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Development of an Integrated Data Visualization Application to Support One Data Implementation in Kubu Raya

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ABSTRACT

This research develops an integrated data visualization application to support the "Satu Data Indonesia" initiative in Kubu Raya Regency. The objective is to enhance data accessibility and decision-making for regional government officials. Utilizing the Enterprise Unified Process (EUP) methodology, the web-based application features a Model-View-Controller (MVC) architecture, incorporating data management tools and Google Looker Studio for visualization. Testing confirmed the application's functionality, with a System Usability Scale (SUS) score of 75.5%, indicating strong usability. The results highlight the successful integration of regional data into accessible visual formats, fostering better resource allocation and evidence-based policymaking. This study demonstrates the potential of structured development and appropriate technology to address data fragmentation challenges and improve governance in Kubu Raya Regency

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1. INTRODUCTION

Initiative is aligned with Indonesia's Satu Data policy, which aims to improve the quality, accessibility, and interoperability of government data. While the national policy provides a strong mandate, its effective implementation at the regional level, such as in Kubu Raya Regency, often faces practical challenges. Prior to this development, data within the Kubu Raya Regency government was often fragmented across various departments, managed in disparate formats, and lacked a centralized, easily accessible platform for integrated visualization and public access. Existing regional data efforts, if any, typically involved static reports or isolated departmental dashboards that hindered comprehensive analysis, cross-sectoral decision-making, and public transparency. This fragmentation and lack of an integrated, dynamic visualization platform represented a significant gap in leveraging regional data effectively, despite the clear directives of the Satu Data Indonesia policy.

This research details the development of an integrated data visualization application specifically designed to address this gap in Kubu Raya Regency. The application aims to improve data accessibility and utilization for decision-making by regional government by providing a centralized, easily accessible platform for data and information, supporting better governance and decision-making. By streamlining public data from various sources into a unified system, the application directly tackles the issue of data fragmentation and enhances the ability of the local government to make data-driven decisions, allocate resources more effectively, and improve public services (Islami, 2021; Poudel, 2024; Wahyu et al., 2024). Visualizing complex datasets in a clear and accessible manner significantly enhances the quality of decisions made in the public sector (Sinaga et al., 2024). Furthermore, the increasing role of data-driven solutions in governance is supported by studies such as Illingworth (2021), who demonstrates how digital tools can foster more effective public administration and the achievement of Sustainable Development Goals (SDGs) (Rădulescu et al., 2023; A. F. Silva et al., 2023). emphasizes the importance of the Satu Data Indonesia policy, a national initiative to standardize government data and promote effective data sharing across agencies.

The developed application is a regional implementation of this policy, demonstrating how national directives are translated into practical tools. A core theme is the use of data visualization to enhance understanding and decision-making. The developed application illustrates how raw data is transformed into visual formats, such as charts and graphs, to make it more accessible to government officials and the public. This reflects a broader trend in data science and public administration, where visualization is crucial for extracting insights from complex datasets (Ramadhani et al., 2024; Wardhana et al., 2024). The project centered on developing a web-based application, highlighting a focus on accessibility and user-friendliness. This choice ensures broad access for various users, including government personnel and the public. It also underscores the growing importance of web technologies in facilitating data access and dissemination (Sinaga et al., 2024).

The developed application provides detailed insights into the system's architecture, including the use of a multi-tier distribution model and the Model-View-Controller (MVC) pattern. These design choices emphasize scalability, maintainability, and efficiency. The MVC pattern, a widely used approach in software development, promotes a clear separation of concerns, simplifying application development and maintenance (Yusuf et al., 2024). The technology stack, including Linux, MySQL, Apache, PHP, HTML, JavaScript, and Google Looker Studio, reflects a combination of open-source and industry-standard tools. This selection indicates a focus on building a robust, flexible, and cost-effective solution (Ramuka, 2019).

The integration of Google Looker Studio for data visualization is notable, demonstrating a reliance on established tools for data analysis and presentation. The developed application outlines the use of the Enterprise Unified Process (EUP) methodology, an iterative and incremental approach to software development. EUP was chosen for its comprehensive coverage of the software development lifecycle, from planning to deployment and support, highlighting a structured approach to project management and a commitment to delivering a high-quality product (Ahmed, 2024).

User-centric design is a key focus, with an emphasis on creating an application that is easy to use and navigate. The inclusion of a user manual and detailed descriptions of the application's features indicates a concern for ensuring accessibility for users with varying levels of technical expertise. The application aims to integrate data from various sources, emphasizing the importance of data management and interoperability—a central aspect of the Satu Data initiative. The developed application also details the rigorous testing process, including unit, system, and user acceptance testing, underscoring the importance of quality assurance in software development (Silva & Siriwardana, 2023).

Furthermore, the developed application describes the implementation and deployment process, including the use of development, staging, and production servers. This highlights the importance of a well-planned deployment strategy for a smooth transition from development to production. The inclusion of training and documentation, such as user manuals, demonstrates a commitment to ensuring the application can be effectively used and maintained. Overall, the development of this application signifies a commitment to regional development through technology, providing better access to data, improving decision-making, and ultimately supporting the progress of Kubu Raya Regency.

2. METHODS

The development process follows a well-structured methodology, the 'Enterprise Unified Process (EUP)', which is especially suited for large-scale application development. This approach is crucial for ensuring that the system is developed iteratively and is scalable over time. The project begins with a requirement gathering phase where the needs of the Kubu Raya government and stakeholders are assessed. This is followed by system design, which focuses on ensuring the application architecture can handle large datasets and facilitate future scalability (Rishabh Mahendrapratap Singh & Azizullah Abdullah Khan, 2024; Setiawan & Karnalim, 2024).

