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E-PORTFOLIO FOR DIGITAL UNIVERSITIES USING SMART CONTRACTS ON INTELLIGENCE BLOCKCHAIN TECHNOLOGY

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ABSTRACT

This research aims to develop and evaluate an e-portfolio for digital universities using smart contracts on intelligence blockchain technology. The analysis was carried out using synthesis, design, and evaluation in accordance with a conceptual framework and process consisting of four parts: Part 1: Input factors, which are objectives, users, equipment, and content. Part 2: The workflow, including interoperable technologies such as smart contracts, blockchain, artificial intelligence, and electronic portfolio formats. Part 3: Expert evaluation of the portfolio based on the research objectives. Part 4: The response to feedback from an expert suitability assessment. The suitability for digital universities of electronic portfolios using smart contracts on intelligence blockchain technology was found to be very good. Consequently, the model that has been developed may be an efficient platform to lead to a digital university according to the mission set by the university. This model serves as a framework for the development of various electronic performance evaluation methods, including but not limited to assessing employee performance and determining wage increments. These methods utilize data obtained from stored electronic records.

Keywords: *E-Portfolio, Smart Contracts, Blockchain Technology, Artificial Intelligence, Digital University*

1. INTRODUCTION

The method of gathering data on student history reveals that it is typically archived in paper format. This leads to the inefficient utilization of workspace and poses challenges in terms of both upkeep and maintenance. From paper portfolios of the past, electronic portfolios have grown in popularity and have become more convenient and efficient for managing and searching large amounts of files. It covers the current work that computers play a role in and helps to improve it into electronic files. However, there are security concerns regarding the privacy of students and their personal information. Traditional file systems are centralized, which causes some problems, such as the organization's complete control of the data that may tamper with the database and the insecurity of electronic portfolios [1]. Nevertheless, it is an essential tool to support and document personal, professional, and intellectual development [2]. Universities are also organizations that must adapt to keep up with these changes. In almost all universities, the distribution of information has always been a problem. In most, student performance data is stored at the university's registrar's office, but personal data storage is scattered across faculties. Achieving more competent in a digital university is the mission of the contemporary university [3]. An e-portfolio is a valuable tool for systematically collecting student information including their CV, educational background, training, transcripts, certificates, etc. Therefore, electronic portfolios can serve as a means to demonstrate potential and reflect students' ideas. The invention of new technologies and the availability of high-speed connections clearly play an essential role in our daily lives despite the challenges they pose, and those related to security in particular. Blockchain technology is one of the most influential and attractive technologies for its potential for secure, smart contracts stored on the blockchain, and artificial intelligence to make

electronic portfolios. For this reason, the research authors conducted research to assess the findings with the following research questions:

(1) What are the components, and what is the process for building e-portfolios?

(2) What does an e-portfolio for digital universities using smart contracts on intelligence blockchain technology look like for a digital university?

The fair is an event focused on the collecting of electronic portfolio data, which leverages the functionalities of blockchain technology through the use of smart contracts and artificial intelligence technology. Its purpose is to generate student recruiting data that aids in facilitating the digital transformation of universities. The potential for future outcomes exists.

2. OBJECTIVES OF RESEARCH

The research objective are:

- To synthesize an e-portfolio format concept for digital universities using smart contracts on intelligence blockchain technology.
- To develop an e-portfolio for digital universities using smart contracts on intelligence blockchain technology.
- To assess the suitability of e-portfolio formats using smart contracts on intelligence blockchain technology for digital universities.

3. RESEARCH HYPOTHESIS

The evaluation of the e-portfolio for digital universities using smart contracts on intelligence blockchain technology was excellent.

4. SCOPE OF THE RESEARCH

4.1 Population and Sample

The research population comprises professionals in information technology, educational information and communications, artificial intelligence and those with at least five years of relevant experience.

The sample group in the research consisted of nine experts who assessed the suitability of the e-portfolio. All were experts in information technology, information and communication for education, and artificial intelligence, and had relevant experience of not less than five years with a specific method.

4.2 Variables

The primary variable is an e-portfolio format for digital universities using smart contracts on intelligence blockchain technology.

The dependent variable is the result of the evaluation of the appropriateness of the e-portfolio format for digital universities using smart contracts on the intelligence blockchain technology.

