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EVALUATION OF THE IMPLEMENTATION OF BIG DATA-BASED AUDITS IN SUPREME AUDIT INSTITUTIONS OF INDONESIA

Aditya Rifa Kartika
Master of Accounting Program, Faculty of Economics and Business, Universitas Indonesia
aditya.rifa@ui.ac.id

Dwi Setiawan Susanto
Master of Accounting Program, Faculty of Economics and Business, Universitas Indonesia
dwisetiawan2010@yahoo.com

EVALUATION OF THE IMPLEMENTATION OF BIG DATA-BASED AUDITS IN SUPREME AUDIT INSTITUTIONS OF INDONESIA

Aditya Rifa Kartika [1]
Dwi Setiawan Susanto [2]
Master of Accounting Program, Faculty of Economics and Business
Universitas Indonesia

ABSTRACT

This study aims to evaluate the application of big data in the State Audit Institution in the examination of LKPD and propose the concept of big data that can be applied smoothly, effectively, and efficiently according to the needs of the Auditor. This study uses a qualitative method with an intrinsic case study approach. Qualitative data is in the form of the results of interviews with auditors to find out the needs of data processing and visualization in the implementation of the audit. In addition, observations are made on the applications used in the examination to find out whether big data has been utilized and other information that is available and relevant in the research. Based on the results of the study, it is known that the State Audit Institution does not have a big data instrument to process the output data of local government financial applications (Regional Government Information System / SIPD). Based on these conditions, the researcher developed a proposal for the concept of big data which contains data processing and visualization based on the data in the SIPD application, including Budget Reports and Revenue and Expenditure Realization, Operational Reports, Balance Sheets, LPSAL, LAK, and LPE. The proposed concept is the result of interviews with the Head of the Subauditorate, Supervisor and the Leader of the Audit Team on the Regional Government Financial Statements and then compiled big data to produce data visualization of regional revenue and expenditure trends, analytical testing of financial statement misstatements, and fiscal resilience of local governments.

Keywords: Audit, Big Data, Data Visualization, SIPD

[1] First author's email: aditya.rifa@ui.ac.id
[2] Second author's email: dwisetiawan2010@ui.ac.id

1. INTRODUCTION

Based on the Decree of the Secretary General of the Supreme Audit Institution (SAI) of Indonesia Number 206/K/X-XII.2/8/2021 concerning the Grand Design of Big Data Analytics of the State Audit Institution dated August 25, 2021, it is known that the State Audit Institution has prepared a big data implementation plan by developing BIDICS. BIDICS is an approach applied by the State Audit Institution to be able to optimize large data sets obtained from various institutions and in various forms of data types. The big data analytics business process at the State Audit Institution starts from the initiation stage which contains interesting questions, then input and process is carried out by the IT Lab team to produce outputs that will be uploaded on the BIDICIS dashboard.

A big data framework is a framework of thinking that looks at data in terms of size, diversity, speed, value, and complexity of processing. The Big Data Framework combines internal and external data for the audit process. Most of the internal data is in the form of structured data, which can be easily found in large-scale data warehouses. Meanwhile, external data sources are in the form of unstructured, such as data from news, conversation data on social media, forums, and other online media. Both structured and unstructured data can be processed using data analysis models such as data mining, social network analysis, and text mining.

The Big Data approach has an advantage with its ability to study data patterns. One of the applications of big data in auditing is a risk assessment procedure with an analytical procedure. To perform this procedure, the auditor performs several tasks such as determining the relationships between the data, comparing, finding unexpected patterns and evaluating the results. Through this process, it is hoped that the auditor will obtain an overview or description of the various possible risks that exist in the entity that are not obtained if only carrying out analytical procedures on internal data, one of which is the possibility of fraud in financial and non-financial statements and can identify and provide further analysis of high risks. Information through big data also helps auditors to provide more comprehensive and in-depth evidence because the analysis procedure using big data requires deeper analysis and research similar to what investigative auditors do (Yudowati & Alamsyah, 2018).

Referring to the study, the application of big data can also be used in auditing, one of which is the preparation of analysis procedures and other financial statement analysis. Based on the results of the understanding of the BIDICS application, it is known that there is no big data instrument to compile the analytical procedure or process the output data of the local government financial application (Local Government Information System / SIPD) automatically. SIPD is an application used by all Regional Governments. Therefore, it is certainly interesting to conduct research on the implementation of big data-based audits.

This study aims to evaluate the application of big data in the State Audit Institution in the examination of LKPD and propose the concept of big data that can be applied smoothly, effectively, and efficiently according to the needs of the Auditor.

2. LITERATURE REVIEW

2.1 BIG DATA

Big data is a term that applies to information that cannot be processed or analyzed using traditional tools. Meanwhile, according to (Dumbill, 2012), Big data is data that exceeds the capacity process of existing database system capabilities. Data is too large and too fast or doesn't fit into the existing database architecture structure. To get value from data, you have to choose an alternative way to process it (Zikopoulos et al., 2012). Refer to Big data and Financial Auditing in Portugal pada 15th Iberian Conference on Information System and Technologies (CISTI) (Maldonado et al., 2020) explained: “Most definitions of Big data focus on the size of stored data. Size is relevant, but there are other important attributes of Big data, namely the variety and speed of data. The definition of the "3 Vs" of Big data (volume,variety and velocity) corresponds to a definition of the most comprehensive, refuting the idea that Big data essentially refers to the amount of data. However, [5] states that the biggest problem with Big data is that there is still no consistent definition. If some definitions focus on the size or characteristics of Big data, others focus more on examples of content and reliability. Regarding characteristics, Big data is often defined in terms of volume, velocity, variety and veracity, usually referred to as "4 Vs", a concept later than the previous "3 Vs". A particularly relevant definition of Big data in the context of auditing is the one presented by [13], focusing on content and taking transactions as a starting point, by defining Big data in a simple way using the equation: "Big data = Transactions + Interactions + Observations".

Referring to the description above, the preparation of big data is expected to be able to provide solutions to the large volume of data processed, data variation and data processing speed. The data sources in this study include transactions recorded on the SIPD application. Then processing is carried out based on a predetermined algorithm. The result of observation and understanding of business processes to produce outputs as needed.

Furthermore (Maldonado et al., 2020) explain the application of big data in auditing is state that auditors can use data mining techniques to analyse external data such as census data, social media or news articles in their assessments of client business risk, fraud risk, internal controls and operational continuity. Consequently, it is a way to improve the efficiency and effectiveness of audit procedures and in addition, instead of sampling techniques, the use of data analysis techniques allows auditors to analyse all client transactions to find irregularities, atypical values, as well as patterns. However, advanced data analysis tools are rarely used in financial auditing and it is crucial to understand the extent to which financial auditing will incorporate big data and how its use will progress in their audit practice in the near future, then it will likely be over time”.

Based on this description, there are many sources that can be used to enrich big data analysis. Big adata can analyze all existing transactions not only by sample. This

is very relevant in data processing at the SAI of Indonesia in determining risks and implementing analytical procedures.

2.2 AUDITING

Auditing is a process of collecting and evaluating evidence in the form of information in determining and reporting the level of conformity between the information obtained and the criteria that have been set (Arens et al., 2021). Based on this description, there are several things that explain the definition of auditing, namely the conditions and criteria set in the implementation of the audit are information that can be tested and there are criteria that the auditor uses to evaluate the information. Furthermore, the collection and evaluation of audit evidence in the form of information is used by auditors to determine the suitability of the information presented with the set criteria so that adequate audit evidence is needed to achieve the audit objectives.

