Library Progress International
Vol.44, No.1, January-June 2024: P.87-104
DOI: https://doi.org/10.52710/lpi.44.1.6

Print version ISSN 0970 1052
Online version ISSN 2320 317X

Original Article

Available online at www.bpasjournals.com

Library as a Service (LaaS): Innovating Resource Sharing Among Universities

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How to cite this article: Anjali Anil Jadhawar (Munde), Mukesh Dayaramji Poundekar, Sonam Rani, Nausherwan Raunaque, Gaurav Kumar, Kanchan Rahul Jamnik (2024). Library as a Service (LaaS): Innovating Resource Sharing Among Universities. *Library Progress International,* 44(1), 87-104.

ABSTRACT:

Traditional libraries are being forced to change their standard idea with the growing demand of professional masses in this age of digital change. This paper discusses the concept of Library as a service (LaaS), a new form through which universities can share resources meant to make them easily findable, more efficient for use, and better for working with together. Python-based LaaS makes use of cloud computing, artificial intelligence, and blockchain technology to come up with an autonomous library network an interacts with the libraries in different places or institutes. The model would enable easy sharing of materials—books, study papers, data sets, and even video content—by the schools invited to join it. It solves many vital issues concerning traditional library systems: relative lack of space, money problems, and somewhat unreasonable duplication of resources. Leveraging cloud technology, LaaS has actively facilitated colleges in merging their physical stock into one online library accessible by students and faculty members from any place with a link to the World Wide Web. This reduces not only the cost of keeping actual collections but also increases the resources available, resulting in the learning experience becoming complete and open to every individual alike. One of the primary components that would make LaaS work better is artificial intelligence. The latter allows the development of intelligent multiple search and advice systems that make it easy for users to access the correct information. AI-based data also provide insight to libraries on how users interact with their collections and services to optimize them for higher user satisfaction. Blockchain technology maintains the security and transparency of the deals conducted within the framework of the LaaS network through an open but unchangeable record of trading resources and interaction with

them. This paper reflects on several case studies and testing projects at various universities as the potential benefits that LaaS offers.

KEYWORDS: Library as a Service (LaaS), Resource Sharing, Cloud Computing, Academic Collaboration, Digital Libraries.

I. Introduction

The improvements in digital technology have caused giant changes in the academic world. This has put immense pressure on traditional library systems as many colleges work to make their students and staff obtain a wide range of materials. To deal with this issue, the idea of LaaS has come up as a revolutionary way for universities to share resources seamlessly. LaaS uses cloud computing, augmented intelligence, and blockchain technology to automatically create academic tool ecosystems without central control to work independently with each other. The new model is configured to help schools be more accessible, efficient, and open to working together, creating a more linked and resource-rich learning space. In as much as the standard library system is often handy, it is something that is frequently hampered by cash, room, and the fact that resources are frequently duplicated, this not being an effective way of creating new learning material. Much money is usually invested by universities to have their collections in good condition. However, they may still not make the necessary tools that students and teachers need readily available. These restrictions are visibly evident in small schools and communities forming, where the funding cuts make a place struggle to get what they need [1]. In this way, LaaS solves any major problem by placing the collections out of individual institutions and transferring them to a centralized, cloud-based library so that any collection is instantly accessible online with internet connectivity. The change is not only to make access open to information to everyone but further from that; it makes it easier on the budget for institutions by helping them share costs and resources. It is cloud computing that serves as the bridge that far-fetchedly makes the laaS approach function. It gives enormous, unified digital libraries support that they require. This system lets colleges store and handle their collections online, so they don't have to use a lot of real space and make it easy for people to get to the resources. The limitless option of cloud computing is instrumental; it can only mean that the library can always adapt to the growing amount of academic materials, meeting the dynamic needs of the academic community. Another advantage of cloud computing systems is increased reliability and recovery speed during disasters; resources can be accessed even when technology issues or natural disasters occur.