5. CONCEPTUAL FRAMEWORK

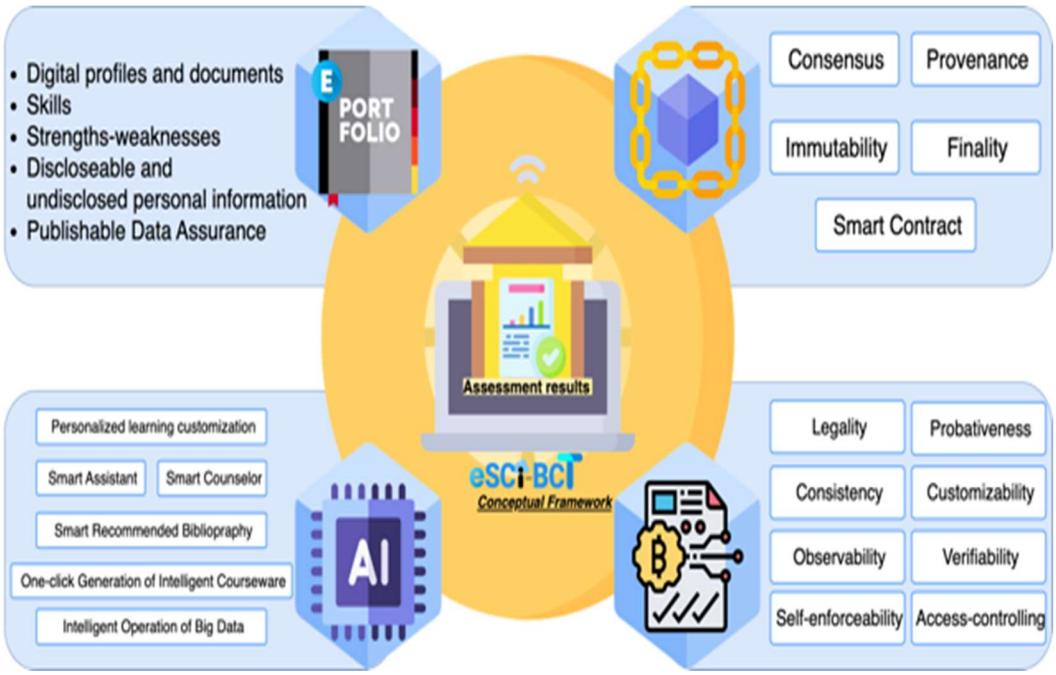

Figure1. E-Portfolio for digital universities using Smart Contracts on Intelligence Blockchain Technology

6. RESEARCH INSTRUMENTS

- E-Portfolio for digital universities using Smart Contracts on Intelligence Blockchain Technology Model.
- The Evaluation form of E-Portfolio for digital universities using Smart Contracts on Intelligence Blockchain Technology Model.

7. DATA COLLECTION

To achieve the results of the research The important data collection steps are as follows.

Step 1: Send the attached assessment form to the experts.

Step 2: The expert returns the assessment form.

Step 3: The assessment data is used to process the results

Step 4: Summarize the results of evaluating the suitability of the model to confirm its accuracy.

8. LITERATURE REVIEW

8.1 E-Portfolio

Many scholars and researchers have defined electronic portfolios. Xe et al. refers to it as a tool that can support a large amount of digital learning evidence, and adds that the nature of a digital e-portfolio will allow access. The e-portfolio will replace the old paper system [4]. Al-Hidabi et al. refers to it as a personal digital record that supports formal and informal learning, and provides evidence of an individual's achievements in the form of inventions and reflective learning. Owners can choose to allow personnel to access the data [5]. Ngui et al. emphasize the process of collecting evidence of individuals or groups whose evidence of competence and achievements is stored in the digital form of an electronic portfolio, which is more portable and accessible than paper records, and facilitates the distribution of all relevant evidence to interested stakeholders [6]. From the above definitions of an electronic portfolio, it can be concluded that it is a personal digital record that supports formal and informal learning, which provides evidence of a person's success using computer technology and the internet. In addition, it allows users to store and collect different media types such as text, audio, images, and animations, to participate in the formulation and selection of content, assessments, and self-assessments, and to choose to allow access to published or non-public private information. It reflects the development and learning outcomes of the users.