2.3 SYSTEM

2.3.1. SYSTEM PREPARATION

The system is developed and created by the organization based on the requirements in the organization. This provides an advantage for the organization. One of the products of in-house information system development is End-user developed software (EUD). EUDs are used in a limited way, are used by only one section and focus on output in the form of reports. The EUD is created by the user himself in that section. EUD is software that is developed directly by the user and controlled directly by the user. EUD is developed based on the needs of users. Several types of enterprise characters can use end-user development systems such as information retrieved from the organization's database is used to generate simple reports, statistical analysis, developing applications using software and database systems (Rainer & Cegielski, 2012). Make a calculation of the term of the loan, such as depreciation and amortization of the loan. EUD can evolve according to the information and data needs of users. So that users can develop and maintain a database processing system in the company. There are advantages to using EUD such as users can control the development process of their own information systems and can determine which information is important and needed, the user can adjust the development of the information system according to his own needs, punctuality, things that can slow down the running of the system, can be avoided by users, effective and efficient, making it easier to work, especially IT staff, so that they can work on other tasks/other system development; and flexibility and ease of use, because the user develops the system itself, so that the software used will be easier to understand and use. However, there are some disadvantages to using EUDs such as wrong development of the system and logic, if the user has little experience on how to develop the system, then there can be errors in the development of the system, the application is not adequately tested, users are likely not to test the system they created because of its difficulty or lack of time to test, the system is inefficient, if the user does not have experience in system development, then it can

waste their time to improve the system, the system is not well controlled and documented, many users do not protect their system, duplication of systems and data, users do not realize that other users have the same information needs so that they can create duplicate systems and data (Romney & Steinbart, 2018). EUDs can be used by utilizing databases (Rainer & Cegielski, 2012). A database is a collection of information that is stored in an organized manner so that if the information is needed, then the information will be presented immediately.

Database systems have several advantages such as access to multiple users, allowing multiple people to access the same data at once, distributed access, users in multiple parts can easily access the data, speed, can access large amounts of information and quickly, data quality, there is a validation check of the data when the user inputs the data, security, access to different types of data can be restricted for different users. In the database there are features such as data entry form, in the database there is an entry form so that users can enter, edit, or delete records in the database, index, storing information according to the order of recording in the database, query, extract data according to the formula predetermined by the limited user, update query, update can be used to change records, tables, and reports stored in the database, security features, such as encryption and password, database access can only be done by authorized authorities, SQL (a programming language for retrieving information from databases) and filters (can be used to delete data that is not used but the deletion of such data is not permanent) (Bocij et al., 2015).

2.3.2. SYSTEM MODELING

System design can be implemented through model-driven or product-driven (Whitten & Bentley, 2007). Model-driven system design is carried out by creating a system overview to help analyze problems, identify needs, and design systems. Product-driven system design is carried out by developing products first and looking at responses from system users. The model-driven approach has several advantages, namely better documentation of the needs in the system; ease of validating images compared to words; ease in identifying, conceptualizing, and analyzing alternative technical solutions; design becomes more flexible because it is designed based on a model and has been analyzed before it is built; and the system can be built correctly the first time because of a clear system model (Whitten & Bentley, 2007).

2.3.3. SYSTEM DESIGN

There are various types or methods of designing systems, either developed by organizations independently or by involving third parties. System design methods is a formal approach and an orderly process in designing a system involving automated activities, methods, best practices, deliverables, or tools. System design basically follows the flow of the system design cycle or Systems Development Life Cycle (SDLC) (Whitten & Bentley, 2007).

The five stages used to design and implement the system consist of (Romney & Steinbart, 2018):

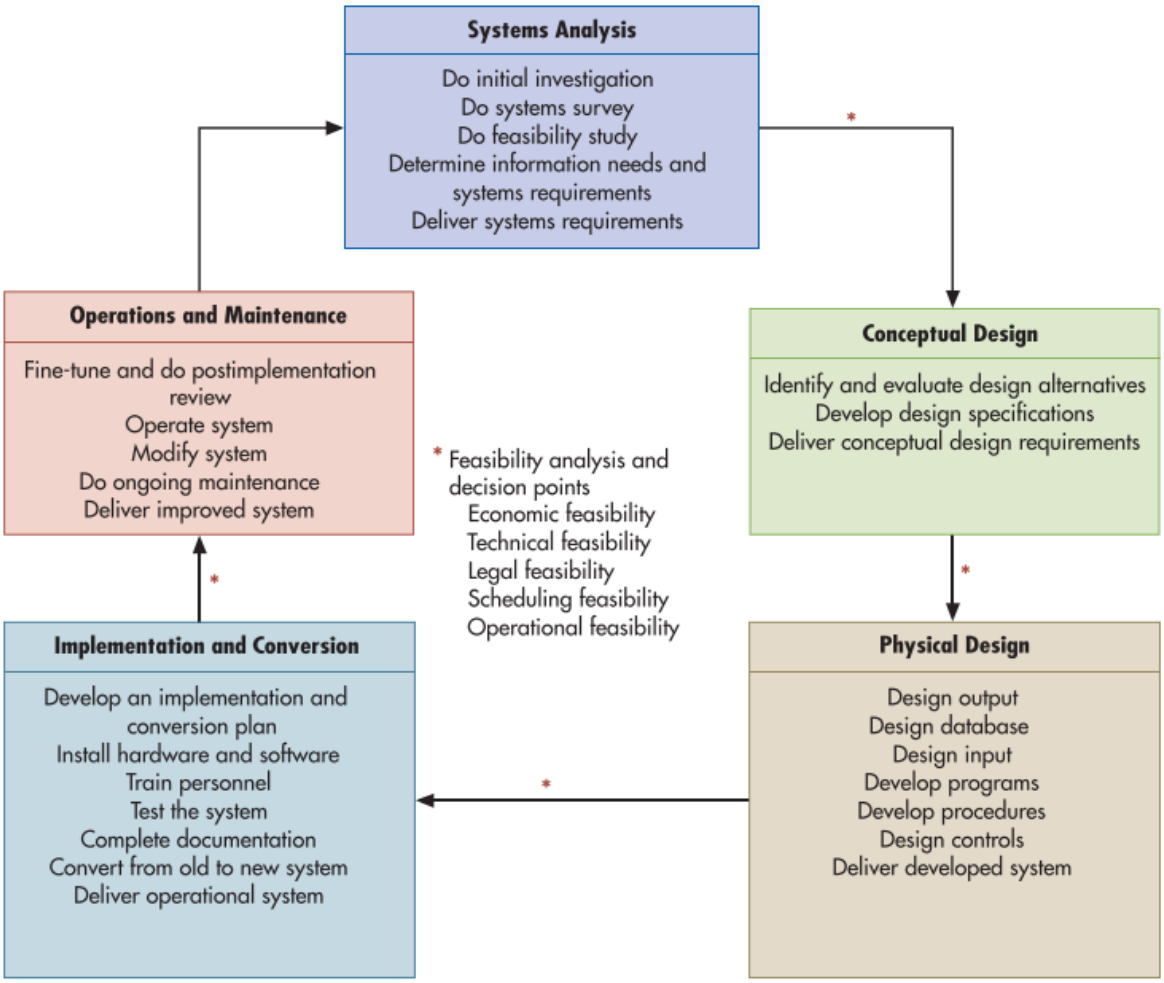


Figure 1. The Systems Development Life Cycle
Source: Accounting Information Systems, 2018

In addition, the system design is divided into six phases, such as (Satzinger et al., 2016):

