonomy loss, or doubtfulness of digital tools effectiveness. Such resistance can only be overt by effective leaders, sensitization and showing real advantages of data-driven solutions (Rahman M.A. et al. 2024; Papuraj, X et al. 2025).

Trust issues and data security

The challenges of trust building and data security are critically important in data-driven education system. Parents, students, and teachers would require the assurance that sensitive educational data will be safely handled. The fear of data privacy, possible abuse, and unauthorized access can be considered as a barrier to the desire to share data. Finland has to be strictly controlled by the rules of GDPR but even in this case, the data solution may be restricted in its acceptance and adoption by perceptions of risk (Lauri Himanen et al.2019; Thummala, V. R. 2024; Gkintoni E. et al. 2025).

Integration with existing policies and systems

The problem that is directly connected with complexity is the one associated with integration of new software and the current systems. Student records, grading and administration Finnish schools and universities are commonly based on the legacy platforms. The integration of new data-driven tools cannot be done without smooth integration that may be technically challenging and expensive. Lack of effective integration of use of digital tools leads to silos of data, duplication of efforts and low efficiency levels which can be ruined the overall system (Gkintoni E. et al. 2025; Rahman M.A. et al. 2024).

Unequal access to resources and apadtation with the digitalization

The integrative literature review found out that institutional culture, support of leadership, and staff readiness determine the adoption and engagement of software tools in Finnish institutions of higher learning. Universities that incorporate digital transformation into the strategic plan and train constantly have the greatest adoption rates (Umar et al., 2025; Nouri et al., 2023). Microsoft Teams, Moodle, and Trello represent somewhat more engaging tools since they correspond to the usual workflows and facilitate collaborative learning. Yet, the inconsistent adoption of all level is still constrained by fragmented implementation in educational sector and project management and different degrees of digital competence among faculties of finish education industry. There are numerous cases of selective adoption among many

educators and researchers who apply digital tools to communicate but not to use more complex analytic functionalities or project management tools due to the perceived workload and uncertainty. Peer influence and departmental norms are also essential to engagement and interest of people, with faculties containing digital champions or institutional incentives achieving better user participation and continued software use in all sections. The results underline that onboarding policy, leadership advocacy, institutional integration, and structured onboarding should be considered a valuable reinforcement of the engagement level and the long-term digital inclusion.

All Finnish educational institutions do not have an equal access to technological infrastructure. Smaller schools or those that are located in the rural area might struggle to acquire the required hardware, reliable internet access, or modernized software. Such disparity brings about a digital divide in the education sector, as there are students who are enabled to learn advanced data-driven and lead the pack, and there are those who are not (Nouri J. et al. 2023; Lauri Himanen et al.2019).

Sustainability of implementation

Lastly, there is a long-term issue of sustainability of data-driven solutions. There is a need to have constant updates, training of the users and adaptation to new technologies even when the tools are effectively implemented. In the absence of a viable structure, solutions will be outdated or underused. In the case of Finland, addressing the idea of sustainability means that the government and institutions invest continuously and educators are expected to improve their professional abilities (Gkintoni E. et al. 2025; Lu Liang ,2025).

5.5 Recommendation for effective use of data-driven solutions

Predictive analytics and big data in academic project management

The results of the analyzed research studies show that the prospects of data-driven solutions in the area of improving the scope of technological tools in managing projects are high in the sphere of research and education in Finnish universities. Vartiainen, Niemi,

and Lipponen (2021) showed that predictive analytics can be transformative in the success of academic projects by determining the early risk factors and performance indicators in university research projects. Their research highlighted the fact that a predictive model can be systematically used to enhance decision-making, allocation of resources, and timely intervention, to make sure that projects remain aligned to the institutional goals. On the same note, (Rahaman et al. 2024) affirmed that decision-making based on big data enables project managers to make comparative analysis under a variety of variables, which ultimately enhances the efficiency and results in research-oriented settings. Collectively, these studies point to the fact that predictive and big data analytics can be integrated in an academic project management, resulting in an increased level of clarity and dependability of the planning, monitoring, and evaluation of the research results.

Collaborative approaches for data-driven learning

The other valuable outcome is related to the role of technology-enhanced, collaborative, and data-driven methods of learning in promoting the success of projects. As demonstrated by (Cujba and Pifarré 2024), when students received collaborative approaches for data-driven project-based learning process for the technological advancement, their attitude towards statistics and research improved in overall section. Benita et al. (2021) also demonstrated that the smart learning ecosystems have the potential to cultivate data-driven skills of thinking, particularly with the STEM education, by designing adaptive and individualized surroundings. The results apply directly to the Finnish universities, as they illustrate that software resources that are backed by data analytics do not only help manage the projects, but also the quality of learning and students engagement. The capability of information-based tools to make learning activity personal, to visualize progress, and to collaboratively solve problems has demonstrated to decrease the resistance of other stakeholders and boost motivation and ownership in a research and educational initiative.