The design also considers testing and deployment, ensuring the application is robust and adaptable. Key to the methodology is the use of web-based technologies and integration with various local datasets, including population demographics, animal husbandry, and public infrastructure. Triandini & Ahmadi (2011) argue that the use of e-government frameworks based on structured processes allows for more reliable systems and better integration of diverse data sources. To illustrate the structured approach used for developing the integrated data visualization application, **Figure 1** presents the System Development Process Flowchart. This flowchart outlines the key stages, from requirement gathering to evaluation, that were followed in this project.

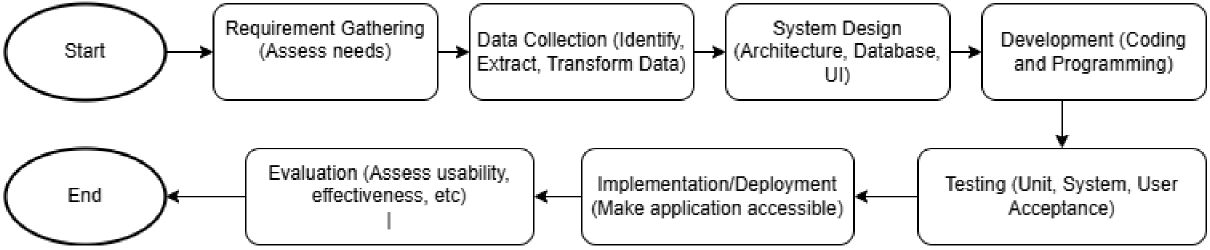

Start
Requirement Gathering (Assess needs)
Data Collection (Identify, Extract, Transform Data)
System Design (Architecture, Database, UI)
Development (Coding and Programming)
Testing (Unit, System, User Acceptance)
Implementation/Deployment (Make application accessible)
Evaluation (Assess usability, effectiveness, etc)
End

Figure 1. System Development Process Flowchart

2.1. Rationale for Methodology Selection

The development of the Integrated Data Visualization Application for Kubu Raya Regency necessitated a structured approach involving numerous processes and activities to ensure the successful achievement of project objectives and goals. A process lifecycle, commonly referred to as a methodology, delineates the scope and encompasses a description of the activities (workflows) involved. Four primary types of process lifecycles are generally recognized:

a. Development System Lifecycle: This type covers the activities from application development through to installation on the production server. Well-known methodologies in this category include the Rational Unified Process (RUP), Agile, and Extreme Programming (XP) (Sharma & Wadhwa, 2015).

b. System Lifecycle: Expanding upon the Development System Lifecycle, this includes activities related to operating and supporting the application post-production installation. It also incorporates activities for retiring the system when it is no longer required (Dearle, 2007). Consequently, the System Lifecycle encompasses: (1). The initial development activities; (2). Subsequent development, operation, and support activities for later versions; and (3). The retirement activities for the final version.

c. Information Technology (IT) Lifecycle: This lifecycle incorporates the activities of the System Lifecycle while adding managerial aspects pertinent to the effective management of information resources within an IT unit. It also considers the potential for integration with other existing applications. In essence, the IT Lifecycle defines the broader environment within which the System Lifecycle operates (Amado & Belfo, 2021). A prominent methodology within this category is the Enterprise Unified Process (EUP).

d. Organization/Business Lifecycle: This encompasses the activities of the entire organization, including both IT and non-IT units. The IT Lifecycle must be effectively aligned with the Organization/Business Lifecycle.

Based on the understanding derived from the Terms of Reference (KAK), the activities and tasks undertaken in the development of the Integrated Data Visualization Application for Kubu Raya Regency included:

a. Processes and activities spanning application development through installation on the production server.

b. Operational (Operate) and Support activities post-installation to ensure the system's continued functionality and adherence to institutional requirements.

c. Activities for comprehensive and continuous improvement, addressing any vulnerabilities (bugs) identified during production.

d. A thorough understanding of the overall system architecture within the relevant institutions and units requiring system integration.

Considering these project activities and their alignment with the scope of the four process lifecycle categories, it was concluded that the system integration development activities fall under the Information Technology (IT) Lifecycle category. The Enterprise Unified Process (EUP) was selected as the preferred methodology due to its congruence with the required category and its status as a widely recognized and accepted standard.

2.2 Enterprise Unified Process (EUP) Methodology

The Enterprise Unified Process (EUP) represents an extended scope of activities (workflows) building upon the Rational Unified Process (RUP), which is an object- and component-based system development framework. EUP is structured in a two-dimensional format, comprising Phases/Stages and Process-activities (workflows) (Ambler et al., 2005). Notably, EUP incorporates the addition of two Phases/Stages and several Process-activities (workflows) compared to the standard RUP version. This extended lifecycle is illustrated in **Figure 2**, showing the added phases and the integration of various disciplines across the project timeline.