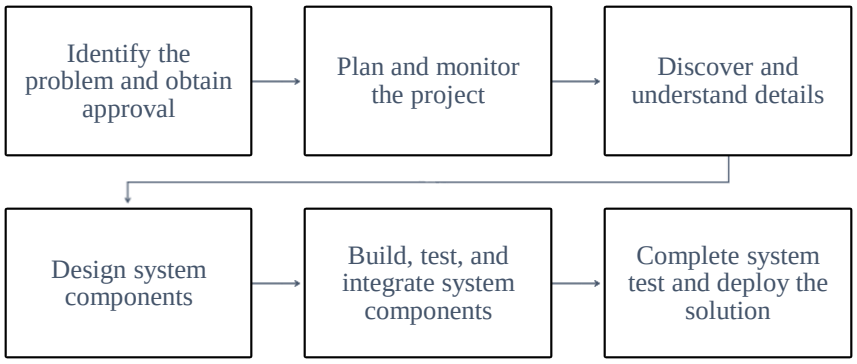


Figure 2. Six core processes of the SDLC
Source: System Analysis and Design in a Changing World, 2016

One of the system design frameworks known as FAST (Framework for the Application of System Thinking) is to understand the system design cycle (Whitten & Bentley, 2007). FAST is an agile method and consists of eight steps which are the development of the four classic steps in the system design cycle, namely scope definition, problem analysis, requirements analysis, logical design, decision analysis, physical design and integration, construction and testing, and installation and presentation.

Figure 3. The PIECES Framework for Problem Identification
Source: Systems Analysis & Design Methods, 2007

FAST Phases	Classic Phases			
	Project Initiation	System Analysis	System Design	System Implementation
Scope definition	X			
Problem analysis	X	X		
Requirements analysis		X		
Logical design		X		
Decision analysis	(a system analysis transition phase)			
Physical design and integration			X	
Construction and testing			X	X
Installation and delivery				X

For more explanation of the eight steps of FAST is as follows (Whitten & Bentley, 2007):

Scope definition, this step is used to answer some questions of a problem. From the overall problem analysis, the limits of the problem to be fixed, the vision for improvement of the problem, the constraints, the number of human resources (HR) needed to solve the problem, as well as making a budget and schedule for solving the problem. Problem analysis, the team will study the existing system and analyze possible problems that arise in completing the project. Based on the level of complexity arising from the problem and the project schedule, the team may decide to continue the project or continue the project, or continue the project by shrinking the constraints of the problem. Problem analysis and evaluation are carried out by developing a framework called the PIECES Framework to group system problems. Requirements

analysis is needed in creating a new system to adjust to the needs of users. In this step, what needs to be identified is the capability of a system and not the specifications or technical implementation of the system to be developed. Based on the three steps above, a System Vision Document can be prepared. System Vision Document is a document that identifies the benefits and functions that can be carried out on the system to be prepared (Satzinger et al., 2016). In this document, there is a description of the problem, system capability, and benefits of the system to be developed. Logical design, business needs are identified and documented so that a logical design of the system can be made. The result of the logic design is the logical model of the system to be executed. The logic model here is technology-free, i.e. it describes the system needs that must be met by the various technical solutions that can be considered. Decision analysis, at this stage, identification of various solutions will be carried out, then analysis will be carried out for the best solution to solve the problem. The criteria for deciding on the best solution can be the technical ability of the system designer to design the system, the operational ability of the system to be able to be used and meet the needs of users, economical ability to develop the system as cost-effectively as possible, ability to meet the set schedule to generate the system and solve user problems, ability to overcome risks and run new systems well, design the physical design and integration, after getting the best solution to meet the needs of the system, the next step is to design the physical design and integration, contruction and testing, at this stage will be built and tested systems that meet business needs and system design specifications and installation and delivery, at this stage training will be carried out for users who will use the system. This stage also includes documentation of instructions that will help users. This implementation stage will be assessed to measure the success rate of using the system.

2.4 PIECES FRAMEWORK

Problem analysis using the PIECES Framework (Whitten & Bentley, 2007) includes Performance, which consists of Throughput in the form of the amount of work that can be completed and Response time in the form of the time at the time of the transaction and the time to respond to the transaction. Furthermore, Information and Data which contains Output to test whether the information presented is less informative, less relevant, accurate, and not very needed, and the information provided is too much and Input to test whether the requested data exceeds the required time, a lot of data is wrong, difficulty in obtaining data, and a lot of data is double/repetitive and Stored data to test whether the data stored is double, No data integration/little data integration, inaccurate stored data, data storage in vulnerable places, data not stored neatly, and data difficult to access. Then there is Economics, which consists of the cost of testing expensive costs or unknown costs from which they come from, and profits on new target markets, increasing marketing, and increasing order numbers. Next, Control (and Security) to test whether the level of control is low or very high. Then Efficiency, to test the time used is not maximum/ the materials used are not optimal/ it takes a lot of effort to complete the task/ the materials used are very much to complete the task. The last is Service, to see the production results of the wrong system, the production results of the system are inconsistent, the system is unreliable, the system

is difficult to learn, the system is difficult to use, the system used makes confusion for the users, the system is not flexible to be used under certain conditions and to undergo a change and the system interferes with the work of other systems.

2.5 BIG DATA AND ANALYTICS

Based on previous research Big data and analytics in the modern audit engagement: Research needs (Appelbaum et al., 2017) that "Big data and business analytics are dramatically changing the business environment and the capabilities of business processes. Business functions are changing, business capabilities are being added, anachronistic business functions are being eliminated, and, most of all, processes are being substantially accelerated. The same should occur within the external audit or assurance function; its rules need to be changed, its steps evolved, automation integrated into its basic processes, and its timing should become almost instantaneous in predictive, prescriptive, and preventive analytical modes."

In Big data Analytics and Other Emerging Technologies: The Impact on the Australian Audit and Assurance Profession (Kend & Nguyen, 2020), the overall importance of big data and advanced analytics emerging for the public audit and accounting professions cannot be overlooked. Big data and analytics tools enable auditors to better identify financial reporting, fraud and operational business risks and tailor their approach to provide more relevant audits. Other studies on innovation in auditing have examined areas such as business risk auditing. Evaluation of studies on audit methodologies and technologies can improve a broader understanding of emerging issues, big data helps auditors in modern audit practices. Big data allows Artificial Intelligence (AI) systems to infer patterns from large amounts of data and then apply those patterns to make decisions when new data is presented.

Furthermore, big data presents diverse datasets and advanced analytics. The increasing use of big data will continue to have a significant impact on accounting. This will continue to be reflected in how data is accumulated and recorded, how company management uses data to achieve organizational goals, and how reporting elements are processed and assembled. Diffusion of innovation theory has been used by previous research based on the flexible application of these tools to various fields. Previous research for example, (Premkumar et al., 1994)has leveraged the diffusion of innovation in website adoption, enterprise resource planning (ERP) and electronic data interchange (EDI). Researchers need to explore the extent to which accountants rely on big data to analyze big data. In order for an innovation to be independent, it must be widely adopted. According to the diffusion theory of the innovation adoption curve, there are five elements involved in IT adoption including innovation, adopters, communication channels, time and social systems. There are also five stages of the decision-making process for diffusion to occur, namely knowledge/awareness, persuasion, decision, implementation and confirmation. Future studies need to identify big data advances on the diffusion of innovation adoption curves and identify implications for accountants. Future research may also provide guidance on the appropriate level of reliance by accountants on different external data sources.