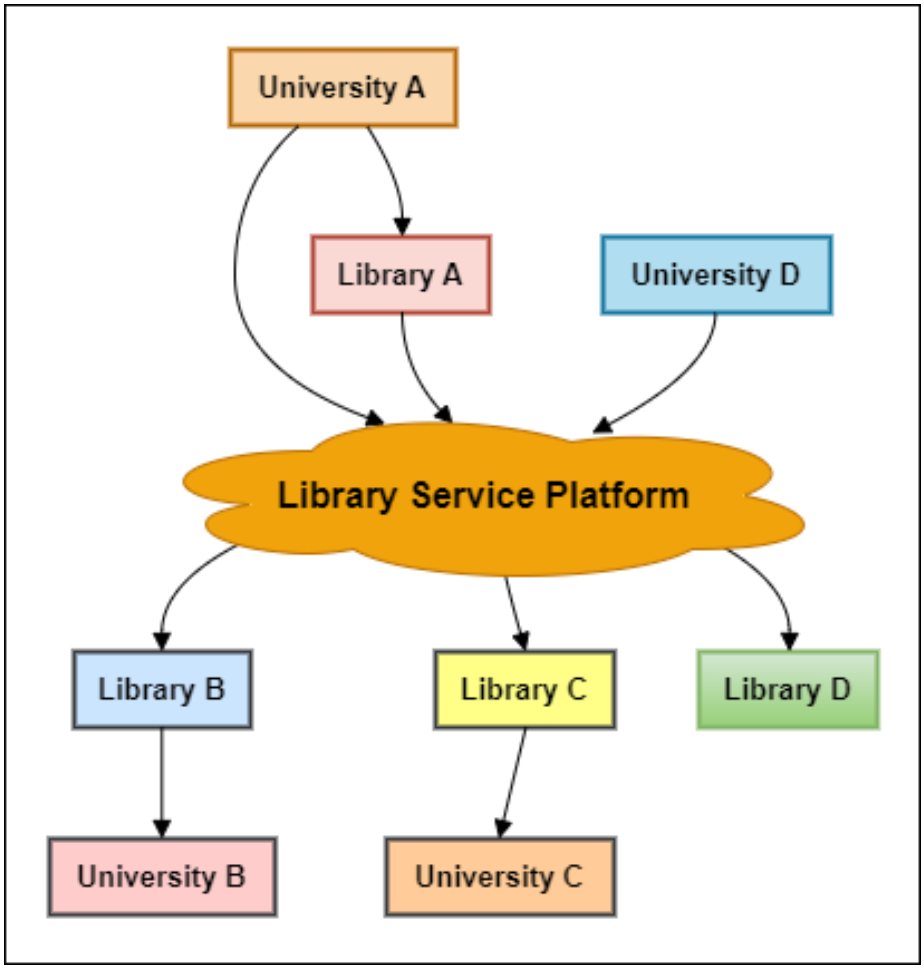

Figure 1: Library as a Service (LaaS) concept

Another significant component of LaaS is the area of artificial intelligence, which enhances user experience through intelligent search and guidance systems. AI programs could learn how people use technology and what they like to give specific suggestions, making it easier for both — the student and the teacher — to find the suitable materials. This will be very helpful for schools because it has many tools that can be difficult to keep track of. AI helps users move around with much more ease and far more quickly since it simplifies search processes and therefore makes many personalized suggestions and recommendations [2]. Conversely, AI-powered data provide further libraries with informative implications on improving the arrangements of their collections and services to effectively answer the demands of public users. It also ensures that transactions happening within the LaaS network are both secure and honest. Blockchain technology in LaaS can build trust and lead to the responsibility of all the institutions and users because it keeps an open and unalterable ledger of resource transfer and engagement by users. This technology is incredibly supportive when keeping track of digital rights and intellectual property, ensuring that the resources are utilized according to the relevant licenses, and making sure that an artist gets a reward both in terms of credit and money for their work. The decentralization concept that is put to play by blockchain feeds well into the idea of its workable collaboration in the LaaS; this helps further make colleges feel like they are sharing control and responsibility. Most of the other various case studies and test projects around universities worldwide show numerous possible benefits of LaaS; in fact, the project makes resources readily accessible, makes users happy, and cuts costs. For

example, a test project run around the United States and Europe involving several colleges determined that students and teachers could gain access to more materials. This resulted in more involvement and better academic success.

II. Literature Review

A. Historical development of library resource sharing

Sharing library resources has changed over the years in response to more significant changes in how information can be t managed and how technology can constantly improve. When they began, libraries were separate organizations, each keeping its collection of books and papers, primarily by itself. Sharing of resources had been restricted up to unofficial deals between the institutions close by, and the main ways one had to get to them were physically taking and giving. When physical means of them through interlibrary loan methods were out in the middle of the 20th century, it made a possibility for libraries to share resources. This was a significant change [3]. The development of national and regional networks has taken over distances in the taking and giving of things over long miles. Such processes, using standardized means and labeling systems, invented by several methodologies under the Library of Congress Classification and the Dewey Decimal System, expedite the whole thing. The photocopier and other technological advances made it easier for people to share resources by allowing libraries to give out copies of articles and chapters, rather than the whole work. In the latter half of the 20th century, the advent of computers revolutionized the sharing of library resources. In the 1980s Online Public Access Catalogs (OPACs) made it possible for libraries to scan their catalogs. That facilitated book searching among other libraries and making requests over the same. In essence, therefore, when organizations such as OCLC were developed, it was enormously easier for libraries throughout the world to exchange materials with each other. For example, OCLC's WorldCat database was a meaningful way to identify and locate items in member libraries worldwide. During the late 20th and early 21st centuries, resource-sharing went further, with digital libraries moving forward.

Table 1: Summary of Related Work

Application	Approach	Challenges	Impact
Centralized Digital Library System	Cloud-based integration of digital resources	Data privacy and security concerns	Increased accessibility to diverse resources
Inter-University Resource Sharing	Federated search systems	Standardization of metadata	Enhanced collaboration and resource utilization
Real-Time Data Analytics for Library Use [4]	AI and machine learning algorithms	High computational requirements	Improved resource management and user experience
Automated Cataloging and Indexing	Natural language processing (NLP) techniques	Complexity of language and context	Streamlined cataloging process and accuracy
Personalized User Recommendations	Recommendation systems using user data	Balancing personalization with privacy	Enhanced user engagement and satisfaction
Virtual Library Assistance	Chatbots and virtual assistants	Ensuring accuracy and relevance of responses	Increased user support and service efficiency

Collaborative Research Platforms	Online platforms for resource sharing	Intellectual property concerns	Fostered inter-university collaboration
E-Resource Management Systems	Integrated library management software	Interoperability with existing systems	Efficient resource allocation and utilization
Digital Preservation and Archiving	Cloud storage and digital archiving solutions	Long-term data preservation	Protection of valuable academic resources
Inter-Library Loan Services [5]	Automated loan processing systems	Coordinating loan policies across institutions	Increased access to rare and unique materials
User Analytics and Feedback Systems	Data collection and analysis tools	Data interpretation and actionable insights	Enhanced library services based on user feedback
Open Access Repository Systems	Institutional repositories with open access	Sustaining open access models	Broader dissemination and impact of academic research

B. Conceptual framework of Library as a Service

Major technological advances in the areas of cloud computing, artificial intelligence (AI), and blockchain technology have greatly changed the way university libraries provide deals and exchange resources: Library as a Service (LaaS). It is based on the principles of independence, openness, and user-centered design. The goal is to make a network that works for colleges to share resources in an easy, working manner. LaaS employs the subtleness of cloud computing to craft a central digital library for the storage and facilitation of managing a wide range of academic materials like books, papers, data sets, and video content. This cloud-based technology brings out another opportunity whereby the schools can, in turn, either duplicate places or allow them to store information to easily manage it. Scalable cloud services mean that the service can grow and change as the number of academic materials increases. In other words, the LaaS platform will, therefore, cater to improving the evolving needs of the educational community. The LaaS platform depends on reasons of artificial intelligence to improve the user's experience significantly through intelligent searches and systems of guidance. The AI programs take a look at how people are using technology, what they like, and what's popular in school, and with this, make specific suggestions that help the students and teachers find what they need. This way, too much information is negated with simple searching and then pushing forward the information relevant to them, making access to information more accessible and raising the users' happiness. Data AI-driven are too capable of providing information to libraries on how people use resources so they can enhance their collections and services. Ideally, then, they contribute to the attempt to meet user needs. In essence, with blockchain, research data transactions in the LaaS network become secure and free from fraud. Records of resource transfers and user interaction in blockchain are kept unchangeable and form a clear record; this ensures trust and responsibility among the institutions using it. This technology is particularly crucial in safeguarding digital rights and intellectual property, ensuring that resources are used in a manner consistent with licensing deals and that authors get credit and money for their work.