Gaps in digital competence, resistance, and change management

The review also found out issues that should be overcome in order to achieve these benefits. It was stated that even though there are robust investments in data-driven learning in Europe, the gaps in digital competence, rejection of data use, and unequal institutional potentials remain the obstacles to complete adoption (Nouri et al., 2019; Lee and Lee, 2023). The results can be applied to Finland, where the educational sector is overly digitized and encounters difficulties in establishing uniform digital competitencies in various universities and fields. According to (Thummala and Saxena 2024), often, the cultural and structural changes in institutions, such as more flexible policies and administration support, are necessary in order to make data-based decisions in program management. Even the most progressive technological tools can be used relatively poorly without effective change management strategies, which (Umar et al. 2025) note are essential. These findings indicate that Finnish universities should enhance institutional culture and leadership dedication in order to provide sustainable and successful application of data-driven project management instruments.

Networks in education artificial intelligence (ai), deep learning

Moreover, artificial intelligence (AI) and deep learning analytics are becoming key factors in data-based project management in the field of education. Wang et al. (2024) discovered that AI can be used in education in order to enhance adaptive learning, administer administrative activities, and provide individualized feedback. Gkintoni et al. (2025) also claimed that the combination of AI and educational neuroscience can be used to maximize cognitive load and redefine the effectiveness of learning and may assist in the implementation of the project in universities in a more efficient way. Jelodar (2025) emphasized that generative AI and large language models, including ChatGPT, find more and more applications in the field of higher education to assist training, practice, and project management, despite the fact that issues of ethical use and accuracy are still present. Devoting their attention to the materials science, (Hamanen et al. 2019) highlighted that though data-oriented research methodologies could help to expedite the discovery and innovation process, they demand both developed data infrastructure

and knowledge. In the case of Finnish universities, these findings indicate that the adoption of AI-based solutions are likely to increase the extent of the technological instrumentation in project management but will require technical capacity, ethics, and sustainability investments.

Establish domain-specific software and digital tools

The other theme that is important is incorporation of domain software and data tools into educational project management. Even though Papuraj et al. (2025) addressed the context of Building Information Modelling (BIM) in Australia, the findings can be applied to Finnish universities: data-providing tools used in the industry can help to conceptualize the bridging gap between academic knowledge and practice. Universities can enhance the educational preparation of students and researchers by integrating domain-specific project management software into the curricula and research to provide them with skills that are academically useful as well as professionally desirable. This is in line with the interests of Finnish universities to generate practice oriented graduates and at the same time make research projects to be responsive to the needs of the real world.

Holistic adoption: data-driven solutions barriers to sustainability

Altogether, the findings can indicate that evidence-based solutions can greatly increase project management in Finnish universities by enhancing decision-making, creating collaboration, using AI, and aligning education with industry requirements. Nonetheless, inequality in digital competence, institutional inertia, privacy of data, and financial viability are also important barriers. The literature review demonstrates the significance of the holistic approach, in which data-driven tools should be backed by a robust change management (Umar et al. 2025), well-defined policies, and lifelong learning of personnel. It is only by solving these barriers that the Finnish universities are able to make the most of the potential of predictive analytics, AI, and smart learning ecosystems in improving both research and management of educational projects.

6 Discussion

The application of software and data-based solutions to Finnish education has developed markedly throughout the last decades, not just due to the technological improvements, but also due to the alteration of the education policy. Finland started incorporating the basic digital tools into classrooms in the early 2000s and was mainly concerned with computer literacy and the availability of internet in schools (Nouri J. et al. 2023; Lauri Himanen et al.2019). By the mid-2010s, with the rise of e-learning sites and cloud services overall the world, Finnish schools and universities had embraced learning management systems (LMS) such as Moodle and digital collaboration tools such as Google Classroom to promote interactive learning like other parts of the world and started to adopt with new system not only in specific sector but also in every section of project management. The use of educational technologies was further quickened around 2016 when the New National Core Curriculum introduced digital competence as one of the core transversal skills. But as these changes were positive, there were issues as well. The more frequent problem was the challenge of the teachers to keep up with fast changing technologies, as not all of them had high data skills, which could be used to analyze and use student performance data (Lauri Himanen et al.2019; Gkintoni E. et al. 2025).