In the working group on IT Audit (INTOSAI, 2019), it was explained that analytical data has the potential to be applied in audits. Analytical data can contribute to every stage of an audit including in addition, data analytics is also relevant in perfecting the overall audit procedure in the implementation of the audit such as audit planning in determining strategy, macro, micro at the entity level or binding planning, understanding entities and their environment and mapping the risk of material misstatements, evaluation of design and implementation, testing of the effectiveness of internal controls carried out, substantive testing includes detailed analytical and testing procedures, presentation of conclusions and reporting. In addition, data analytics is also relevant in perfecting the overall audit procedure in the implementation of the audit such as fraud risk identification and mapping, perform external confirmation procedures based on the results of identification of high-risk items, auditing accounting estimates, gain an understanding of related party relationships and transactions, obtain evidence of investment valuation, inventory existence and condition, as well as completeness of litigation, claims, and valuations, identify the material of the next event evaluate whether there are substantial doubts about the entity's ability to continue operations as per the principle of going concern. Analytical data integrated with traditional audit methodologies allows auditors to derive potential benefits, regardless of the type of audit conducted.

Based on this description, what distinguishes this study from previous studies is that the focus of this research is to provide proposals for the application of the big data concept that can be applied to the SAI of Indonesia focusing on designing big data based on the needs of the auditor as the end user who carries out the audit at the West Sulawesi Provincial Government. Then a prototype was prepared using data sourced from the Regional Government Information System.

3. RESEARCH METHODS

This study was conducted using the single-case study method. Single-case studies aim to examine a unique case and be conducted in a short period of time (Robert K. Yin, 2018). The research period was relatively short for six months. With this time limit, this study is aimed at answering one case. The cases taken in the study are unique because they focus on the application of big data to develop the application of big data-based audit concepts at the State Audit Institution which is used in the audit of LKPD smoothly, effectively, and efficiently according to the needs of the Auditor.

This study uses a qualitative method with an intrinsic case study approach. Case study research is defined as research conducted on an object referred to as a case in its entirety, comprehensive, and very in-depth using various data sources. Qualitative data are used in the form of interview minutes, observation results, transcripts, and relevant internet information (Denzin & Lincoln, 2006). Qualitative data is generally data in the form of non-numerical data, such as sentences/photo notes, voice recordings, and images. Qualitative research is a method to explore and understand problems that are considered by a number of individuals or groups of people to

originate from social or humanitarian problems. The information and data obtained are then analyzed qualitatively to present the data, interpret, validate, and show the potential results of this study. Based on the results of the analysis, a proposed system to be developed is prepared (Creswell & Creswell, 2018).

3.1 OBTAINING DATA

There are three types of data collection used, namely through observation, unstructured and semi-structured interviews and document requests which are described as follows:

1. Observation
   Observation is aimed at obtaining additional information and viewpoints in understanding the context of the object being studied in order to convince other parties (Robert K. Yin, 2018). Observation was carried out by understanding the BIDICS application and its use at the time of the examination. Furthermore, an evaluation of the application of big data was carried out.
2. Interview
   The interview aims to obtain in-depth information on the ongoing business process. Semi-structured interviews are conducted by compiling a list of questions that can answer research problems but still accommodate the development of questions if necessary, so that the information obtained is more comprehensive and in-depth. The research began by compiling a list of research questions to obtain information with details of the interview questions can be seen in the Table 1.

Table 1. Interview Question

Sources	Role	Question
Head of Subauditorate	Person in Charge / Deputy Person in Charge	1. Has the Regional Government utilized the Application in the preparation of the Regional Government Financial Statements? and What Apps to use? (if any) 2. Is there an application of big data-based data processing at the State Audit Institution? 3. What functions are needed by the Auditor in processing data on the output of the application?
Associate Auditor/ Associate Expert	Deputy Person in Charge / Technical Controller	
Junior Auditor/ Junior Expert	Team Leader	

   Then an interview was conducted as well as a simulation of an example of the application of big data carried out to resource person 1, namely the Head of Subauditorate (KSA) with experience in carrying out financial statement audits 38 times, Performance 20 times and PDTT 27 times. Furthermore, interviews were conducted with resource person 2, namely the Technical Controller with experience in carrying out Financial Statement audits 42 times, Performance 17 times and PDTT 19 times. Then interviews were conducted with resource person 3, namely the Team Leader with experience in carrying out Financial Statement audits 32 times, Performance 15 times and PDTT 12 times.
3. Document Request
   The use of relevant documents aims to find out the business processes and obstacles faced by the State Audit Institution in implementing big data. One of the

documents obtained is the BPK Strategic Initiative Monitoring Report 2020-2024 which contains the development and utilization of big data.

3.2 DATA ANALYSIS

In this study, the author divides data analysis activities into two stages, namely problem identification using the PIECES Framework and system design using the FAST method. These two stages are to answer research questions and in accordance with the formulation of the problem that has been described. In the second stage, there are eight steps of system design which include scope definition, data analysis, needs analysis, system logic design, decision analysis, physical design and system integration, system prototyping, and implementation and confirmation of the final result. The data analysis used is analytic induction. This method is used to analyze qualitative data by giving a broad explanation of an event until the discovery and explanation of a hypothesis. Analytic induction begins with a description of the conditions that occur. Furthermore, a hypothetical explanation of the conditions that occurred was given, then case testing was carried out using in-depth interviews. If a case does not match the research hypothesis, the researcher redefines the hypothesis or excludes "deviant" cases that are not related to the hypothesis. Analytic induction involves inductive (not deductive) reasoning that allows modifications to be made to hypothetical explanations for events during the research process (Sekaran & Bougie, 2016).

3.2.1. PROBLEM ANALYSIS (PIECES FRAMEWORK)

In this section, problems are identified based on the results of interviews conducted with resource persons related to the use of big data using the PIECES Framework (Sekaran & Bougie, 2016). The analysis unit used is a multi-unit analysis with a research object in the form of the BIDICS application. The activity chosen in this study is to evaluate whether BIDICS has been able to process big data in the application for the preparation of local government financial statements (SIPD).

3.2.2. SYSTEM DESIGN

The system design uses the eight-step FAST method which includes the following:

1. Definition of Scope
   In this step, the researcher presents specifically the scope discussed in this study and its limitations, namely the management and audit of Local Government Financial Statements.
2. Problem Analysis
   Considering that the problem analysis has been carried out previously through the PIECES Framework, at this stage the conclusions that have been obtained previously related to the problems that exist in the proposed application of the concept are presented.
3. Needs Analysis
   After categorizing the problems from the PIECES Framework, then an analysis of system needs is carried out as outlined in the system vision document. This system vision document consists of a description of the problem, system capabilities, and system benefits.
4. System Logic Design

This logic design was made to describe the stages of applying big data in audits through a simulation of the system to be developed.

5. Analysis Result
   Based on the design of the system logic, then the identification of problem solving or solutions that can meet the provisions of the system logic design is carried out. Some alternative solutions to meet the needs of the system can be seen in the Table 2.

Table 2. Decision Analysis of Big Data System Solutions at the SAI of Indonesia

Assessment Aspects	Software purchase	System Development with In-house	Outsourcing
Technical feasibility	Easy	Easy	Easy
Operational feasibility	Easy	Easy	Easy
Economic feasibility	Expensive	Easy	Expensive
Schedule feasibility	High	Low	High
Risk feasibility	Medium	Low	High

Source: (Whitten & Bentley, 2007)

Based on the table, various considerations can be seen to decide on the right solution in realizing the system.