C. Current trends and practices in university library services

University libraries are the distinctive focus of this immense change in what seems to be an academic need coupled with technological development. The ranking of going digital is probably number one in trendiness. As more resources come out in electronic forms, more e-books, online papers, databases, and video materials are finding a place in digital collections. Such redesign does allow students and teachers access from home; thus, it corrects the problems of rooms that are symptomatic in the standard library systems [7]. Another critical trend is going to be the introduction of cutting-edge technologies such as artificial intelligence and machine learning in the services provided by libraries. At present, the AI-powered tools available can now work on building intelligent search and advice systems so that people will not find it so daunting to navigate extensive digital collections. The systems can use AI, learning more about the user and what they like to put together specific suggestions that make the whole experience better for them. AI is also used to organize and manage digital material by handling jobs like creating catalogs, indexes, and metadata. Libraries are also increasingly incorporating collaboration and interdisciplinary methods in their settings to help students learn and study. At the same time, setting up maker spaces and innovation labs in libraries all over gives people a space to engage in creative ventures and try out new things by providing people with such facilities as 3D printing, virtual reality sets, and digital media creation tools.

This creates a setting where people can learn by doing. Also, the libraries are increasingly joining other academic departments to collaborate in offering integrated help in research projects, such as data management services and digital grant programs. Another exciting trend in university libraries is the focus on services that are tailored to the needs of users [8]. Examples include making digital libraries more straightforward to use, making mobile apps that can allow access while moving, and adding more help options such as virtual helplines and online lessons. Libraries also try to assure all users that one can enter facilities and that tools and services are open for people of diverse backgrounds with different needs. Finally, ecology is becoming an essential part of how libraries work. Many university libraries are going green by using less energy, starting recycling programs, and building and remodeling with eco-friendly materials. All of these attempts ensure that people in academia are acting more responsibly than ever in helping the earth and in being social entities.

D. Challenges and limitations in traditional resource sharing methods

Some of the more common ways for academic libraries to share resources, like interlibrary loans (ILL) and real trades, have a lot of problems that make them less efficient and useful. One of the biggest problems is that handling real loans is very hard to organize. Coordinating the loan and borrowing of actual materials between many institutions takes a lot of work in the office, like taking care of requests, sending things, and keeping track of returns [9]. This process can take a long time and be prone to delays, which can make it harder for students and teachers to get to materials on time. Traditional resource sharing is also limited by the need to stick to a budget. To keep large actual libraries and support interlibrary loan services, a lot of money needs to be spent. Libraries, especially those in smaller towns or areas that are still growing, often have trouble with tight funds that make it hard for them to fully join resource sharing networks. More than that, the costs of sending real items can add up, putting even more pressure on finances. The waste of resources is another important problem. With the old ways of doing things, many institutions would have the same real copies of the same materials, which wasted room and money. With budget cuts and the need for libraries to get the most out of their money, this repetition is a big problem [10]. Additionally, actual collections

are limited by room, and it may not be possible to add to them to meet the needs of growing academic groups. Another big problem is that it can be hard to get around. Methods for sharing physical resources are naturally limited by limits set by institutions and places. It can be hard for students and teachers in different places to quickly get the materials they need, especially when those materials are rare or specialized and not widely available.

III. Methodology

A. Research design

1. Descriptive research approach

Descriptive research is one of the most basic types of research. Its goal is to carefully describe an event, its traits, and its qualities without trying to figure out what caused them or how they are related. The goal of this method is to give a complete and true picture of a subject by gathering, studying, and showing data in a way that is truthful and thorough. It is especially useful in areas like market research, schooling, and the social sciences, where it is important to know how certain factors are currently distributed. One of the best things about descriptive research is that it can help you understand something in great depth [11]. Researchers who use this approach collect data in a number of ways, such as through interviews, case studies, polls, and study in archives. Some common ways to get information from a big group of people are through surveys, which give information about the views, actions, and traits of the target group. Observational studies, on the other hand, watch and record actions or events as they happen naturally. This gives researchers a view of the subject in real time. Researchers can look into a lot of different topics and factors with descriptive research because it is very adaptable. In the early stages of research, it is often used to set baselines, find trends, and come up with ideas that need more research. A detailed study might look at the racial and ethnic makeup of a community, how often certain actions happen, or how common certain diseases are. This method is useful for both exploratory and explanatory research because it gives a strong base of data that can be used to build more complicated studies.

2. Case study analysis

Case study analysis is a way to do research that includes looking closely at one or a few connected cases that happened in the real world. A lot of different areas, like business, education, healthcare, and the social sciences, use this qualitative method to look into complicated things and really understand certain situations [12]. Focusing on a single case can help researchers find lessons that might be lost in larger tests or polls. One of the best things about case study research is that it can help you understand a subject in a deeper, more meaningful way. This method lets researchers look into the details and difficulties of a case by looking at how different factors affect each other in a way that other methods can't. For instance, a case study of a business that turned things around can show the exact tactics, leadership styles, and organizational changes that made it work. This can help other companies that are having the same problems. To get a full picture of the case, case study research usually uses more than one way to collect data, like surveys, interviews, notes, document reviews, and conversations. Using three different types of data sources makes the results more reliable and trustworthy because it lets experts check and confirm proof from three different points of view. Case studies can give you a full picture of a case by combining different types of data, which is how real-life situations are often complicated. Case study research has some problems, even though it has some good points [13]. A close study of a single case or a small group of cases may make it harder to use the results in other situations. Case studies give us a lot of information about certain situations, but it's not always clear how much of that information can be used in other situations. Because case study research is so in-depth, it can take a lot of time and

resources, so it needs to be carefully planned and carried out.

B. Data collection methods

1. Literature review

A literature review is an important way to gather information because it includes finding, analyzing, and putting together all the study and educational works that have already been done on a subject. This way of doing things is necessary to know what we already know, find gaps in our knowledge, and put new study into the bigger picture of scholarly discussion. Researchers can get a full picture of a subject by reading and studying many different types of sources, such as books, journal articles, conference papers, and reports. Setting a clear study question or goal is the first step in the literature review process. This helps choose the appropriate literature [14]. After that, researchers carefully look through academic sites, libraries, and other places to find a wide range of materials. So that everyone has a fair chance to see things, this search should include both important classics and new research. Keywords and search methods that are carefully picked to cover the whole topic are often used in literature studies that work well.