The 2020 COVID-19 crisis was a watershed and every Finnish institution was forced to quickly deploy remote learning tools like Zoom, Teams, and other online solutions. Although this move has made accessibility and flexibility more accessible, it also caused the issue of differences in the use of gadgets and good internet connection particularly in rural areas. The level of cloud-based services was so high that the issue of data privacy and data security became even more sensitive, which is one of the primary aspects that should be considered in the framework of GDPR compliance and safe storage of sensitive information about students (Lu Liang ,2025). Between 2021 and 2025, however, Finland has made a new direction towards artificial intelligence (AI) and learning analytics in the personalization of education, but this change has brought with it new challenges, such

as financial sustainability, fragmentation in policy across institutions, and cultural resistance in educators who regard traditional teaching autonomy as an important value. In this way, although the history of software application in Finnish education shows a gradual shift towards digitalization, several issues of skill gaps, inequality in infrastructure usage, and data system trust and sustainability are present (Nouri J. et al. 2023; Rahman M.A. et al. 2024).

The findings of this study have gone a long way to indicate that data-driven solution integration can go a long way in transforming the project management practices in the Finnish universities. As Vartiainen, Niemi, and Lipponen (2021) note, predictive analytics provides a methodical means of determining risk factors and performance indicators at an early stage of the academic project life cycle. This enables the universities to use the resources in a better way, intervene before it is too late, and make sure that the projects are up to date with the institutional purposes. Equivalent findings by Rahaman et al. (2024) strengthened the fact that big data-based decision-making provides the project managers with the tools to make a comparative analysis of the various variables, which is a necessity in a complex research-based environment. All these findings combine to indicate the increasing understanding that predictive analytics and big data are not luxury items to add to the project management but must be part of the tools to guarantee clarity, reliability, and overall success in project management in higher education. At the same time the study findings showed some important points-

Improving both collaborative and student-centered learning

Administrative functions are not the only aspects of data-driven project management but the key to enhancing the learning outcomes of students. Cujba and Pifarré (2024) and Benita et al. (2021) demonstrated in their papers that technology based collaborative learning leads to motivation and critical thinking of the users who are related with project work or delivering education directly. It is similar to the previous research by (Karnaelin et al. 2007) who believed inclusivity and balanced school days were supported by technology in the special education in Finland. The implication to the

universities is to focus on the integration of data-driven approaches into the project-based learning to facilitate the inclusiveness, enhance student attitudes, and a sense of engagement among the diverse groups of learners.

Dealing with institutional and cultural resistance

These advantages are not without institutional difficulties, which are a significant impediment. Nouri et al. (2019) and Lee and Lee (2023) determined that digital competence and cultural resistance to data-driven approaches have gaps. These issues align with Umar et al. (2025) who have established that effective change in higher education can be achieved through change management strategies that are buttressed by transformational leadership. In the case of Finnish universities, this implies that leadership should help create a data-positive culture, promote the ability to be flexible in institutional policies, and promote knowledge-sharing mechanisms to overcome resistance.

Use of AI and generative technological roles

The findings point to the increasing role of the artificial intelligence (AI) and generative tools like ChatGPT in the education management of projects (Wang et al., 2024; Jelodar, 2025). Though these tools contribute to adaptive learning, automation of administrative tasks, as well as personalized education, their ethical application is a question. As Hamanen et al. (2019) emphasized, it requires a solid infrastructure and capabilities when it comes to managing data-driven research. In the case of Finnish universities, it means the implementation of AI should be accompanied by robust ethical standards, the openness of its use, and capacity-building programs that will help make its use responsible.

Connection between academic and industry practices

Another opportunity is the possibility of integrating industry-level data-driven tools in academia. Papuraj et al. (2025) illustrated it related to Building Information Modelling, and Balestra et al. (2025) proved that digital simulations may change the way forestry

management is taught. In the case of Finnish universities, the gap between theoretical education and practice may be overcome through the implementation of similar software that is relevant to the industry. This dual approach is very effective towards increasing the execution of projects, besides equipping graduates with skills that align with the demands of the labor market.

Information processing and training requirements

Data-driven solutions need a good structure of data management practices to be effectively used. According to Kanerva et al. (2022), the researchers found gaps in the research data management (RDM) training in Finland, which are characterized by disparities in awareness and capacity across institutions. The potential of data-driven solutions in project management may not be used properly without appropriate training in RDM and analytics. Universities thus should implement the RDM training in the curricula and research procedures so that the staffs and the students are able to utilize, analyze and preserve data efficiently.