6. Physical Design and System Integration
   Based on the analysis of the decision, a big data-based audit system will be developed at the State Audit Institution. The system developed must be compatible with software specifications, hardware and user capabilities.
7. System Creation
   The system prototype was carried out using the php, javascript, sublime text, dbms navicat programming language with a mysql database in the form of a website-based dashboard.
8. Installation and Confirmation of Final Result
   After the system is designed, a prototype of the system is then tested to financial managers and auditors of the SAI of Indonesia. From the results of the trial, interviews were conducted to confirm the results of the implementation of the system in the audit. Here is a list of questions asked:
   a. What is your opinion on the system design that has been prepared?
   b. Are there any suggestions or considerations for this concept?

3.3TRIANGULATION OF RESEARCH DATA

Triangulation in case studies can be carried out through 4 (four) types, namely data triangulation, investigator triangulation, theoretical triangulation and method triangulation. The triangulation of data in this study is presented as follows (Michael Quinn Patton, 2015):

Table 3. Triangulation of Research Data

Triangulation Type	Triangulation Treatment
Data Triangulation	Information on an object related to the application of big data in auditing at the State Audit Institution in this study was obtained through interviews with the Person in Charge/Deputy Person in Charge, Technical Controller, and Team Leader and observation of the use of BIDICS. The interview was conducted to find out the use of BIDICS and the big process expected by the Auditor.

Triangulation Type	Triangulation Treatment
Triangulation of investigators	To improve the accuracy in explaining the application of big data in audits at the State Audit Institution, an evaluation was carried out by researchers, government accounting expert Dr. Deddi Nordiawan, S.E., M.M, audit expert Dr. Dwi Setiawan S.E., M.Si., CA, CSFA, FCMA, CGMA and big data expert Laode Nusriadi S.E., M.Si., CA, Ak, CSFA, CFrA, ACPA, FCPA.

Source: Processed by Researcher

4. ORGANIZATION PROFILE

The SAI of Indonesia is the only institution authorized to conduct an audit of the management and responsibility of state finances. State finance is all the rights and obligations of the state that can be valued in money, as well as everything both in the form of money and in the form of goods that can be used as state property in connection with the implementation of these rights and obligations (DPR RI, 2003). In conducting an audit of the management and responsibility of state finances in the Regional Government, the State Financial Auditorate V for the Sumatra and Java regions while the State Financial Auditorate VI for the Kalimantan, Bali, Nusa Tenggara, Sulawesi, Maluku and Papua regions. The scope of financial audits examined by the SAI of Indonesia based on the results of the Regional Financial Information System (SIKD) data recap as of February 7, 2024 in Table 4 (Ministry of Finance, 2019, 2020, 2021, 2022, 2023)

Table 4. Realization of State Revenue sourced from the APBD for the 2019 to 2023 Period

No	Year	Regional Revenue	Regional Financing Receipts	Total Regional Revenue
1	**2**	**3**	**4**	**5 (3+4)**
1	2023	1,190,202.79	115,425.33	1.305.628,12
2	2022	1,187,223.49	137,027.43	1.324.250,92
3	2021	1,168,216.11	112,691.13	1.280.907,24
4	2020	1,115,490.41	114,001.81	1.229.492,22
5	2019	1,198,407.26	106,988.07	1.305.395,33
Total		**5.859.540,06**	**586,133.77**	**6,445,673.83**
Average per year		**1.171.908,01**	**117,226.75**	**1,289,134.77**

Note: In billions of rupiah

Source: Processed by Researcher

The description of the table above is the object of examination by the SAI of Indonesia. The auditor must ensure that all such receipts are in accordance with the rights. If it is found that there is a shortfall in state revenue, the responsible party must follow up by depositing the shortfall in revenue into the regional treasury. In addition, there are other audit objects in the form of

expenditure realization with data in the Table 5.

Table 5. Realization of State Expenditure sourced from the APBD for the 2019 to 2023 Period

No	Year	Regional Spending	District Financing Expenditure	Total Regional Expenditure
1	**2**	**3**	**4**	**5 (3+4)**
1	2023	1,194,679.48	21,662.99	1.216.342,47
2	2022	1,184,242.23	17,100.27	1.201.342,50
3	2021	1,145,087.49	14,649.27	1.159.736,76
4	2020	1,121,957.88	12,909.84	1.134.867,72
5	2019	1,188,023.28	17,364.31	1.205.387,59
Total		**5,833,990.36**	**83,686.68**	**5,917,677.04**
Average per year		**1,166,798.07**	**16,737.34**	**1,183,535.41**

Note: In billions of rupiah

Source: Processed by Researcher

The table above shows the amount of expenditure and regional financing that is the object of audit to ensure that every cost incurred is in accordance with the provisions. If expenditure or financing is found that is not in accordance with the obligation, the responsible party will carry out financial recovery by depositing it into the regional treasury. To examine and test the fairness of the object of the audit, the *risk-based audit* (RBA) method has been applied.

4.1. VISION AND MISSION

The vision of the SAI of Indonesia is "To Become a Trusted Audit Institution that Plays an Active Role in Realizing Quality and Useful State Financial Governance to Achieve State Goals"(Finance, 2020). The mission of the SAI of Indonesia is (Finance, 2020), First, Examine the governance and financial responsibility of the state to provide recommendations, opinions, and considerations, Second, Encouraging the prevention of corruption and accelerating the settlement of state compensation, Third, Implement transparent and sustainable organizational governance to be an example for other institutions.

4.2. SAI OF INDONESIA

To carry out the management of the audit, it is necessary to arrange an audit organization consisting of the Audit Task Provider (PTP), PSP, and PFP. PTP is a body consisting of the Chairman, Vice Chairman, and Members or Officials who are assigned in writing by the Agency responsible for providing direction and assignment of audits to PSP and PFP, monitoring the progress of the audit, signing exit letters and LHPs, and submitting LHP and IHPS to the representative institutions and entities being audited. PSP is the implementing officer of the Audit Work Unit who is in charge of managing audit resources and ensuring the quality of the audit in accordance with

the scope of the audit work area. The PSP at the Office of the Central SAI of Indonesia is held by the Chief Auditor of State Finance (Tortama), the Head of the Auditorate, and the Head of the Sub-Auditorate. The PSP at the Office of the Representative SAI of Indonesia is held by the Head of Representative (Kalan) and the Head of Subauditorate (Kasubaud) in stages. PFP is the functional executor of the SAI of Indonesia who is responsible for carrying out the audit assignment given by PTP. The role of PFP is built on the competence of the auditor as evidenced through the role certification process and formally recognized by the SAI of Indonesia as the Supervisor of the Auditor's Functional Position through the Auditor's Role Determination Letter (SKP) by the Secretary General of the SAI of Indonesia. The role of PFP that is legitimized with SKP is also called the Formal Role (SAI of Indonesia, 2015).

5. RESULT AND DISCUSSION

Problem analysis in the implementation of audits at the SAI of Indonesia is carried out by observing and interviewing auditors, it is known that there are several things that are obstacles for auditors to process SIPD data using BIDICS, namely SIPD data analysis is not automatic. Based on the BIDICS architecture document, an overview of the data analysis process can be obtained which can be seen in Figure 5.