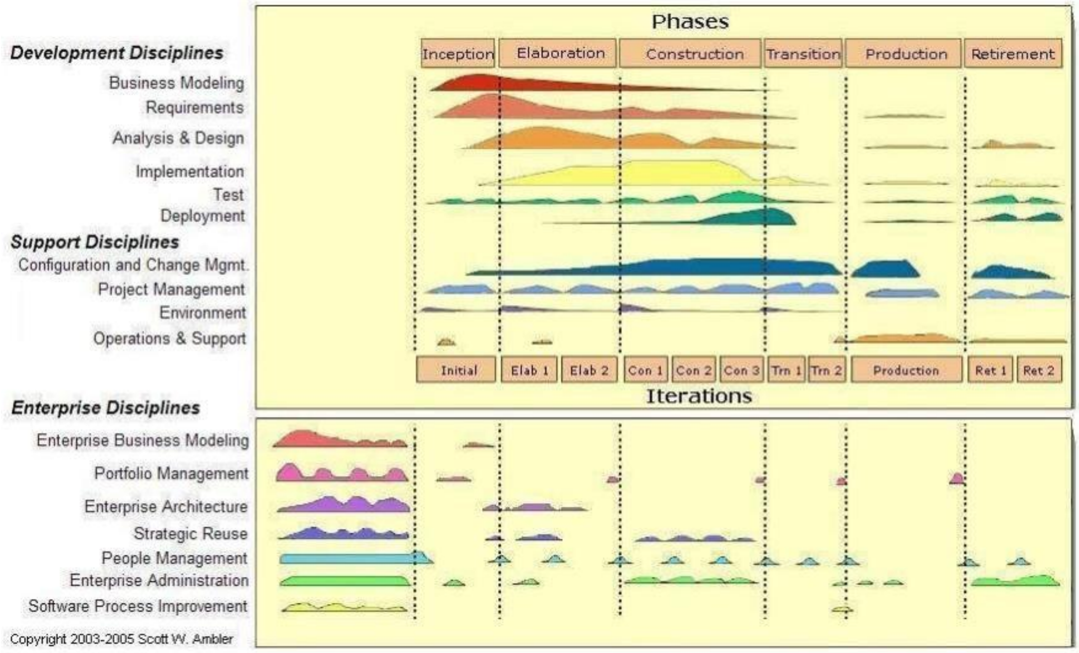


Figure 2. Overview of a software development process showing phases, iterations, and disciplines from EUP

Phases/Stages within EUP are represented by six distinct stages traversed throughout the system's development, operation, and eventual retirement. The Process activities (workflows) are broadly categorized into three main areas: System Development, System Support, and Organization Management.

2.3 Process Activities in EUP

The Enterprise Unified Process (EUP) distinguishes itself as a comprehensive framework by extending the foundational principles of the Rational Unified Process (RUP) (Ambler et al., 2005). This extension is primarily realized through an expanded scope encompassing a detailed set of process activities, often referred to as workflows. These workflows are systematically organized and categorized to provide a holistic view of the software development and maintenance lifecycle within an enterprise context.

The process activities within EUP are fundamentally divided into the following overarching categories:

a. Development System (Development Disciplines), which has the following Process Activities (workflows):

- Business Modelling: This workflow involves modelling the business processes of the organizational system. The focus of this workflow includes:
    1. Identifying the context of the system to be built. This provides an understanding of the general organizational structure and the organizational units crucial for the system's success. It also maps relationships with external systems requiring integration. In the context of the One Data App, this involved understanding the data flow and reporting needs within the Kubu Raya Regency government and how the application would integrate with the existing Satu Data portal and various regional government data sources.
    2. Building a shared understanding with all stakeholders involved in system development. This includes stakeholders such as users, executive levels, the development team, and others. For this project, this involved close consultation and coordination with the Dinas Komunikasi dan Informatika Kabupaten Kubu Raya and other relevant regional government units.
    3. Modelling the Business. The organizational units whose business will be modelled are relevant to the application system to be created. This will involve activities such as business process modelling, business use case modelling, and conceptual object modelling. This included modelling the processes for data collection, data management, and how different government departments would interact with the application for data submission and access.
- Requirements: This workflow is performed to build a list of user requirements that the system must fulfill. The focus of this workflow includes:
    1. Identifying user requirements. This will involve activities such as requirement diagram modelling and the preparation of technical specification documents containing business rules, constraints, and non-functional requirements. User requirements for the One Data App included the need for a centralized platform, easy data accessibility, various visualization options, and specific features like dataset management, testimonials, and download requests.
    2. Developing the project vision. This will involve creating documents containing high-level requirements, technical constraints that must be met, and the platform for the system to be built. The project vision was to create a web-based application integrated with the Satu Data portal to improve data utilization and transparency in Kubu Raya Regency.
    3. Creating a Catalog of Business and Technical terms. This list of terms will be built and continuously developed throughout the project lifecycle. These terms must be understood by all related parties, including stakeholders. A glossary of terms related to government data, visualization types, and application features was developed to ensure clear communication among stakeholders.

4. Defining the project scope. An important part of compiling the list of requirements is defining the system's boundaries and scope, so that the development team knows which requirements must be met and which do not. The scope of the One Data App project was defined to include specific modules such as Dashboard, Dataset, Visualization, Slider, Testimoni, Download, and User Management, focusing on web-based access and integration capabilities.

- Analysis & Design: This workflow is performed to model the software. The focus of this workflow includes:
  1. Developing detailed design models. The design models created must be consistent with the system architecture model, requirements list model, and business model previously created. This will involve at least activities such as creating class diagrams, sequence diagrams, collaboration diagrams, state diagrams, and component diagrams. Detailed design models for the One Data App included defining the multi-tier architecture, the MVC pattern implementation, and the structure of the database to store and manage the integrated data.
  2. Adapting the design to the implementation environment. The design created must be adjusted to the conditions where the system will be implemented. For example, the design for a distributed system will certainly be different from a design created for a standalone or web system. The design was specifically tailored for a web-based system deployed on a server environment utilizing Linux, Apache, MySQL, and PHP.
  3. Interface design. As part of the application prototyping workflow, this interface design is especially useful as a communication medium to explain how user requirements will be executed in the application system later. User interface design focuses on creating a user-friendly and intuitive interface for both public users accessing visualizations and administrators managing the content.
  4. If needed, design changes can be made to accommodate changes in user requirements. The iterative nature of EUP allowed for design adjustments based on feedback received during the development process.

- Implementation: This workflow involves writing and evaluating the application. The focus of this workflow includes:
  1. Close coordination between programmers and system designers. Programmers must work according to the design model, so good coordination between programmers and system designers is necessary. Programmers developing the One Data App worked closely with the system designers to translate the architectural and interface designs into functional code.
  2. Code documentation. This is documentation written by programmers about the description of the code to be created before programming activities. Code documentation was maintained to ensure the development of the application.