Value of change management and leadership

Transformational leadership is an important facilitator of technological solutions sustainability as highlighted by (Umar et al. 2025). The project management requires data-driven efforts and the leader must be able to foster trust and lead the digital transformation of institutions and promote constant professional growth. This observation can be directly applied to Finland where the level of digitalization is high, both opening opportunities and challenges to the universities to change rapidly without jeopardizing levels of education.

Ethical and privacy issues

How the privacy of data and ethical issues in academic settings can be handled is one of the issues that are recurrent. As indicated by (Khan 2019), although Finland has made progress in data-driven education, it is still difficult to balance between innovation and responsible data practices. Since Finland is highly compliant with GDPR, universities

should consider putting in place structures that ensure protection of student and research data without restricting their creativity of utilizing analytics. The trust between the stakeholders should be established in order to promote the wider use of the data-driven tools.

Data-based adoption and ensure sustainability

Another key theme that is brought out in the outcomes is sustainability. Although AI and predictive analytics, as well as smart ecosystems are potential solutions, they need long-term investment, technical infrastructure, and institutional alignment. Pantović et al. (2024) underscored that data-driven decision-making needs to be integrated into the sustainable IT project management approaches. Long-term planning models that allow the Finnish universities to ensure that they invest in infrastructure, software updates, and training all the time should therefore be used.

Towards a holistic approach

Lastly, the fact is that it requires the holistic approach, and predictive analytics, AI, collaborative learning, and industry-aligned toolsets should be combined into one project management strategy. This also demands alignment of policies, inclusivity (Kärnä-Lin et al., 2007), and entrenching lifelong learning amongst the staff and students. This holistic framework is the only one that can help the Finnish universities to harness the maximum potential of data-driven solutions, and mitigate the challenges of competence gaps, cultural resistance and data privacy.

Finally, the discussion highlights the need to take a holistic strategy that incorporates predictive analytics, AI, and collaborative learning tools as well as industry-specific software into a single project management system. This integration should be backed up by a strong leadership, good data management, sustainable funding and good sense of ethics. The experiences of the previous Finnish research, e.g., Kärnä-Lin et al. (2007), are to remind us that the adoption of technologies must be inclusive and harmonized, whereby all learners and researchers are granted equal opportunities. Incorporating

inclusivity, sustainability, and ethical responsibility into their policies, Finnish universities will be able to maximize the potential of data-driven solutions and solve several age-old problems such as competence gaps, institutional resistance, and privacy issues. This holistic approach is necessary in order to ensure that the Finnish higher education can be globally competitive and in line with the changing needs of research as well as the society.

There has been a common issue of data quality and standardization. The performance indicator systems are based on the correct, comparable, and timely data input. The inconsistency in the standards of metadata, the absence of consistency in reporting processes, and inadequate automization make reports about institutional performance less reliable. According to studies like Kumpulainen et al. (2020) and Kanerva et al. (2022), the lack of training in research data management (RDM) and irregular staff digital literacy decrease the success of performance analytics tools.

The performance indicator software analysis, in the Finnish universities, indicates that these systems are the key to institutional governance, quality assurance, and strategic management. The Finnish higher education institutions (HEIs) are becoming more and more data-driven, which is in line with national priorities established by the Ministry of Education and Culture and the Digivisio 2030 initiative, which encourages the adoption of digital tools and analytics in the process of tracking performance and strategic decision-making. In this context, the software platforms like Pure, Converis, CRIS, and Power BI have developed into the foundation of performance measurement and reporting of academic and research-related activities.

Nevertheless, as much as these have been promoted, difficulties still exist in matching the software features with institutional practices. The integrative literature review found that there was fragmentation in the use of software across the Finnish universities. Although at universities like Aalto University, the University of Helsinki or Tampere University more complex analytics systems have been developed with access to national

data repositories (e.g. Vipunen and VIRTA), in many smaller universities and applied science institutes, less sophisticated tools are used.

The other important argument area is on the usability and acceptance of performance indicator software. Although Finland is well-digitally prepared, end-users (especially teaching personnel and researchers) are often seen as administrative burdens and not supportive tools. Effectiveness of performance monitoring software requires both technical integration and institutional culture and user engagement. The opposition to new data-based evaluation systems might be caused by the fear of the loss of academic autonomy, performance measure transparency, and the possibility of using data improperly.

In addition, the ethical and privacy are also important in the performance measurement systems. Because these instruments usually involve gathering personal information (sensitive and sometimes professional), adherence to the General Data Protection Regulation (GDPR) is obligatory. To maintain a secure approach to data management and transparency, universities have come up with internal principles and data governance models.