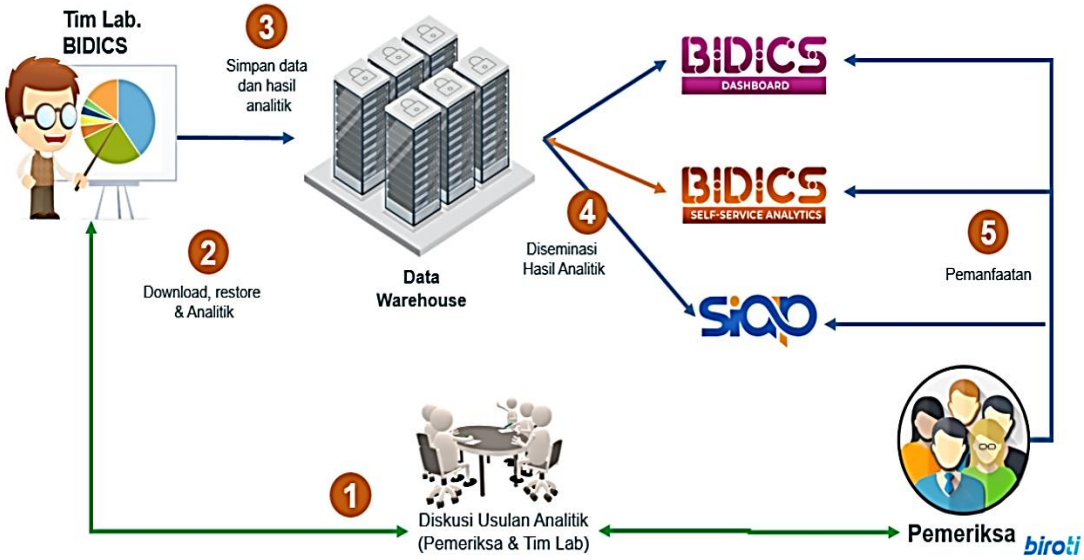


Figure 5. BIDICS Architecture
Source: IT Division, 2021

Based on the figure, it can be explained that the data processing process is carried out by the Auditor submitting a manual data processing request to the Lab Team and the Auditor assigned to process the data. The results of the data processing are sent to the BIDICS server so that the Auditor can download and use the data processing results. The following is the display of the BIDICS application used in the implementation of audit. The BIDICS interface can be seen in Figure 6.

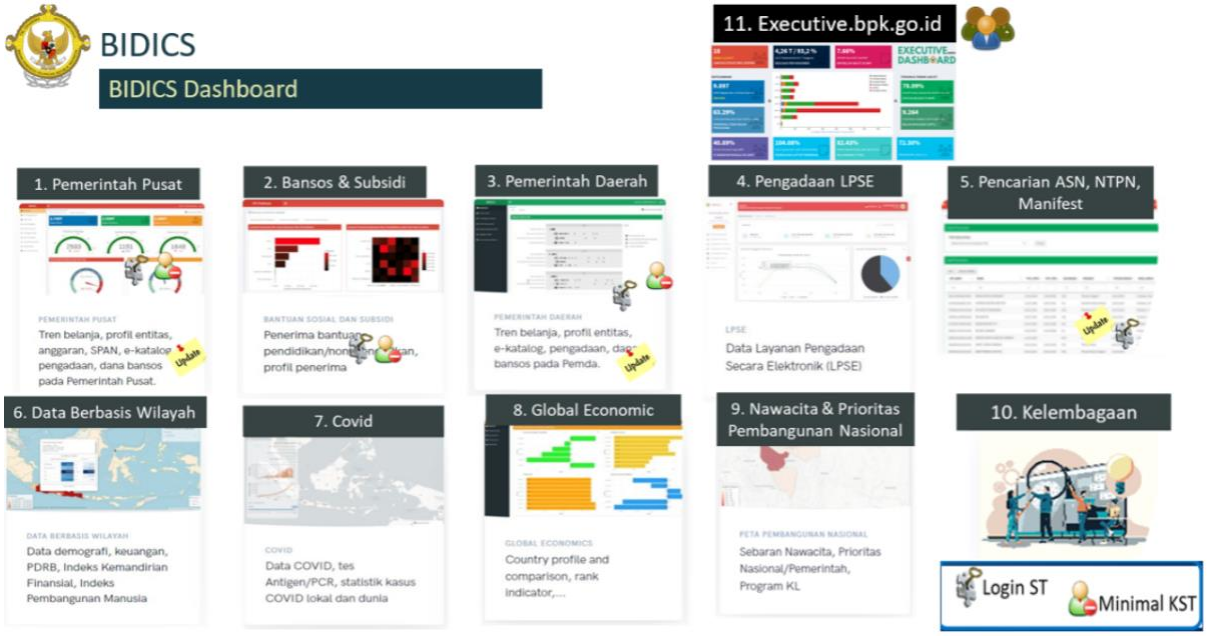


Figure 6. BIDICS Interface
Source: IT Division, 2021

Auditors, in addition to obtaining processing data from the BIDICS application, also obtained Audit data from the AKN VI Audit Management Auditorate in the form of SIPD data withdrawal results in the form of expenditure realization data, budget, general journal, payment order (SPP) deduction, Expenditure Proof (TBP) deduction, contract register, fund disbursement order (SP2D) register and SP2D details. Based on the results of the interview with the Head of Subauditorate, Supervisor and Team Leader can be seen in the Table 6.

Table 6. Interview Results

Role	Result
Sources 1 (Head of Subauditorate)	1. The application used in preparation Regional Government Financial Statements is SIPD which has been used since 2023. The application was issued by the Ministry of Home Affairs. 2. There is an application that is used to process data nationally to obtain symptoms, namely the BIDICS application. 3. There is an application used in the audit at the BPK West Sulawesi in the form called SiAP LKPD, which is for the presentation of data and monitoring/supervision instruments by the chief until to reporting process. Meanwhile, data processing/processing uses BIDICS by sending data to the Head Office for processing and then submitting it to the Auditor who proposes the data processor.
Sources 2 (Supervisor)	The entities that have been examined since 2023 have used the application but are not yet same. There is still 1 (one) entity using the FMIS application (SIMDA). (A total of 7 (seven) audit entities with details of SIPD 6 (six) and FMIS 1 application users)
Sources 3 (Team Leader)	1. The preparation of Regional Government Financial Statements has mostly used applications. 2. There is an obligation to use the SIPD application in the preparation of Regional Government Financial Statements. 3. There is no application that can be used in automatic data processing. It is hoped that there will be an application that can process and analyze the

	output data of the local government financial report preparation application (LKPD).

Based on the interview above, BIDICS is an application used by SAI of Indonesia in carrying out data processing. However, the data processing process is carried out manually by sending data to be processed to the head office. After the data processing is carried out, the processed products are sent to the inspector who proposes the processing. So that the functions of big data and analytics have not been fully used. The following are the results of the analysis and evaluation of BIDICS using the PIECES Framework can be seen in the Table 7.

Table 7. Results of Analysis and Evaluation of BIDICS Using the PIECES Framework

No	System Weakness Analysis	Relevant Problem	Suggestions
1	Performance	There is a waiting time for data processing which is done manually by sending data to the IT Lab	A system that is able to produce output in the form of direct analysis
2	Information and Data	There has been no application of big data in BIDICS	The system is able to present historical data in the form of the necessary database
3	Economics	Development of BIDICS by the State Audit Institute	BIDICS has been developed by the IT Department
4	Control (and Security)	The BIDICS application can only be accessed when the examiner obtains an assignment	Data and application security policies have been implemented
5	Efficiency	Data processing by sending a data processing proposal to the Head Office (IT Lab) for further processing and sending back to the examiner	A system capable of stand-alone processing
6	Service	In data processing, BIDICS as a medium to convey data processing requests for auditors	A system that is able to implement big data-based data processing

In accordance with the problems that have been identified in the audit business process and the use of big data will be carried out using the PIECES Framework, a system that can present and process the data output from the SIPD is needed. Based on this data, further processing is carried out according to the needs of the auditor. Based on the definition of scope, problem analysis, opportunities and analysis of system needs that have been outlined above, the following is presented as a System Vision Document on the application of big data in audits can be seen in the Table 8.