3. Writing code (Programming). This involved writing the HTML, CSS, JavaScript, PHP, and SQL code for the various modules and functionalities of the application.
4. Fixing bugs if deficiencies are still found. Bug fixing was an ongoing process throughout the implementation phase as issues were identified during testing.
5. If it is still possible, the code will be rewritten to adjust to changes in the system design. Minor code refactoring or adjustments were made if necessary to align with evolving design decisions.

- Testing: This workflow involves verifying and validating the quality and correctness of the application system. The focus of this workflow includes:
    1. Examining the requirements list model, design, and implementation. For example, to test the requirements list, this can be done with the help of the interface display, use case model, and use case scenario. Testing for the One Data App involved verifying that all specified requirements, as outlined in the requirements documentation, were met by the implemented system.
    2. Helping to reduce the risk of project failure. Testing will help provide an accurate perspective on quality. This perspective can help measure how well a project is progressing and to identify potential problems earlier. Testing aimed to identify and mitigate potential risks related to functionality, performance, and security before deployment.
    3. Performing several types of testing on a large scale, namely function testing, system testing, user acceptance testing, and alpha/beta/pilot testing. The project included unit testing, system testing, and user acceptance testing (UAT) involving the stakeholders from the Kubu Raya Regency government.
    4. Performing testing on a small scale, relative to problem reports submitted by users. Post-deployment, any reported issues or bugs would be addressed through smaller-scale testing cycles.

- System Installation (Deployment): This workflow is performed to ensure the successful installation of the application system. The focus of this workflow includes:
    1. Installation planning (deployment plan). Application installation, especially for applications that replace or integrate with existing applications, is a complex task that requires careful planning. A deployment plan was developed to guide the installation of the One Data App on the designated server environment.
    2. Adapting the deployment model to changes in the system environment. Changes can occur at any time in the system environment where the application will be installed, so the deployment model must continuously adapt. The deployment process needed to be flexible to adapt to the specific server configuration and infrastructure of the Dinas Komunikasi dan Informatika.
    3. System installation on the production server. This activity will involve the installation of applications, hardware, and middleware. It will also include

training activities for operators, technical support, staff, and others. Several documents, including training documents, will be needed in this activity. The One Data App was installed on the production server, followed by training sessions for the administrators and operators who would manage the application.

b. System Support (Support Disciplines), which has the following Process Activities (workflows):

- Configuration & Change Management: This workflow is performed to ensure the success of system installation. The focus of this workflow includes:
    1. Creating Configuration Management Control. CM is particularly important to ensure the consistency and quality of various modules, components, and others created by the development team. Without CM, team members can risk overwriting each other's work. With CM, versioning of various components or modules can be created, making it possible to roll back to previous versions if needed. Configuration management practices were employed to manage different versions of the application code and associated configurations.
    2. Prioritization and allocation of requirement changes. Changes to the system need to be managed well. New requirements can continuously emerge, and old requirements will continue to change or even be deleted. This list of changes needs to be prioritized and allocated to specific application versions, stages/phases, and workflows appropriately. Any requests for changes or new features for the One Data App would be managed through a change management process, prioritizing and scheduling their implementation in future updates.

- Project Management: This workflow is performed to ensure the successful management of the project team. The focus of this workflow includes Identifying potential risks. The list of risks must be handled effectively. One of the best ways to do this is by identifying and including all important system requirements in the early phases/stages of development. Project management for the One Data App involved identifying potential risks such as data availability, integration challenges, and user adoption, and planning strategies to mitigate them.
    1. Measuring the feasibility of various aspects of the project. One example is measuring the technology aspect. Is the chosen platform compatible with the team's competence or not? An assessment of the technical feasibility and the development team's expertise with the chosen technologies (LAMP stack, Google Looker Studio) was conducted.
    2. Creating a general project schedule plan. This schedule is general and describes the long-term goals that the team must achieve. In this general schedule, the list of requirements that must be processed further when entering each initial phase is also mapped. A project schedule outlining the key milestones and timelines for the different phases of the One Data App development was created.
    3. Creating a detailed schedule plan for each phase/tahapan that is consistent with the general schedule. This schedule will continue to develop according

to the iterations performed. More detailed schedules were developed for each EUP phase, adapting as needed based on progress and feedback.

4. Building good relationships between the consultants and stakeholders. Maintaining strong communication and collaboration between the development team, the Dinas Komunikasi dan Informatika, and other stakeholders was crucial for the project's success.
5. Building the project team. A project team with the necessary skills in web development, database management, and data visualization was assembled.
6. Managing team cohesion. The key to successful project management is ensuring the team works together effectively so that all targets can be achieved well on time. Effective team management practices were employed to ensure the development team worked cohesively and efficiently.

- Environmental workflow: This workflow is performed to configure the processes, tools, standards, and guidelines used by the project team. The focus of this workflow includes:
  1. Customizing the software used for application development. Customization needs to be done relative to the characteristics of the project requirements. The development environment was set up with the necessary software and tools tailored for developing a PHP-based web application with MySQL.
  2. Selecting standards and guidelines in system development. Coding standards and guidelines were established to ensure consistency and quality in the codebase.
  3. One example is Unified Modeling Notation (UML), which is a standard modelling notation and programming guideline for object-based languages. UML was likely used for modelling the system design during the Analysis & Design phase.
  4. Selecting and Integrating Tools. The development process, architecture, and organizational culture greatly determine the tools chosen. The tools selected include project collaboration tools, programming tools, modelling tools, and database editors. All these tools must work together well and support all processes performed by the team. Tools for coding, database management, version control, and potentially project management and collaboration were selected and integrated to support the development workflow.

2.3 Tools and Techniques

This part describes the tools and methods used to handle and change the data. Since JSON and PDF data are common, the tools chosen were those that could process these formats effectively and flexibly. Google Sheets and Apps Script were chosen as the main tools because they are easy to use and offer strong features for automating data tasks.