However, to achieve maximum using these benefits, a national policy in the governance of performance data is needed in the case of Finnish universities. Comparability and long-term sustainability would be enhanced with standardizing the definition of indicators, e.g. system integration across institutional borders and interoperable data architecture. Also, it is essential to invest in digital upskilling and develop a culture of trust and collaboration between academic personnel and data management specialists. Finnish universities can progress to a unified process, data-driven ecosystem and can make linkage with other part of the world, which not just quantifies not only the performance but improves academic quality in globally, innovation potential in a strategic manner by supporting digital literacy, standard harmonization.

7 Conclusion

This study explained how data-driven solutions and software tools can be used to improve research and educational project management in Finnish universities with references to two major research questions: which factors contribute to the adoption of software and what factors can promote the use of data-driven solutions. The results showed that the use of such tools as Microsoft Teams, Trello, Pure, and CRIS is popular in Finnish institutions, yet their effectiveness is impacted due to inconsistent implementation, low digital ability, and fragmentation of systems. The analysis also revealed that institutional culture, user training, data governance, and policy alignment are very important in adoption and success of software. The use of data-driven methods, including predictive analytics, integrated data management, and AI-supported decision-making, demonstrated to enhance the efficiency and collaboration of the project, as well as its transparency, when implemented well. To maximize these advantages, Finnish universities need to focus on the standardized systems, ongoing training in digital and effective ethical data management. Finally, the results of the study are that the adoption of data-based solutions in the context of coherent institutional strategies can greatly reinforce the performance, sustainability, and innovation of educational and research project management in Finland.

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Appendices

Appendices 1. Quality assessment with diverse studies (QuADS)

Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	Score	Score %
Shahawati Binti Umar et al. 2025	3	3	3	3	3	3	3	2	3	3	3	3	3	38/39	99%
Shan Wang et al. 2024	3	3	3	2	3	3	3	3	3	2	3	3	3	37/39	90%
Md Atiqur Rahaman et. al 2024	3	3	2	2	3	3	3	2	2	2	3	3	3	35/39	95%
Evgenia Gkintoni et al. 2025	3	3	3	3	3	3	2	2	3	3	3	3	3	37/39	95%
Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023	3	3	3	3	3	3	3	3	3	3	2	3	3	38/39	99%
Jalal Nouri, 2019	3	3	3	3	3	3	3	3	2	3	3	2	3	37/39	95%
Lauri Himanen et al. 2019	3	3	3	2	2	2	2	2	2	3	2	2	3	31/39	80%

MB Jelodar, 2025	3	3	3	3	3	2	2	2	2	2	2	2	2	31/39	80%
Xavier Papuraj et al. 2025	3	3	3	3	2	2	2	3	3	3	3	2	2	35/39	90%
Venkata Reddy Thummala and Dr. Shruti Saxena, 2024	3	3	3	3	3	3	3	3	3	3	3	2	2	37/39	95%
Francisco Benita et al. 2021	3	3	3	3	3	3	3	3	2	2	3	3	3	37/39	95%
Andreea Cujba1 & Manoli Pifarré 2024	3	3	3	3	3	3	3	3	3	3	3	2	2	37/39	95%

Appendices 2. Description of the data analysis processes

Facilitators of enhancing data-driven solutions and the use of software tools in research and educational project management in Finland

Facilitators	**Individual Level**	**Institutional Level**	**Government Level**
Institutional Necessity	• Students' operators need hands-on, practice-based learning with	• Universities and research centers require accurate data-driven systems (e.g.,	• National need for sustainable forest management and goals drives

	digital/VR tools for skill development and Project managers and workers need real-time insights for operational efficiency, risk mitigation, and timely delivery. They should develop skills on machine learning, feature engineering, and data curation are crucial for researchers **(Shan Wang, 2024; Evgenia Gkintoni et al. 2025; Jalal Nouri 2023 ; Md Atiqur Rahaman, 2024; Venkata Thummala, 2025).** • Need for adaptive tools to reduce cognitive load and personalize learning and researchers need access to reliable, standardized metadata to conduct machine-learning-driven studies **(Xavier Papuraj et al. 2025; MB Jelodar, 2025; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Lauri**	MLS, VR/AR) for training and decision-making and universities must adopt AI-driven systems for personalized learning, adaptive assessments, and real-time feedback **(SB Umar et al. 2025; Francisco Benita, 2021; MB Jelodar, 2025; Jalal Nouri,2023 ; Evgenia Gkintoni et al. 2025; Andreea Cujba& Manoli Pifarré, 2024).** • Universities and labs require digital infrastructures (databases, repositories) to store and share large volumes of experimental and computational data and organizations require robust data governance frameworks and integration of BIM/IoT/software to manage complexity **(Xavier Papuraj et al. 2025; Jalal Nouri, 2023; Lee, Ed Yi-Fang, and**	adoption of digital replicas **(SB Umar et al. 2025; Francisco Benita, 2021; Evgenia Gkintoni et al. 2025; Jalal Nouri,2023).** • Governments push for Open Science frameworks, requiring data accessibility in publicly funded projects and also programs and grants have historically promoted gender equality on campuses, though adoption remains uneven. **(Xavier Papuraj et al. 2025; Lauri Himanen et al.2019 ; Jalal Nouri,2023).** • Governments emphasize digital transformation in infrastructure projects to ensure transparency and accountability to to integrate