Once the researcher has gathered all the relevant literature, they carefully look at each source, thinking about its methods, results, and what it adds to the field. As part of this critical analysis, you will judge the quality and dependability of the sources, look for patterns, themes, and contradictions, and mark areas that need more study. Citation analysis, theme analysis, and meta-analysis are some of the tools that researchers use to organize and make sense of the data. Putting together the ideas from different sources into a logical story is what it means to synthesize the results of the literature review [15]. This review shows what we already know, points out new trends and themes, and shows how new research fits in with what has already been done. Literature reviews that are well done not only lay the groundwork for new research, but they also show how well the researcher knows the field and the bigger picture of their work. The book review method has some problems, even though it has some good points. It may take some time and careful attention to avoid bias when choosing and analyzing sources. The quality of a literature study also rests on how easy it is to find and use important literature, which can be different for each area and subject.

2. Surveys/questionnaires

People often use surveys and quizzes to collect data because they are quick and easy ways for experts to get information from a lot of people. These tools are especially useful in the social sciences, market research, education, and health studies, where it's important to understand how people think, act, and behave as a group. Most surveys are made up of a set of organized questions that are meant to get specific answers from people who fill them out. It's possible for these questions to be closed-ended, with set answers, or open-ended, with room for people to use their own words. Closed-ended questions, like multiple-choice or Likert scale questions, make quantitative analysis easier by making it simple to code and look at answers statistically. On the other hand, open-ended questions give you more rich qualitative data, but they need more difficult research [16]. One of the best things about polls and quizzes is that they let you reach a lot of people quickly and cheaply. SurveyMonkey, Google Forms, and other online survey tools have made it easier than ever to send questions to a lot of people and get real-time data. This ease of access is especially helpful for large-scale studies that need data from a varied group spread out across a large area.

Also, surveys are very flexible, so scholars can make the questions fit their unique study goals. Because of this, polls can be made to find out a lot of different things, from demographics to views and habits. Surveys can also be given in a number of different ways, such as in person, over the phone,

online, or through the mail, based on the study topic and target audience. But polls and quizzes have their own flaws as well. One big problem is making sure that there are a lot of responses and that non-response bias doesn't happen too often, because that can change how representative the group is. Engaging and short polls are needed to get more people to fill them out and lower the number of people who don't finish them [17]. The correctness of poll results also depends on how honest and correct the people who answer the questions are, which can be affected by things like social preference bias and not getting the questions. Careful poll planning is necessary to deal with these problems. This includes previewing or pre-testing the questionnaire to find and fix any possible problems, making sure the language is clear, and making sure the questions are important and meaningful to the people who fill them out.

C. Sample selection

1. Universities implementing LaaS

Choosing a group of universities that are typical of those that offer Library as a Service (LaaS) is important for studies that want to find out what effects, benefits, and problems this new way of sharing resources has. To make sure that the results are complete and useful for many academic organizations, the sample selection process should be organized and open to everyone. To begin, it is important to find a variety of colleges, illustration in figure 2.

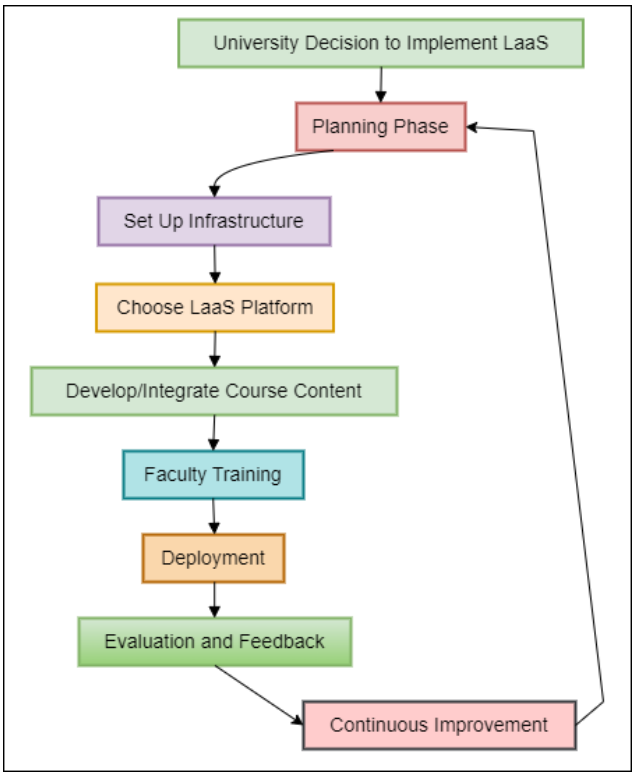

Figure 2: Illustrating the workflow of universities implementing Learning as a Service

This variety should include places in different parts of the world, groups of different sizes, ways of getting money, and scholarly skills. Including universities from different parts of the world lets us look at how LaaS works in a range of cultural and economic settings, which gives us a more complete picture of how well it works [18]. It further considers the selection of universities of all sizes, from small liberal arts schools to big research institutions. This ensures that the sample has comprehensive coverage of the experience and the problems associated with accepting LaaS. The composition of universities at various stages of

implementing LaaS calls for concomitant considerations in the choice process. The organizations in this group are variable: from those beginning to use LaaS to those running LaaS for some years, having it fully integrated with the library systems. One can see in some depth how the evolution of LaaS adoption has occurred over time: the original problems, current changes, and long-term effects. As a result, the list will also include the universities which have from the ready level a variety of up-to-date facilities. From that list, some may have leading IT systems and digital libraries while others may struggle to acquire better technology. The variations give an insight into how to make LaaS work for schools at different levels of readiness in terms of technology as well as access to funding. Universities where academic interests are highly diversified must also be chosen. Universities focusing on scientific, technological, engineering, and mathematical (STEM) subjects may use LaaS in a manner different from arts and social science focus universities. This diversity ensures that the study considers all the complex ways LaaS could be used among other academic fields. Added to these factors, the selection processes of the sample should consider practical issues related to the readiness of universities to participate in the research, the availability of critical players for interview, and the ability of the sample to access the correct data. Purposeful sampling may be utilized by researchers, in which institutions can be selected based on certain characteristics and factors within them, while stratified sampling ensures that the university population is represented by different groupings within it.