Table 8. System Vision Document Big Data System at the SAI of Indonesia

System Vision Document
Big Data System at the SAI of Indonesia

Description Problem

In accordance with the problems that have been identified in the audit business process and the use of big data will be carried out using the PIECES Framework, it is known that there is a waiting time for data processing which is done manually by sending data to the IT Lab, there has been no application of big data in BIDICS, data processing by sending a data processing proposal to the Head Office (IT Lab) for further processing and sending back to the auditor and in data processing, BIDICS as a medium to convey data processing requests for auditors.

System Capabilities

Big data *systems* must be able to provide:

- A system that can support the analysis of structured and unstructured data.
- A system that is able to produce output in the form of direct analysis
- The system is able to present historical data in the form of the necessary database
- A system capable of stand-alone processing
- A system that is able to implement big data-based data processing

System Benefits

Big data *systems* are expected to provide the following benefits:

- Automate data processing.
- Presenting the results of the analysis of the Regional Government Financial Statements.

The system logic design in this study is prepared using modeling techniques in a model-driven approach, namely process modelling using a prototype to describe the big data system to be compiled. Process modelling that has been compiled to explain the design of big data logic at the SAI of Indonesia. The layout of the proposed big data design that will be applied to the SAI Indonesia. The results of the decision analysis with technical feasibility criteria, that the In-house system is suitable because it can accommodate and adjust the features in the big data system according to the needs of the auditor. In addition, the risk of in-house operations is smaller, if there is a system that is not running, you can directly contact the IT staff in the office without using a third party. In terms of operational feasibility, system operations can be adjusted to the needs and capabilities of users in operating the system. Meanwhile, in terms of economic feasibility, it is more economical to use the system in-house rather than outsourcing and buying software. Then in terms of schedule feasibility, in-house system construction can be carried out according to a specified time such as outsourcing, which must wait for a third party's schedule to be able to build the system. In terms of risk feasibility, because the audit data is confidential, it is safer to implement in-house. Specifically, in-house system development using EUD, more precisely what is used is website visualization with a database. The use of websites and databases is suitable for big data systems in the SAI of Indonesia because it is user-friendly (all auditors can take advantage of the system) and is more economical to implement. Logical design of big data system at the SAI of Indonesia. Based on discussions and

interviews with the SAI of Indonesia, the solution decided to be taken is the development of an in-house system.

Based on the results of the above analysis, it was decided to develop an in-house information system. The method used is End-user Development (EUD) with the software and hardware used already available on computer devices and laptops at the State Audit Institute. In the next discussion in physical design, software, hardware, and user specifications will be discussed. Based on the results of interviews with resource persons 1, 2, and 3 for validation of the simulation of the application of big data in the form of a website dashboard interface, the three have agreed. The website dashboard can be accessed through a browser available on a computer/laptop using the internet network. By using such a browser, the cost of accessing and developing EUDs can be minimized. The hardware used to implement big data is computer and laptop devices available at the State Audit Institution. Minimum hardware specifications in Table 9.

Table 9. Results of Analysis and Evaluation of BIDICS Using the PIECES Framework

No	Item		Minimum Requirements
1	Computers and processors	:	Prosesor x86-bit atau x64-bit 1 GHz or faster
2	Memory	:	RAM 2 GB
3	Hard disk	:	1 GB available disk space
4	Screen Resolution	:	1024 x 768
5	Graphics	:	Graphics card with Direct X
6	OS	:	Windows 7/8/10/11
7	Internet network	:	1 Mbps

Specifically, the hardware devices contained in the SAI of Indonesia use the Windows 10 operating system, 2.50GHz-2.90GHz processor, 8.00/16.00 GB RAM, and x64-bit operating system type.

Based on the results of observations, it is known that big data system users are all auditors assigned to audit Financial Statements. So that this big data system will present data analysis according to user preferences using browsers that are already available on the Auditor's computers and laptops. Based on the results of the interview with the auditor, it was explained that the big data system can be applied in the implementation of the audit so that it runs smoothly, effectively, and efficiently. To develop of a big data system is carried out simply using the programming languages php, javascript, sublime text, dbms navicat with a mysql database in the form of a website-based dashboard. The system interface uses data visualization features. Access to the big data system is done through a website address link so that it does not require special installation and training to open a previously designed big data system. However, in order to make it easier for users to understand and use this system, instructions for using the big data system are then prepared. In order for every user who is granted access rights to use the big data system, this system is installed on a server that can be accessed from every computer device and laptop belonging to the SAI of Indonesia. Based on the results of the interviews, the system that has been designed has been tested and received input from the auditor which has subsequently been

refined as the input submitted. The existence of this system is expected so that the implementation of the audit can run smoothly, effectively, and efficiently. The following is an overview of the application of big data, the results of the research can be seen in Figure 7 until 12.

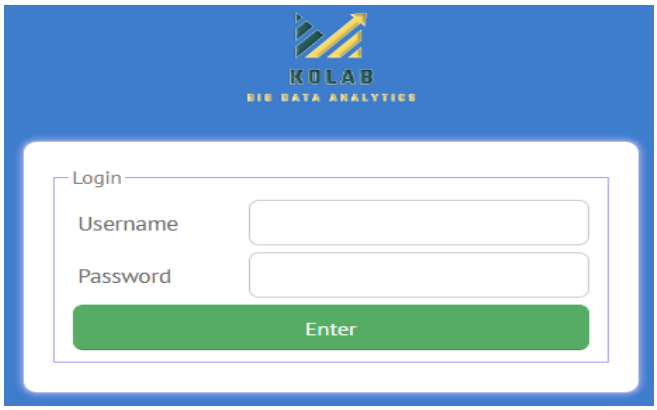
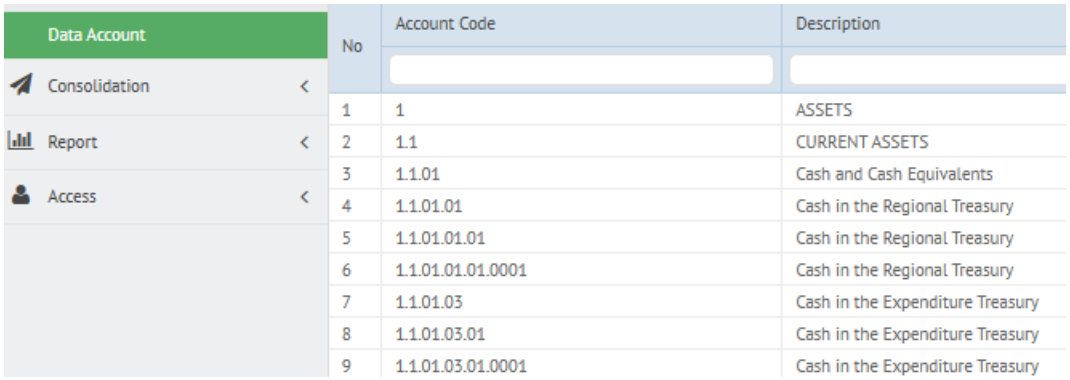


Figure 7. Login Page
Source: Research Results



No	Account Code	Description
1	1	ASSETS
2	1.1	CURRENT ASSETS
3	1.1.01	Cash and Cash Equivalents
4	1.1.01.01	Cash in the Regional Treasury
5	1.1.01.01.01	Cash in the Regional Treasury
6	1.1.01.01.01.0001	Cash in the Regional Treasury
7	1.1.01.03	Cash in the Expenditure Treasury
8	1.1.01.03.01	Cash in the Expenditure Treasury
9	1.1.01.03.01.0001	Cash in the Expenditure Treasury