	Himanen et al.2019 ; Jalal Nouri,2023).	**Ed Lung-Sheng Lee, 2023 ; Shan Wang, 2024; Md Atiqur Rahaman, 2024 ; Lauri Himanen et al.2019 ; Venkata Thummala, 2025; SB Umar et al. 2025)**	AI in curricula, standardize practices, and promote digital transformation **(Venkata Thummala, 2025; Shan Wang, 2024; MB Jelodar, 2025; Md Atiqur Rahaman, 2024; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023).**
Technical Capacity	• Individuals gain capacity through training in MLS/VR/AR tools, increasing digital literacy and Skills in machine learning, feature engineering, and data curation are crucial for researchers **(Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Lauri Himanen et al.2019 ; Md Atiqur Rahaman et.al. 2024 ; Jalal Nouri et al.2023; MB Jelodar, 2025; SB Umar et al. 2025).** • Students and teachers require AI literacy training to effectively use	• Institutions build technical capacity with free/open software (e.g., 3DFin, CloudCompare) and digital infrastructures and Institutions vary (research vs. teaching focused) in shaping professors' workload and stress; capacity depends on support from colleagues. **(MB Jelodar, 2025; Jalal Nouri et al.2023; Lauri Himanen et al.2019 ; Lu Liang ,2025 ; Venkata Thummala, 2025).**	• Governments enhance capacity through national forestry networks (EFI Integrate+ Network across 26 countries) and national and regional bodies set standards for data quality, privacy, and technology readiness and invest in infrastructure for equitable AI access in rural/low-resource regions **(Shan Wang, 2024; Md Atiqur Rahaman, 2024**

	tools . Need for continuous training in AI ethics, coding, and system use **(Francisco Benita, 2021; Shan Wang, 2024; Evgenia Gkintoni et al. 2025; Xavier Papuraj et al. 2025; Andreea Cujba& Manoli Pifarré, 2024).**	• institutions need skilled analysts, cross-disciplinary collaboration, and continuous workforce training to capacity-building in AI literacy for educators; integration of AI in curricula. Also universities require AI tools for adaptive learning, assessment, and management to remain competitive with Institutions must build infrastructure such as AI-powered LMS and collaborative platforms **(Shan Wang, 2024; Jalal Nouri et al. 2023; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Md Atiqur Rahaman, 2024; Evgenia Gkintoni et al. 2025; Francisco Benita, 2021; SB Umar et al. 2025).**	**; Evgenia Gkintoni et al. 2025; MB Jelodar, 2025 ; Venkata Thummala, 2025).** • National and EU-level initiatives (e.g., European Materials Modelling Council, RDA) aim to unify standards and promote FAIR data and strategies to build capacity through national education policies, teacher training programs, and digital literacy initiatives **(Francisco Benita, 2021; Xavier Papuraj et al. 2025; Jalal Nouri et al.2023; Lauri Himanen et al.2019; Andreea Cujba& Manoli Pifarré, 2024; SB Umar et al. 2025).** • Broader social structures (e.g.,

			gender norms, UN equality agendas) influence capacity-building for women in academia **(Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Venkata Thummala, 2025).**
Financial Support	• Limited at individual level; depends on institutional projects or scholarships for training and grants help young scientists adopt high-throughput AI-based approaches and Individual professors face financial stress balancing childcare and career needs **(Venkata Thummala, 2025; Lauri Himanen et al.2019 ; Evgenia Gkintoni et al. 2025; MB Jelodar, 2025; Shan Wang, 2024).** • Individuals benefit from reduced costs through data-	• Funded through EU Rural Development and Horizon programs, institutional grants, and university projects. Also Firms require investment in cloud computing, IoT, and analytics platforms to cut waste and optimize budgets. Universities need funding for AI labs, data centers, and pilot projects **(Xavier Papuraj et al. 2025; MB Jelodar, 2025; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Francisco Benita, 2021; Md Atiqur Rahaman, 2024 ; Jalal Nouri,2023).**	• Major EU and national programs (e.g., EU Rural Development Programme 2014–2020) finance digital forestry adoption and long-term funding policies (e.g., EU Horizon programs) support Open Access publishing and Open Data infrastructures through Governments and global organizations (EU, UNESCO) allocate budgets for digital education and AI adoption **(Francisco Benita, 2021;**