- Google Sheets and Apps Script: Used for data manipulation and transformation, particularly for JSON and PDF data. Google Sheets provides a user-friendly interface for organizing and manipulating data (Chandra & Dwivedi, 2022), while Apps Script allows for automation and customization of data processing tasks.

- Google Looker Studio: Employed for creating data visualizations, such as charts and tables. Google Looker Studio is a business intelligence tool that enables the creation of interactive and informative visualizations.
- Web technologies: HTML, JavaScript, and PHP are used for developing the web-based applications. These are standard technologies for building interactive and dynamic web applications.

2.4 Application Design and Development Process

The development of the integrated data visualization application followed a structured and iterative process to ensure all requirements were met and the final product was robust and user-friendly. This process involved several key stages, moving from understanding the core needs to the final testing and preparation for deployment.

- System Analysis: Understanding the data needs of the Kubu Raya Regency government and identifying the requirements for the application. This involves gathering information about the types of data available, how it is currently used, and what visualization needs exist. **Figure 3** shows the overall structure of the integrated data visualization application designed to support the Satu Data Kubu Raya Regency initiative. This figure visually depicts how the different components of the application are organized and interact, particularly highlighting the multi-tier distribution model and the Model-View-Controller (MVC) pattern discussed in the system design.

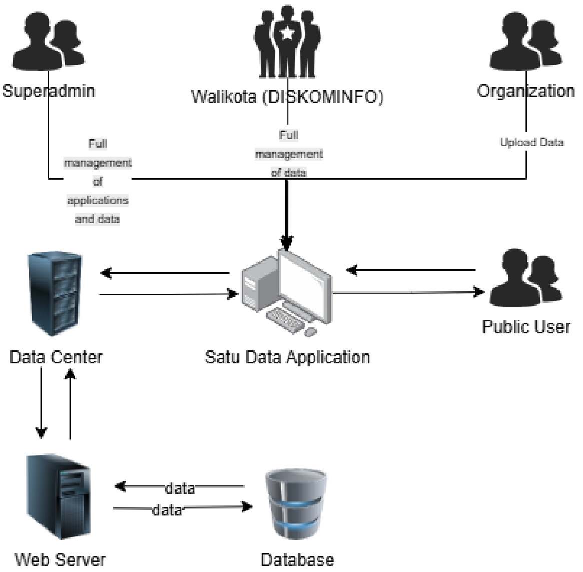


Figure 3. Integrated Data Visualization Application Structure with Satu Data Kubu Raya Regency

- System Design: Designing the application architecture, database, and user interface. The application architecture follows a multi-tier distribution model and the Model-View-Controller (MVC) pattern. As highlighted by Melhuish et al. (2016), using digital visualizations allows local governments to engage with complex data in a straightforward way, enabling better decision-making and resource allocation in urban planning.

- The multi-tier architecture separates the application into distinct layers (presentation, business logic, and data), which improves scalability, maintainability, and security.
- The MVC pattern separates the application logic into three interconnected elements. The Model manages the data, the View displays the data, and the Controller processes user input.

- Development: Coding and programming the application. This involves translating the design specifications into functional code using the selected technologies. The underlying technical infrastructure supporting the application is detailed in **Figure 4**, illustrating the key components and their relationships. This figure provides a visual representation of how elements like the browser, cloud, web server, and database are connected.

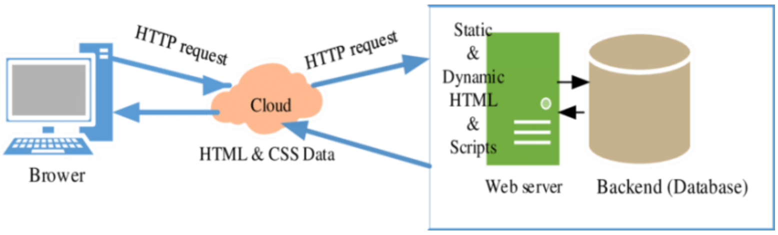


Figure 4. Infrastructure Architecture

- Testing: Conducting unit, system, and user acceptance testing to ensure the application's quality and functionality. This process involves verifying that each component of the application works as expected, that the application meets the specified requirements, and that it is user-friendly and meets the needs of the intended users.

2.5. Justification of Technology Choices:

Selecting the appropriate technology stack is a critical step in software development, directly impacting the application's performance, scalability, maintainability, and overall success. For the development of the integrated data visualization application to support the Satu Data Indonesia initiative in Kubu Raya Regency, careful consideration was given to various factors, including project requirements, resource availability, and the need for a robust, reliable, and cost-effective solution. The following points detail the specific technologies chosen for this project and the rationale underpinning each selection.

- Linux, MySQL, Apache, PHP: This combination is a popular open-source stack known as LAMP. It is robust, reliable, and cost-effective, making it suitable for developing web applications.
- HTML, JavaScript: These are fundamental web technologies for creating the user interface and adding interactivity.
- Google Looker Studio: This tool is chosen for its ability to create interactive and visually appealing data visualizations, which is a core requirement of the project.

2.6. Implementation Procedures

The implementation procedures involve the following steps:

- Coding Practices: The developed application does not provide detailed information on specific coding practices. However, it can be inferred that standard coding practices are followed to ensure code quality, readability, and maintainability.
- Testing Phases: The developed application mentions several testing phases:
  - Unit testing: Individual components of the application are tested to ensure they function correctly.
  - System testing: The application as a whole is tested to verify that it meets the specified requirements.
  - User acceptance testing: The intended users test the application to ensure it is user-friendly and meets their needs.
- Iterations Based on Feedback: The EUP methodology emphasizes iterative development, which means that the application is developed in a series of cycles, with feedback from stakeholders incorporated into each iteration. This ensures that the final product meets the needs of the users and is of high quality (*Usability Testing for Survey Research*, 2017).
- Deployment: The application is deployed to a production server, making it accessible to users. The developed application mentions the use of development, staging, and production servers, which is a standard practice for ensuring a smooth and reliable deployment process. **Figure 5** outlines the workflow for deploying the application, including the use of development, staging, and production servers. This diagram illustrates the process for moving the application from development through testing and into the live production environment.