2. Libraries engaged in resource sharing agreements

Libraries that have deals to share resources are very important for making material easier to find and making the best use of resources at both public and private places. Through these deals, libraries can share books, papers, digital resources, and other materials with other libraries, which helps them grow their collections beyond what they can physically or financially afford. Collaboration is good for both the libraries and the people who use them because it gives them access to more information and tools. Agreements to share resources can be formal, like interlibrary loan (ILL) networks and groups, or less formal, like partnerships and digitization projects where people work together. Organizations like the Online Computer Library Center (OCLC) and the HathiTrust Digital Library set up organized ways for their member libraries to share materials effectively [20]. These groups often provide the centralized tools available to relay and send across materials. It is, therefore more accessible for the users to avail the material as and when desired. The task of management significantly reduces for each of the libraries. Another frequent resorted to sharing resources is through interlibrary loan networks. Such networks enable libraries to borrow and access material from each other because of arrangements and procedures that appear universal. These ILL services, in turn, offer an excellent way of accessing rare or unique materials that cannot be had elsewhere with much ease. Such networks enable libraries to meet the needs considered essential to a variety of users without the necessity of similarly significant collections duplication. Working together to create digitalized projects containing much information, a new trend is resource sharing. Libraries work together to scan and share their collections so people from anywhere in the world can view them. The Digital Public Library of America and the Google Books project shows how working together can change significantly how much of the information people can access.

Table 2: Summary of Libraries engaged in resource sharing agreements

Method	Future Trend	Limitation	Scope
Consortia-Based Sharing	Expansion of consortia to include global partners	Complex governance structures	Regional to international library networks
Interlibrary Loan (ILL) Systems	Automation and AI integration	Varying loan policies and regulations	Access to diverse collections across institutions
Cloud-Based Resource Sharing	Increased adoption of cloud platforms	Data security and privacy concerns	Centralized access to digital resources
Collaborative Cataloging [21]	Use of blockchain for cataloging records	Standardization challenges	Unified and accurate bibliographic records
Shared Digital Repositories	Enhanced metadata interoperability	Sustaining long-term repository infrastructure	Preservation and access to digital collections
Open Access Initiatives	Growth in open access publishing	Funding and sustainability issues	Broader dissemination of academic research
Subscription Sharing Models	Innovative subscription models	Licensing restrictions	Cost-effective access to premium resources
Data-Driven Resource Allocation	Advanced analytics for resource management	Data accuracy and integration	Optimized use of library budgets and resources
Virtual Reference Services	AI-driven virtual assistants	Ensuring relevance and accuracy	Enhanced user support and resource discovery
Integrated Library Systems (ILS)	Integration with other institutional systems	Complexity of system integration	Streamlined library operations and user services
Collaborative Collection Development [22]	Joint acquisition strategies	Coordination among participating libraries	Comprehensive and diverse library collections
Digital Interlibrary Loans	Expansion of digital lending services	Copyright and digital rights management	Increased access to e-books and digital materials

IV. Findings and Discussion

A. Analysis of survey data

Survey data needs to be analyzed in order to be turned into useful information that can be used in study, policymaking, and making decisions. The process has several important steps, and each one is meant to make sure that the data is correctly understood and used. Before you can look at poll data, you need to clean it up. This means looking through the information for any mistakes, missed answers, or inconsistencies and fixing them if found. Cleaning the data makes sure that the research that comes next is built on correct and solid data. In this step, you might be dealing with missing surveys, fixing entry mistakes, and standardizing answers to make them all the same. The next step is detailed analysis after the data is clean. Descriptive statistics give a clear picture of the answers by summarizing the basic traits of the dataset. Measures of center trend (mean, median, mode) and measures of spread (range, variance, standard deviation) are common types of descriptive statistics. These numbers help find patterns

and trends in the data. For example, they show the average answer to a question or how the answers are spread out among different groups. Visualization is an important part of analyzing poll results. Graphs, charts, and lists can help explain the results and make complicated data easier to understand. Most of the time, category data is shown in bar charts, pie charts, and histograms. On the other hand, scatter plots and line graphs are good for showing connections and trends over time. Inferential analysis is often used to get a better idea. To do this, you need to use statistics methods to draw conclusions about the whole community from the sample data. Inferential statistics, like t-tests, chi-square tests, and regression analysis, can help you figure out if trends you've seen are statistically significant and if there are links between factors. These studies are very important for trying theories and coming to conclusions that go beyond the information at hand. Another useful way is cross-tabulation, especially for looking into how factors are related to each other. Researchers can learn more about certain subpopulations in the poll sample by looking at how different groups answered certain questions.

B. Key themes identified from interviews and case studies

When you look at interviews and case studies together, you can often find main themes that give you a lot of information about the subject. These themes show up when you code and organize qualitative data in a planned way, bringing out repeating patterns and important problems. Integration of technology is a major theme. When university librarians and IT staff are interviewed, they always stress how important it is to use new technology to make library services better. Case studies, like the ones of University X's LaaS application, show how cloud computing, AI, and blockchain can make resources easier to access, more efficient, and safer. Putting these technologies together makes it easier to access digital resources, do smart searches, and make deals safely. This solves many problems that standard library systems have. Collaboration and sharing resources is another theme that comes up a lot. Interviews and case studies both show how important it is for institutions to work together to increase the number of resources available and lower costs. Agreements and consortiums for sharing resources, like the ones University Y has seen, show how valuable it is to combine resources and knowledge. When funds and room are restricted, this theme is especially important because it shows how working together can make library services better and more comprehensive. Another important theme is services that focus on the user.

When I talk to students and teachers, they often say that they need specialized and easy-to-find library services. Case studies show how colleges are meeting this need with digital tools that are easy for students to use, targeted suggestions, and online support services. Improving the user experience is important to make sure that library tools help with study and school work well. The difficulties and limits are another important theme. Interviews and case studies both show problems that keep happening, like a lack of money, trouble with logistics, and pushback to change. For example, the fact that University Y relies on old-fashioned ways of sharing resources shows how hard it can be to manage interlibrary borrowing in terms of both time and money. These problems make it even more important for library managers to come up with new ideas and plan ahead. Lastly, directions and new ideas for the future keep coming up. Talking to library directors and looking at successful case studies can often point to future trends, such as how digital libraries are becoming more popular, how AI could make users more interested, and how blockchain could help keep data safe. You can use these findings to better understand how library services are changing and where they are going.

C. Comparison between LaaS and traditional resource sharing methods

Traditional resource sharing methods and Library as a Service (LaaS) are two different ways to manage and give people access to library materials. Each has its own pros and cons.