	informed procurement and budget tracking and personal device ownership critical for equitable access **(Xavier Papuraj et al. 2025; Md Atiqur Rahaman, 2024; Francisco Benita, 2021; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Jalal Nouri,2023; SB Umar et al. 2025).**	• Universities depend on sustained funding to maintain repositories; without it, infrastructures risk becoming "digital ruins" and Universities hesitate to fund costly supports (on-campus childcare, lactation rooms), limiting institutional aid. Here partnerships with private sector for subsidized AI deployment can work good **(Shan Wang, 2024; Evgenia Gkintoni et al. 2025; Lauri Himanen et al.2019 ; Venkata Thummala, 2025).**	**Andreea Cujba& Manoli Pifarré, 2024; Jalal Nouri,2023; Md Atiqur Rahaman, 2024 ; Lauri Himanen et al.2019; Shan Wang, 2024 ; Venkata Thummala, 2025).** • Policies like federally funded grants and equality programs provide some structural financial backing and provide subsidies and public-private funding for AI in education **(SB Umar et al. 2025 ; MB Jelodar, 2025; Evgenia Gkintoni et al. 2025; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Xavier Papuraj et al. 2025).**
Research Scope	• Individuals (students, researchers) use digital replicas to practice tree marking, thinning	• Institutions expand research by integrating experimental and computational data under	• Governments and EU bodies set broader research agendas on sustainable

	simulations, and ecological studies and learners contribute to feedback loops on AI personalization Focus on adaptive learning, personalized tutoring, and emotional engagement **(Shan Wang, 2024; Jalal Nouri,2023; Evgenia Gkintoni et al. 2025; MB Jelodar, 2025 ; Venkata Thummala, 2025; Xavier Papuraj et al. 2025; Francisco Benita, 2021).** • Researchers explore diverse applications of ML (e.g., catalysts, superconductivity, materials discovery) and sometimes Academic mothers struggle with reduced research productivity due to family demands, affecting career trajectories where individuals can explore predictive analytics, risk	standardized ontologies. Also Institutional expectations (e.g., research vs. teaching load) shape women's scope of contribution in academia with institutions expand scope through real-time monitoring, quality control, subcontractor, and supply chain management **(Jalal Nouri,2023; Md Atiqur Rahaman, 2024 ; Lauri Himanen et al.2019 ; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023; Evgenia Gkintoni et al. 2025; MB Jelodar, 2025 ; Xavier Papuraj et al. 2025;).** • Institutions broaden research through interdisciplinary collaborations across computer science, psychology, and education **(Venkata Thummala, 2025; Shan Wang, 2024; Francisco Benita,**	forestry, digital innovation, and climate monitoring and Governments influence scope by prioritizing strategic areas (e.g., energy materials, sustainability, equity in STEM, diversity hiring) expand or limit opportunities for women's research **(Lauri Himanen et al.2019; MB Jelodar, 2025; Francisco Benita, 2021; Andreea Cujba& Manoli Pifarré, 2024).** • Governments shape scope by prioritizing sustainable construction and smart city initiatives and expand national research agenda in AI, equity, and education and National research funding agencies set priorities for AI and EdTech research to maintain global

	forecasting, and optimization in project workflows **(Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Md Atiqur Rahaman, 2024 ; Lauri Himanen et al.2019; SB Umar et al. 2025).**	**2021; Andreea Cujba& Manoli Pifarré, 2024; SB Umar et al. 2025).**	competitiveness **(Shan Wang, 2024; Jalal Nouri,2023; Evgenia Gkintoni et al. 2025; Md Atiqur Rahaman, 2024; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ;).**
Policy Making	• Individuals contribute indirectly by participating in field simulations that inform management practices and Professors navigate inconsistent or inequitable parental leave and tenure policies across universities and Awareness of ethical use of AI and privacy of personal data **(Evgenia Gkintoni et al. 2025; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Jalal Nouri,2023 ; Venkata Thummala, 2025).** • Practitioners must comply with data privacy/security	• Institutions provide evidence-based recommendations for forest management policy (via simulation outcomes) and enforce data management plans and promote open-source software in research workflows **(Venkata Thummala, 2025; Jalal Nouri,2023; Lauri Himanen et al.2019; Andreea Cujba& Manoli Pifarré, 2024).** • Institutions design but inconsistently enforce family-friendly policies; cultural stigma discourages use of them and develop internal policies	• Governments integrate digitalization into policies on sustainability, biodiversity, and climate resilience with Governments legislation on cybersecurity, open data standards, and construction safety monitoring **(Xavier Papuraj et al. 2025; Venkata Thummala, 2025; Md Atiqur Rahaman, 2024).** • Governments and funding agencies mandate Open Data and Open Access as conditions for