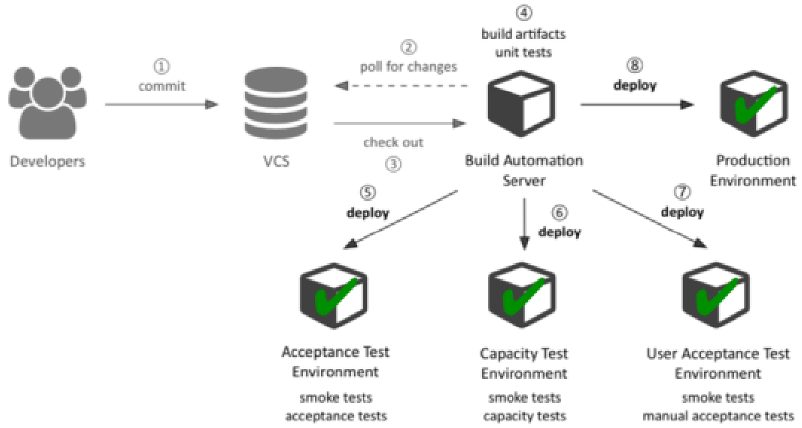


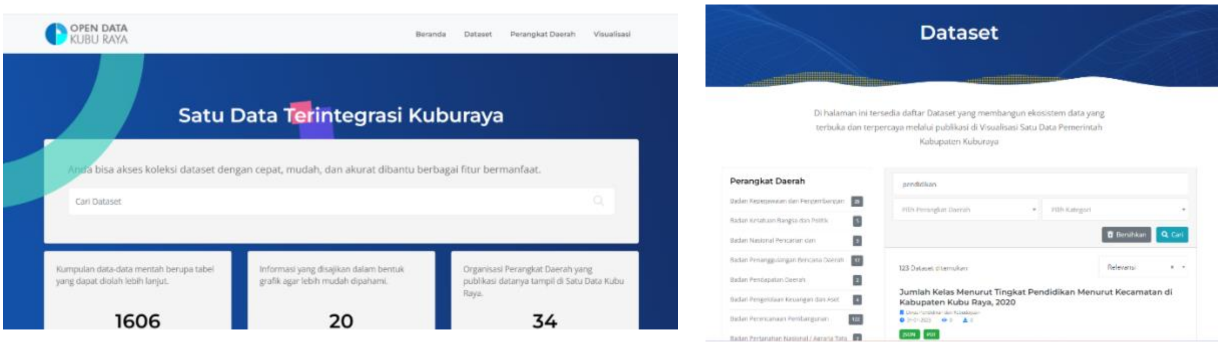
Figure 5. Deployment and Staging Server Workflow

2.7. Evaluation Metrics

To assess the effectiveness and usability of the integrated data visualization application, the evaluation focused on three key metrics: Usability Testing, Adoption Metrics, and System Response Time. Usability testing was conducted to understand user satisfaction and ease of interaction with the application through user sessions or surveys (Geisen & Bergstrom, 2017). Adoption metrics were tracked to measure the extent to which the application was used by its intended audiences, including public users, administrators, and regional government staff, by monitoring active user numbers and target user percentages over time. System response time was measured to evaluate the application's technical performance, assessing factors such as the speed and responsiveness of the system during user interactions.

3. RESULTS AND DISCUSSION

This section synthesizes findings from the analysis of data visualization applications in the context of integrated data systems, evaluating the effectiveness of current methodologies and suggesting actionable insights for future development. The discussion aligns with the overarching goal of supporting integrated data initiatives.



Satu Data Terintegrasi Kuburaya

Anda bisa akses koleksi dataset dengan cepat, mudah, dan akurat dibantu berbagai fitur bermanfaat.

Cari Dataset

Kumpulan data-data mentah berupa tabel yang dapat diolah lebih lanjut. 1606

Informasi yang disajikan dalam bentuk grafik agar lebih mudah dipahami. 20

Organisasi Perangkat Daerah yang publikasi datanya tampil di Satu Data Kubu Raya. 34

(a)

Dataset

Di halaman ini tersedia daftar Dataset yang membangun ekosistem data yang terbuka dan terpercaya melalui publikasi di Visualisasi Satu Data Pemerintah Kabupaten Kuburaya

Perangkat Daerah

Badan Kepegawaian dan Pengembangan	28
Badan Kesatuan Bangsa dan Politik	5
Badan Nasional Pencarian dan	3
Badan Penanggulangan Bencana Daerah	17
Badan Pendapatan Daerah	2
Badan Pengelolaan Keuangan dan Aset	4
Badan Perencanaan Pembangunan	122
Badan Pertanahan Nasional / Agraria Tata	[illegible]

pendidikan

123 Dataset ditemukan

Jumlah Kelas Menurut Tingkat Pendidikan Menurut Kecamatan di Kabupaten Kubu Raya, 2020