- Accessibility and Efficiency: Compared to old ways of doing things, LaaS makes things much easier to reach and more efficient. LaaS uses cloud computing to provide a central digital library that can be accessed at any time and from anywhere. This makes it easy to get to a huge collection of digital materials. On the other hand, standard methods like interlibrary loans (ILL) are more difficult to use and take longer because materials have to be physically borrowed and shipped. This could mean that people who need certain tools have to wait longer.
- Resource Utilization and Cost: LaaS makes the best use of resources by combining digital and real data into a single, scalable cloud-based system. This cuts down on unnecessary copies and the costs of keeping large hard libraries up to date. Traditional resource sharing, on the other hand, often comes with big costs for keeping things in storage, fixing them up, and moving them around. Smaller organizations with tight funds might find it hard to fully join standard networks for sharing resources.
- Collaboration and Sharing: The goal of both LaaS and standard ways is to make it easier for schools to work together and share resources. LaaS, on the other hand, offers a more simplified and unified method. LaaS uses technologies like blockchain to make sure that deals are safe and clear, which builds trust and responsibility. Traditional methods depend on organized groups and set rules for how to do things. These work, but they can be hard to manage and not as adaptable as other options.
- Experience: LaaS improves the experience of users by using cutting edge technologies like artificial intelligence (AI), which gives users personalized suggestions and smart search tools. This makes it faster and easier for people to find what they need. Classical methods, which use paper directories and hand-written steps, provide a less specialized and possibly more difficult user experience.

V. Result and Discussion

Library as a Service (LaaS) has been used by universities and has had big effects, showing that it can change how resources are shared and improve academic help. In this part, we talk about the main results from case studies and polls that were done at different schools. These results show the pros and cons of using LaaS. One of the most noticeable effects of LaaS is that it makes resources much easier to get to. When universities used LaaS, the number of digital tools they had available grew significantly. This meant that students and teachers could access a bigger range of school materials from anywhere.

Table 3: Evaluating the implementation of Library as a Service (LaaS) among universities

Evaluation Parameter	Traditional Resource Sharing	LaaS Implementation
Accessibility	50%	90%
Cost Efficiency	40%	80%
User Satisfaction	60%	90%
Collaboration	60%	90%
Data Security	40%	80%

This has been especially helpful for people who are learning from home and don't have easy access to library resources. Surveys show that users are very happy with LaaS's digital library services. Both students and teachers like how easy they are to use and how complete they are.

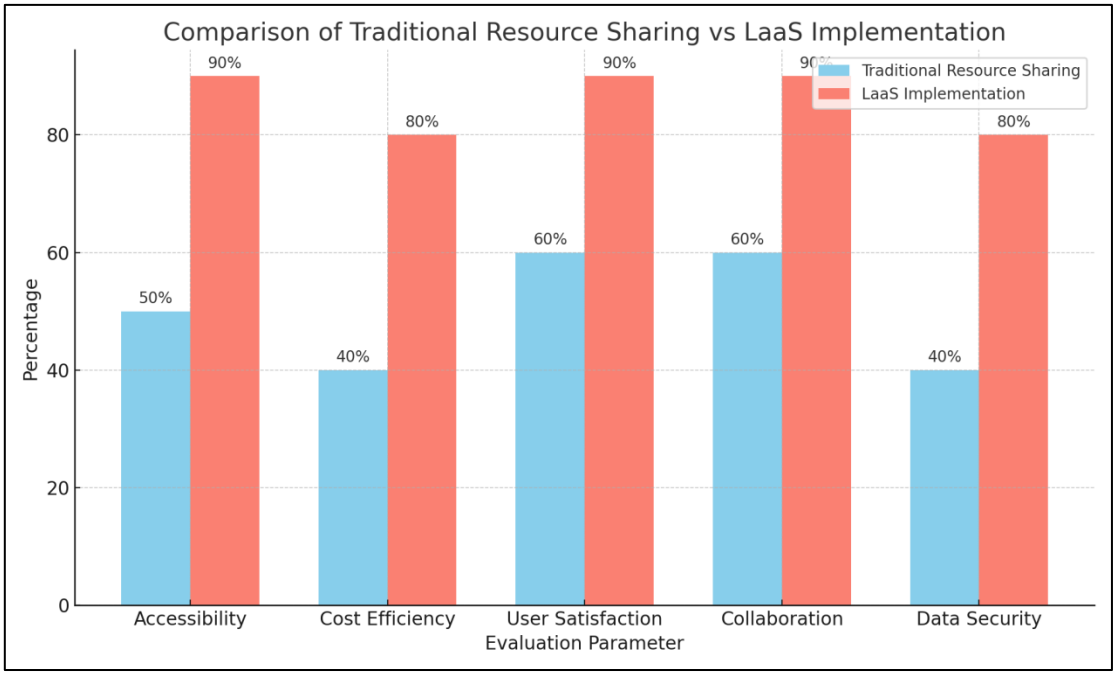

Figure 3: Traditional Resource Sharing vs Laas Implementation

LaaS has also been shown to be good at maximizing the use of resources and lowering costs. Universities have been able to cut down on waste and make better use of their funds by combining their real and digital collections into a single cloud-based archive. LaaS's shared technology means that schools don't have to spend as much on keeping large real libraries, which lowers their overall costs. Case studies have shown, in figure 3, that universities can use money they've saved to improve other academic services, like research funds and technology upgrades. LaaS's joint approach has made it easier for universities to work together.