	rules and adapt to evolving digital standards and scientists adapt to Open Access and FAIR data principles to remain eligible for grants. Like Individual researchers and educators advocate for ethical AI policies in classrooms **(Francisco Benita, 2021; Shan Wang, 2024; MB Jelodar, 2025; Xavier Papuraj et al. 2025; Md Atiqur Rahaman, 2024 ; Lauri Himanen et al.2019).**	on data integration, governance, and accountability **(MB Jelodar, 2025; Md Atiqur Rahaman, 2024; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023; Xavier Papuraj et al. 2025).** • Institutions develop internal AI-use guidelines and ethical standards which will align with EU AI Act, UNESCO & IEEE AI ethics guidelines **(Francisco Benita, 2021; Shan Wang, 2024; SB Umar et al. 2025; Evgenia Gkintoni et al. 2025; ; Venkata Thummala, 2025).**	support and Government and associations (e.g., AAUP, federal equality acts) push for standardized family-supportive academic policies **(Xavier Papuraj et al. 2025; MB Jelodar, 2025; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Lauri Himanen et al.2019 ; Jalal Nouri,2023; SB Umar et al. 2025).** • Governments regulate data privacy, inclusion, and standardization of AI in education. Regulations on data privacy, security, and bias mitigation in AI education **(Shan Wang, 2024; Evgenia Gkintoni et al. 2025 ; Venkata Thummala, 2025).**
Transparency & Sustainability	• Training increases awareness of ecological, social, and economic	• Institutions must ensure transparency in AI-driven	• Governments ensure transparency via EU-funded

	trade-offs, fostering responsibility and workers benefit from accountability in task monitoring and fairer performance evaluations. Also researchers benefit from reproducibility and open workflows, increasing credibility and women professors call for fairer evaluation systems to sustain careers **(Jalal Nouri,2023 ; Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Lauri Himanen et al.2019 ; Md Atiqur Rahaman, 2024).** • Students need empowerment to question algorithmic decisions, ensuring sustainability of AI practices and Individuals expect algorithm fairness, trust, and unbiased learning materials **(MB Jelodar,**	decision-making and promote sustainable digital infrastructure which will ensure sustainability by using open-source tools and promoting reproducibility in data-driven and ensure longevity of databases and adopt curation practices to prevent data loss **(Xavier Papuraj et al. 2025; Shan Wang, 2024; Lauri Himanen et al.2019 ; Venkata Thummala, 2025).** • Institutions achieve sustainability by reducing waste, improving quality assurance, and ensuring long-term system integration and universities often lack transparency in applying policies, creating inequities in tenure/promotion **(MB Jelodar, 2025; Md Atiqur Rahaman, 2024 ; Jalal Nouri,2023; Lee, Ed Yi-Fang, and Ed Lung-**	networks and public access to sustainable data and Governments promote public accountability through Open Science mandates, enhancing trust and sustainability **(Lee, Ed Yi-Fang, and Ed Lung-Sheng Lee, 2023 ; Lauri Himanen et al.2019 ; Venkata Thummala, 2025; SB Umar et al. 2025).** • Governments enforce accountability frameworks, ethical AI deployment, and long-term sustainability policies and Governments push for sustainable, transparent, and cost-efficient infrastructure delivery and long-term sustainability depends on systemic

	2025; Xavier Papuraj et al. 2025 ; Evgenia Gkintoni et al. 2025 ; Shan Wang, 2024 ; Venkata Thummala, 2025; Andreea Cujba& Manoli Pifarré, 2024).	**Sheng Lee, 2023; (Evgenia Gkintoni et al. 2025; Francisco Benita, 2021; SB Umar et al. 2025).**	reforms and national policy enforcement for gender equity in academia. Along with enforce algorithmic accountability, transparency reports, and inclusive datasets **(Andreea Cujba& Manoli Pifarré, 2024; Shan Wang, 2024; MB Jelodar, 2025; Jalal Nouri,2023; Md Atiqur Rahaman, 2024; Evgenia Gkintoni et al. 2025 ; Xavier Papuraj et al.2025).**