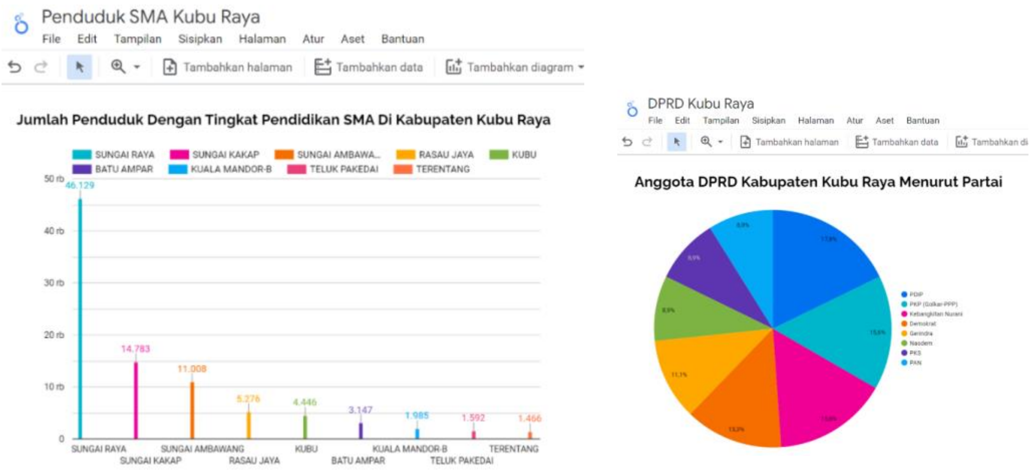
(b)

Figure 6. Overview of the Satu Data portal. (a) The portal's landing page, showing key statistics on available data. (b) The dataset search interface, allowing users to filter and browse available datasets.

As Shown as **Figure 6**, provides an overview of the Satu Data portal interface, highlighting key aspects of the developed application. Specifically, **Figure 6(a)** shows the portal's landing page with key statistics, while **Figure 6(b)** displays the dataset search interface, demonstrating how users can find and explore available datasets.

3.1. Overview of the Current Landscape of Data Visualization Applications Used for Data Integration

The analysis reveals that web-based applications and tools such as Google Looker Studio are prominent in the current landscape of data visualization for data integration. This trend indicates a move towards leveraging web technologies and business intelligence platforms to create user-friendly interfaces for accessing and comprehending integrated data. These applications frequently aim to serve diverse user groups, including government officials and the public, by presenting data through interactive dashboards and reports. Examples of the data visualizations generated by the application are presented in **Figure 7**. **Figure 7(a)** provides a snapshot of the high school educated population by district, and **Figure 7(b)** shows the political party representation in the Kubu Raya Regency DPRD, demonstrating the application's ability to transform data into informative visual formats.



(a) (b)

Figure 7. Data Visualizations Snapshots of Kubu Raya Regency data. (a) High school educated population by district. (b) Political party representation in the Kubu Raya Regency DPRD.

3.2. Evaluation

To assess the developed application's effectiveness and usability, a quantitative evaluation was conducted focusing on functional correctness and initial usability aspects. System testing was performed on key application interfaces to ensure core functionalities operated as expected. The testing covered the Login, Visualization, Slider, Testimony, and Download pages. Results, summarized in **Table 1** through **Table 4**, indicated a high success rate for intended operations when required fields were correctly provided. For instance, login functionality succeeded when both username and password fields were filled, while failures occurred when fields were left empty, demonstrating correct validation implementation. Similarly, data submission forms for visualization, slider, testimonies, and download functionalities passed testing when all mandatory inputs were supplied. This testing primarily confirmed the application's adherence to functional requirements and its stability under standard input conditions. To provide a concise overview of the System Usability Scale evaluation, including the overall calculated SUS score, the total number of participants, and the study methodology employed, a summary is presented in **Table 1**.

Table 1. Summary of System Usability Scale (SUS) Evaluation Results

Metric	Value	Interpretation
System Usability Scale (SUS)	**75.5**	**Above Average / Good Usability**
Sample Size	20 users	Number of participants in the SUS study
Study Method	Post-task survey	How the SUS questionnaire was administered

Finally**, Table 2** presents the detailed results of the System Usability Scale (SUS) evaluation conducted for the application. The table lists each of the ten standard SUS questionnaire items, which assess various aspects of system usability. For each item, the table shows the distribution of responses across the 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The columns indicate the count of participants who selected each response option. The table also includes the total number of responses for each item, the sum of responses used in the SUS calculation, and the calculated mean score for each individual question. Finally, Table 1 provides the overall calculated SUS score for the application, which is 75.50%. This score falls within the "Above Average" to "Good" range, indicating a generally positive perception of the application's usability by the participants in the study.

Table 2. System Usability Scale (SUS) Results

System Usability Scale	**Strongly Disagree**				**Strongly Agree**	**Total Response**	**Summary of Responses**	**Summary of Contribution**	**Mean Score**
	1	**2**	**3**	**4**	**5**				
I think I would like to use this application frequently.	0	2	4	5	9	20	81	61	4.05
I found the login process unnecessarily complex.	4	13	3	0	0	20	39	61	1.95
I thought accessing datasets was easy.	0	2	4	5	9	20	81	61	4.05
I think I would need help to use the administration features.	4	13	3	0	0	20	39	61	1.95
I found the different parts of the application worked well together.	0	2	4	5	9	20	81	61	4.05
I thought there was too much inconsistency in the application.	4	13	3	0	0	20	39	61	1.95
I imagine that most people would learn to use this application very quickly.	0	3	3	5	9	20	80	60	4
I found managing visualizations very	3	14	3	0	0	20	40	60	2

System Usability Scale	Strongly Disagree				Strongly Agree	Total Response	Summary of Responses	Summary of Contribution	Mean Score
	1	2	3	4	5				
cumbersome.									
I felt noticeably confident using the application's public features.	0	3	3	5	9	20	80	60	4
I would need to learn a lot before I could effectively use this application.	3	14	3	0	0	20	40	60	2
Overall, SUS Score									**75.50 %**

Table 3 presents the system adoption metrics tracked over a period following the application's launch, illustrating user engagement across different user categories. The table details the number of active users for Public Users, Administrators, and Regional Government Staff (Non-Admin) at specified time intervals (e.g., Week 1, Month 3). For Administrator and Regional Government Staff categories, the table also indicates the percentage of the target user base that was actively using the application. The 'Notes' column provides contextual information regarding the observed usage patterns at each time point. This data serves to quantify the initial uptake and continued engagement of the application by its intended user groups.