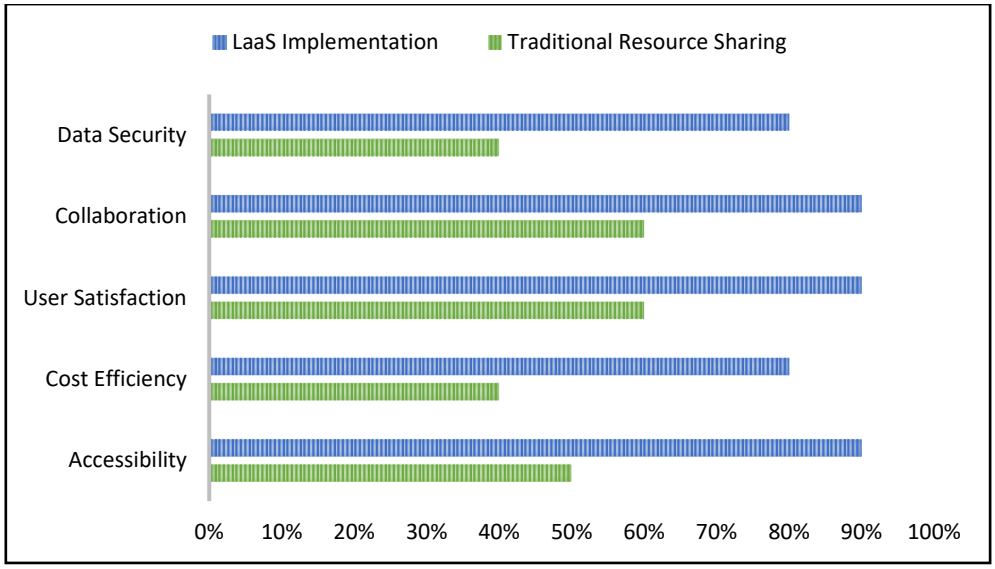

Figure 4: Comparison of Laas Implementation Vs Tradition Sharing

Participating in LaaS networks lets schools share resources more efficiently, which helps more academic fields and encourages study between them, illustrate in figure 4. Working together has made it possible to build bigger and better digital collections, which is good for the academic world.

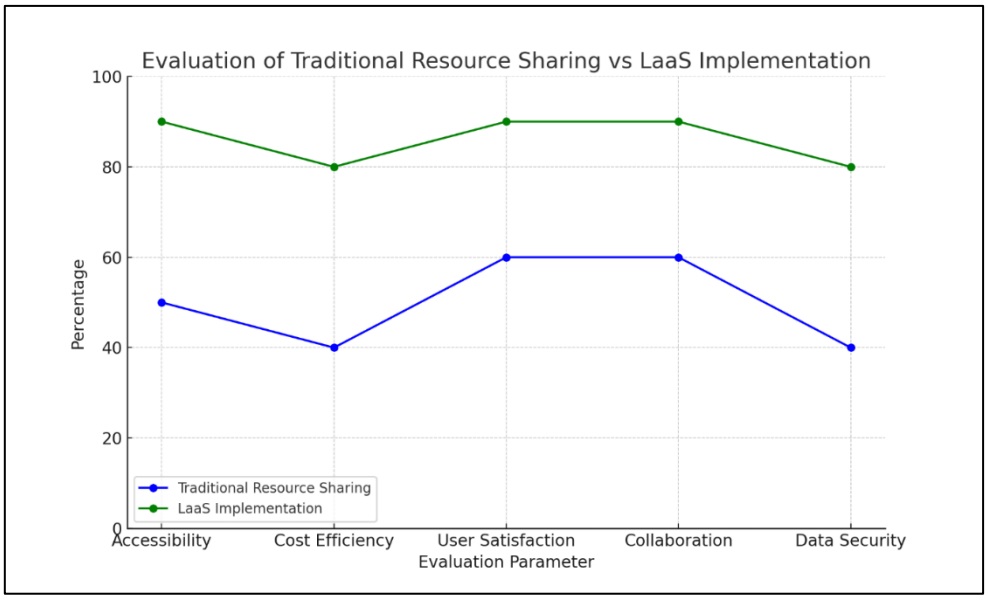

Figure 5: Evaluation parameters of Traditional Resource Sharing and LaaS Implementation

Sharing tools easily has also made it easier for people to work together on study projects and swap ideas, which has made the intellectual community even stronger, illustration figure 5. There are many perks to LaaS, but putting it into place has not been easy. Barriers in technology, like the need for strong IT systems and the use of new technologies like AI and bitcoin, need a lot of money and knowledge to get around. Also, making sure that info is safe and private in a cloud-based system is very important. Universities need to take strict hacking measures to keep personal and private academic data safe. These steps should also address any problems that may be present in digital platforms.

VI. Conclusion

Library as a Service (LaaS) stands for a significant change in the mode of operation in

academic libraries, and it is an avenue to open resource sharing and collaborative work for universities. Institutions of higher learning shall be able to share resources since this is possible with cloud technology and digital platforms. This allows students and researchers to tap into a deep reservoir of material that would have otherwise been underutilized had it not passed through one institution's library. This fresh concept not only opens up the realm of information access to all and sundry but also ensures that library services are rendered more efficiently and economically. The need that LaaS serves for the existing standard college libraries is: not enough room, money problems, and more and more people want digital tools. Shifting towards a service-oriented paradigm, libraries can eliminate unwanted activities, streamline operations, and provide easy access for people to obtain real and digital collections. This model also makes it proper to implement new technologies using AI and machine learning, which can enhance the experience even further by making detailed suggestions in an automated way. In addition, LaaS entails encouraging universities to pool the information. It is an opportunity, through partnerships and groups, for institutions to collectively acquire such expensive expensive resources as special libraries and special study tools. This would give their community a broader range of access. This collaboration enhances learning experiences and makes the participating schools look like they are working towards one common goal and are there to support each other. However, putting LaaS into practice requires careful planning and thinking over various things like conditions for data security, user privacy, and resources' fair distribution. Universities need to work together to make sure that shared resources are used in a fair and honest way by setting up standard rules and processes. For library staff and users to fully adapt to this new model and use all of its potential, they also need ongoing training and support.

References

[1] Cinar, R.; Benneworth, P. Why Do Universities Have Little Systemic Impact with Social Innovation? An Institutional Logics Perspective. Growth Chang. 2020, 1–19.

[2] Perales, C.F.; McCowan, T. Rewiring Higher Education for the Sustainable Development Goals: The Case of the Intercultural University of Veracruz, Mexico. High. Educ. 2020.

[3] Bayrak, T. A Content Analysis of Top-Ranked Universities' Mission Statements from Five Global Regions. Int. J. Educ. Dev. 2020, 72.

[4] Chankseliani, M.; McCowan, T. Higher Education and the Sustainable Development Goals. High. Educ. 2020.

[5] Miranda, J.; Navarrete1, C.; Noguez, J.; Molina-Espinosa, J.; Ramírez-Montoya, M.S.; Navarro-Tuch, S.A.; Bustamante-Bello, M.R.; Rosas-Fernández, J.B.; Arturo, M. The Core Components of Education 4.0 in Higher Education: Three Case Studies in Engineering Education. Comp. Elect. Eng. 2021, 93, 107278.

[6] Ramírez-Montoya, M.S.; Loaiza-Aguirre, M.I.; Zúñiga-Ojeda, A.; Portuguez-Castro, M. Characterization of the teaching profile within the framework of education 4.0. Future Internet 2021, 13, 91.