Figure 8. Data Account
Source: Research Results

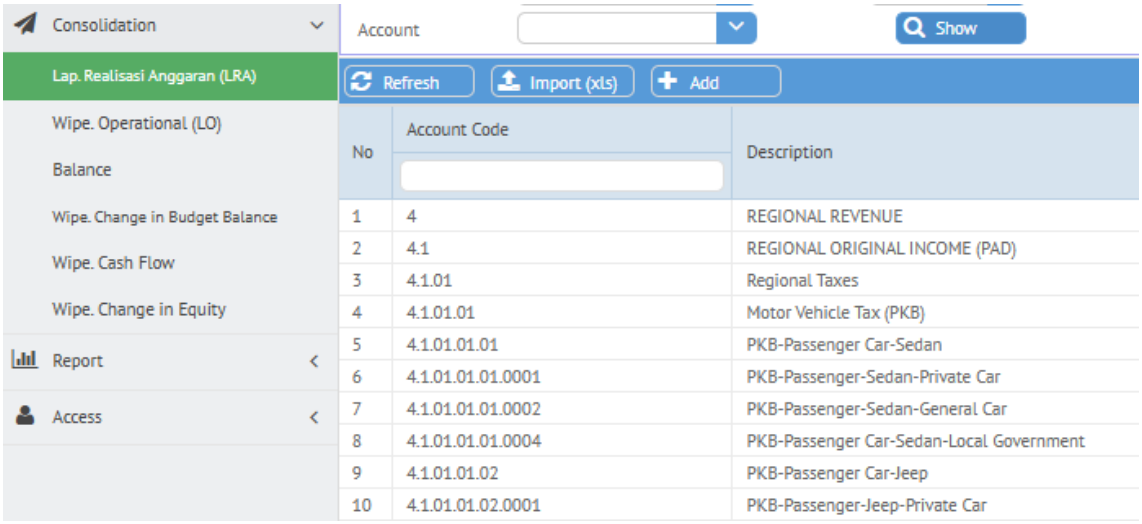


Figure 9. Data Consolidation
Source: Research Results

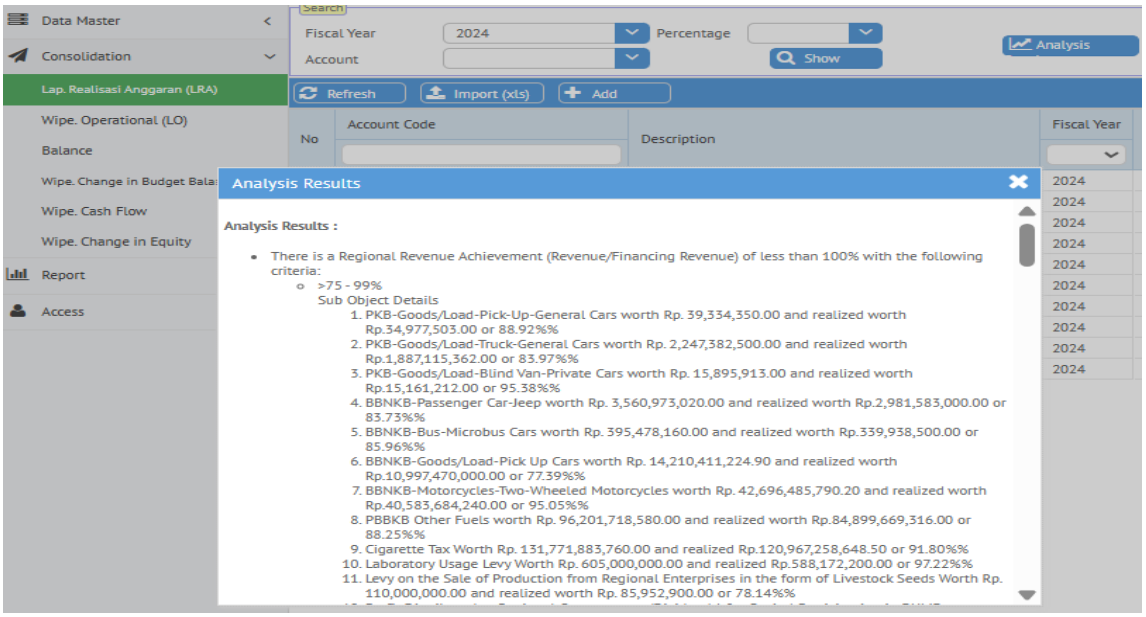
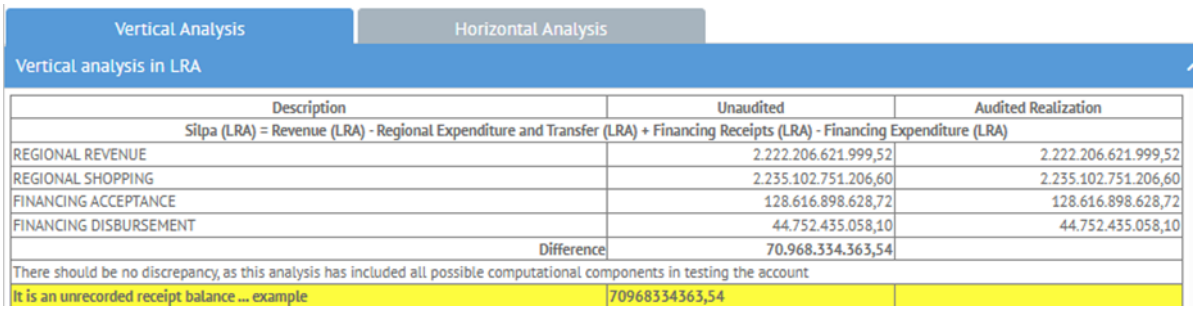


Figure 10. Result of Analytics Data
Source: Research Results



Description	Unaudited	Audited Realization
Silpa (LRA) = Revenue (LRA) - Regional Expenditure and Transfer (LRA) + Financing Receipts (LRA) - Financing Expenditure (LRA)		
REGIONAL REVENUE	2.222.206.621.999,52	2.222.206.621.999,52
REGIONAL SHOPPING	2.235.102.751.206,60	2.235.102.751.206,60
FINANCING ACCEPTANCE	128.616.898.628,72	128.616.898.628,72
FINANCING DISBURSEMENT	44.752.435.058,10	44.752.435.058,10
Difference	70.968.334.363,54	
There should be no discrepancy, as this analysis has included all possible computational components in testing the account		
It is an unrecorded receipt balance ... example	70968334363,54	

Figure 11. Result of Analytics Procedure
Source: Research Results

Figure 12. Result of Analytics Trend
Source: Research Results

6. CONCLUSION AND RECOMMENDATION

This study aims to evaluate the application of big data in the SAI of Indonesia in the examination of LKPD and propose the concept of big data that can be applied smoothly, effectively, and efficiently according to the needs of the Auditor. Based on this study, it can be concluded that the State Audit Institution has a grand design in the development of big data through BIDICS. However, the application has not met the needs in the LKPD examination. The results of the simulation of the big data application prototype to the Head of Subauditorate, Supervisor and Team Leader show that the application can be used and help in the implementation of LKPD audits.

The causative factors of the problems described in the PIECES Framework have been addressed in the designed system. However, it is necessary to conduct a review every time there is a change in provisions/policies to assess whether the system can accommodate these changes or it is necessary to update the system again. Considering that in the preparation of this big data system, there is a change in the use of applications in the Regional Government which initially used SIMDA to SIPD, so it is necessary to make changes to the big data system due to the business process and the overall data structure that has changed.

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