Table 3. System Adoption Metrics

User Type	Time Period (e.g., Weeks Post-Launch)	Number of Active Users	Percentage of Target Users	Notes
Public Users	Week 1	150	-	Initial public access
Public Users	Week 4	450	-	Increased awareness
Administrators	Month 1	10	80%	Key administrative staff onboard
Administrators	Month 3	12	95%	Nearly all administrators actively using

Regional Gov Staff (Non-Admin)	Month 1	50	15%	Initial exploration by other departments
Regional Gov Staff (Non-Admin)	Month 3	120	35%	Growing use for data access

The measured response times for various user actions are presented in **Table 4**, serving as a key metric for evaluating performance. The table lists specific actions that users can perform, such as loading pages or submitting data. For each action, the measured average response time in milliseconds (ms) is provided, alongside a predefined target response time. The 'Notes' column offers additional context or observations related to the performance of each action. This data allows for an assessment of the application's speed and responsiveness, indicating whether user interactions are processed within acceptable timeframes and highlighting potential areas influenced by factors like data loading or processing complexity.

Table 4. System Response Time

Action Performed	**Average Response Time (ms)**	**Target Response Time (ms)**	**Notes**
Load Homepage	850	< 1000	Within acceptable range
View Dataset List	1200	< 1500	Slightly slower, but acceptable
View Single Dataset Details Page	900	< 1000	Good performance
Load Visualization (Simple Chart)	1500	< 2000	Data loading impacts time
Load Visualization (Complex Dashboard)	2500	< 3000	More data points increase load time
Submit Testimonial	400	< 500	Quick transaction
Request Data Download	600	< 800	Processing download request
Administrator Login	700	< 1000	Standard authentication time
Administrator Add New Visualization	1800	< 2500	Involves data upload/processing

3.2. Challenges in the Implementation of Integrated Data Systems

The analysis identifies several challenges in implementing integrated data systems, consistent with common issues in this domain:

- Data Availability and Quality: The effectiveness of data visualization applications is highly dependent on the availability and quality of the underlying data. Incomplete or inaccurate data can significantly impede the ability to derive meaningful insights.
- Technical Constraints: Integrating data from diverse sources poses technical challenges related to data formats, system interoperability, and data standardization.

- User Adoption: Ensuring the effective utilization of these applications by the target audience can be challenging due to factors such as resistance to change and varying levels of technical proficiency.

3.3. Technological Advancements Enhancing Data Visualization Capabilities

Several technological advancements are enhancing data visualization capabilities:

- Web Technologies: The utilization of HTML, JavaScript, and PHP enables the development of interactive and dynamic web-based visualization applications.
- Data Visualization Tools: Tools such as Google Looker Studio provide advanced features for creating sophisticated visualizations and dashboards.
- APIs and Data Integration Platforms: These facilitate the connection of various data sources and streamline the process of data integration for visualization.

The development of integrated data visualization applications is essential for supporting evidence-based decision-making, particularly in initiatives such as Indonesia's Satu Data policy. By centralizing data from disparate sources and presenting it in a user-friendly format, these applications have the potential to enhance data accessibility, improve data utilization, and promote transparency.

However, the effectiveness of these applications is contingent upon several factors. As this analysis has shown, ensuring data quality, addressing technical constraints, and promoting user adoption are critical challenges. Organizations must invest in robust data governance frameworks, employ appropriate technologies, and provide adequate training and support to overcome these challenges.

Looking forward, emerging trends in data visualization, such as AR, VR, and AI, offer opportunities to further enhance how users interact with and derive meaning from integrated data. By incorporating these advancements into their data strategies, governments and organizations can unlock new insights, foster innovation, and ultimately improve outcomes.

4. CONCLUSION

This research aimed to address the challenges of data fragmentation and accessibility within the Kubu Raya Regency government by developing an integrated data visualization application. The primary objectives included improving data accessibility and utilization for regional government decision-making, providing a centralized platform for data and information, and supporting the implementation of the "Satu Data Indonesia" initiative at the regional level. The project utilized the Enterprise Unified Process (EUP) methodology and a web-based system architecture following the MVC pattern.

The critical findings highlight the successful development of a functional application capable of integrating diverse data and information from various regional government agencies. The application provides a user-friendly interface for accessing and visualizing data in both graphical and raw table formats, as demonstrated by the overview of the Satu Data portal interface and the examples of data visualizations presented. System testing, including unit, system, and user acceptance testing, confirmed the application's functionality and stability. The System Usability Scale (SUS) evaluation yielded an overall score of 75.50%, indicating above average or good usability. Initial adoption metrics show increasing usage by public users and regional government staff.

The significance of these findings lies in their direct contribution to realizing the principles of the "Satu Data Indonesia" policy by providing a practical tool for data integration, accessibility, and transparency at the regional level. The developed application serves as a crucial central data medium, empowering government officials and the public with access to relevant information for analysis and decision support, which is expected to have a significant impact on improving data governance and evidence-based policymaking in Kubu Raya Regency. The successful implementation demonstrates that a structured development approach and appropriate technology selection can effectively address regional data management challenges.

Based on this research and the initial implementation, several avenues for future research and development are suggested. Further studies on user adoption patterns and the quantifiable impact of the application on the efficiency of data utilization by government agencies and the public are recommended. Exploring advanced visualization techniques, such as the incorporation of real-time data feeds, could further enhance the application's capabilities. Potential future improvements include developing more interactive and customizable visualization options, strengthening data security and access controls for different user roles, and integrating additional data sources and types. The implementation of a comprehensive in-application feedback mechanism and the provision of more in-depth user training modules would also contribute to continuous improvement and maximize the application's value in supporting the evolving needs of the "One Data" initiative and the broader field of data visualization.

6. AUTHORS’ NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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