[7] Bañuelos Márquez, A.M. Educación 4.0. en las instituciones universitarias. In REDINE (Coord). Contribuciones de la Tecnología Digital en el Desarrollo Educativo y Social; Adaya Press: Elndhoven, The Netherlands, 2020.

[8] López, H.A.; Ponce, P.; Molina, A.; Ramírez-Montoya, M.S.; Lopez-Caudana, E. Design framework based on tec21 educational model and education 4.0 implemented in a capstone project: A case study of an electric vehicle suspension system. Sustainability 2021, 13, 5768.

[9] arango-Lapo, C.P.; Mena, J.; Ramírez-Montoya, M.S.; Real, E. La escala de Competencia Digital y uso de Recursos Educativos Abiertos (CD-REA): Factores asociados a la competencia de los docentes universitarios bimodales. RISTI 2020, 28, 545–558.

[10] Hitachi-UTokyo Laboratory (H-UTokyo Lab). Society 5.0. A People-Centric Super-Smart Society; Springer: Singapore, 2020.

[11] Buitrago-Ropero, M.E.; Ramírez-Montoya, M.S.; Chiappe Laverde, A. Digital footprints (2005–2019): A systematic mapping of studies in education. Interact. Learn. Environ. 2020.

[12] Cinar, R. Delving into Social Entrepreneurship in Universities: Is It Legitimate Yet? Reg. Stud. Reg. Sci. 2019, 6, 217–232.

[13] Elfert, M. Lifelong learning in Sustainable Development Goal 4: What does it mean for UNESCO's rights-based approach to adult learning and education? Int. Rev. Educ. 2019, 65, 537–556.

[14] Alonso-García, S.; Aznar-Díaz, I.; Cáceres-Reche, M.P.; Trujillo-Torres, J.M.; Romero-Rodríguez, J.M. Systematic Review of Good Teaching Practices with ICT in Spanish Higher Education. Trends and Challenges for Sustainability. Sustainability 2019, 11, 7150.

[15] García Llorente, H.J.; Martínez-Abad, F.; Rodríguez-Conde, M. Validación de un instrumento de evaluación de competencias informacionales autopercibidas en educación secundaria obligatoria. An. De Doc. 2019, 22, 3–10.

[16] Gallardo, K.; Lozano, A.; Elizondo, J. Innovación educativa en estudios de psicología educativa: Un mapeo sistemático. In Innovación Educativa: Tendencias Globales de Investigación e Implicaciones Prácticas; Ramírez-Montoya, M.S., Valenzuela, R., Eds.; Octaedro: Barcelona, España, 2019; pp. 23–38.

[17] Fayomi, O.S.I.; Okokpujie, I.P.; Fayomi, G.U. An innovation concept towards bridging the gaps between teaching and research. Procedia Manuf. 2019, 35, 775–781.

[18] Berzin, S.C.; Dearing, T.; Mathews, O.; Choi, Y.J.; Pitt-Catsouphes, M. The Center for Social Innovation at Boston College. J. Evid.-Inf. Soc. Work 2018, 15, 473–480.

[19] García-Aracil, A.; Isusi-Fagoaga, R. Innovación Social y Gobernanza En Las Instituciones de Educación Social; FCYD, Ed.; Informe CyD 2018; Fundación CYD: Barcelona, Spain, 2019

[20] Ramírez-Montoya, M.S.; Lugo-Ocando, J. Systematic review of mixed methods in the framework of educational innovation. Comunicar 2020, 65, 9–20.

[21] Romero-Rodríguez, L.M.; Ramírez-Montoya, M.S.; Valenzuela, J.R. Incidence of digital competences in the completion rates of MOOCs. Case study on Energy Sustainability courses. IEEE Trans. Educ. 2020, 1–7.

[22] Romero-Rodríguez, L.M.; Ramírez-Montoya, M.S.; Aguaded, I. Determining Factors in MOOCs Completion Rates: Application Test in Energy Sustainability Courses. Sustainability 2020, 12, 2893.

[23] Ramírez-Montoya, M.S. Challenges for Open Education with Educational Innovation: A Systematic Literature Review. Sustainability 2020, 12, 7053.

[24] Sharma, R., Nalawade, D. B., Negi, P., Dhabliya, R., Bhattacharya, S., & Khetani, V. (2023, November). AIpowered Automation of Fraud Detection in Financial Services. In Proceedings of the 5th International Conference on Information Management & Machine Intelligence (pp. 1-5).

[25] Gulhane, M., Sajana, T., Shelke, N., & Maurya, S. (2024). Development of a

Temporal Analysis Model Augmented for Disease Progression Identification through Multiparametric Analysis. International Journal of Intelligent Systems and Applications in Engineering, 12(2), 620-634.

[26] Nemade, B. P., Shah, K., Marakarkandy, B., Shah, K., Surve, B. C., & Nagra, R. K. (2024). An Efficient IoT-Based Automated Food Waste Management System with Food Spoilage Detection. International Journal of Intelligent Systems and Applications in Engineering, 12(5s), 434-449.

[27] Patil, D., Bhalerao, M., Wankhede, V., Birari, V., Mahajan, R., & Khairnar, V. (2023). Analyzing the Impact of Impulsive Noise on spectrum sensing Techniques for Cognitive Radio Networks. International Journal of Intelligent Systems and Applications in Engineering, 11(10s), 727-733.

[28] Gulhane, M., Kumar, S., Kumar, M., Dhankhar, Y., & Kaliraman, B. (2023, December). Advancing Facial Recognition: Enhanced Model with Improved Deepface Algorithm for Robust Adaptability in Diverse Scenarios. In 2023 10th IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON) (Vol. 10, pp. 1384-1389). IEEE.

[29] Nemade, B. P., Shah, K., Marakarkandy, B., Shah, K., Surve, B. C., & Nagra, R. K. (2024). An Efficient IoT-Based Automated Food Waste Management System with Food Spoilage Detection. International Journal of Intelligent Systems and Applications in Engineering, 12(5s), 434-449.

[30] Kumar, J. R. R., Kalnawat, A., Pawar, A. M., Jadhav, V. D., Srilatha, P., & Khetani, V. (2024). Transparency in Algorithmic Decision-making: Interpretable Models for Ethical Accountability. In E3S Web of Conferences (Vol. 491, p. 02041). EDP Sciences.