A large number of research studies have used electronic portfolios. The research guidelines are summarized as follows. Merlec et al. provide a summary of steps towards intelligent autonomous e-portfolio management. These include the exchange of educational information nationally and internationally that is safe and reliable [7]. Purnama et al. used Blockchain technology-based cooperative learning to provide a set of teaching strategies designed to educate students to work together to achieve learning goals through active and creative thinking. They found using blockchain can prevent data from being manipulated by third parties. Because the data is traditionally stored in a centralized network, user data is unnecessarily centralized. Therefore, linking co-ops with digital competencies through blockchain technology helps increase the reliability of student assessment evidence using a hash; thereby, blockchain can verify a learning process that is not limited by space and time [8]. Syzdykova et al. showed how electronic portfolios can be versatile tools that provide educational and professional benefits. It allows students to reflect on their academic performance while receiving feedback and to complete assignments to be evaluated and shown to future employers. This is the most critical factor affecting the true motivation of students. To actively contribute to the creation and use of portfolios is the primary value and usefulness of this tool [9]. Wanotayapitak et al. found that the design of this research process made it possible to solve problems in the cooperative education information system by connecting information to the public and enhancing digital competency through evaluating cooperative education electronic portfolios. Finally, blockchain has increased the credibility of assessment evidence in the open digital labor market [10]. Zheng designed an electronic portfolio evaluation system on a blockchain to assess the educational and teaching process. Its purpose is to apply blockchain to electronic portfolio evaluation with the aim of solving the complex problems of traditional electronic portfolio evaluation. This protects privacy, data sharing, and data tracking [11].

8.2 Smart Contracts

Many scholars and researchers have defined the meaning of smart contracts. For example, Al-Saqqa and Almajali refer to a small computer program stored on the blockchain. Every node in the blockchain is accessible and can interact with it. It shares a blockchain with immutable attributes, and no one can change the smart contract without consensus for the agreement. It is used in blockchain transactions and secures the network from attacks aimed at stealing or tampering with assets [12]. Ekaterina et al. define it as computer code that

automatically fulfills all or part of an agreement between parties and stores it in a blockchain-based platform. It derives from the platform features regarding security, consistency, and immutability [13]. B. Liu et al. define it as a particular computer program that runs on virtual machines worldwide on distributed and decentralized ledgers by running a consensus protocol and following a replicated machine state model. A centralized view of the system status and overall network participants is determined [14]. Synthesizing the above definitions of a smart contract, it can be concluded that it is a type of agreement that works similarly to a written contract. However, it is automated, and the data is preserved in the public domain instead. It will be recorded and documented like a typical contract but stored in a blockchain. Every node in the blockchain can be accessed and interacted with, sharing the blockchain with its immutable attributes. Smart contracts are inflexible and entail consensus for contract transactions on the blockchain and secure the network against looting attacks.

Many researchers have used smart contracts. The research guidelines are summarized as follows. Ahubele & Ndukwe discussed a smart contract model that uses verified ethereum to detect fake education certificates. It ensures that the system is designed according to specifications, meets functional requirements, and reduces the possibility of counterfeit certificates [15]. Alshahrani et al. discussed a blockchain-based smart contract certification system for higher education. Higher education certificates emphasize the production and sharing process and demonstrate trust, security and privacy, social influence, and efficiency. This has a positive effect on student and employer acceptance of blockchain-based systems [16]. Gunawan et al. found that smart contract innovations and tokenization help prevent data leakage, and identity theft and manipulation of digital data. Due to the very high level of data security, risks are minimized, and student quality can be improved [17]. S. Wang et al. found the application of blockchain technology to smart contracts is of outstanding academic and industrial interest due to smart contracts' decentralization, enforcement, and validation nature. It enables the fulfillment of contracts between untrusted parties without the involvement of trusted entities or central servers [18]. Zhao et al. found that the proposed use of smart contracts to store and manage relevant data in a blockchain creates a natural environment that can guarantee data security. This decentralized storage method solves a single flaw in traditional systems [1].

8.3 Blockchain Technology

Many academics and researchers have explained what blockchain technology means. For instance, A. A. Hussain et al. refer to a chain of data structures because all data form a square where all created courts are relative to their respective request. The blockchain is cryptically insured, so it will not be distorted or altered by ledger innovations [19]. Abreu et al. refer to it as a sequence of blocks in which complete transaction records are publicly available and maintained by multiple nodes in the network, each of which has a copy of the same ledger. Each block is a logical sequence of transactions, a permanent, transparent, and immutable record [20]. Capece et al. refer to its capacity to generate legitimate information because many participants in the network verify it. As a result, identity credentials are immutable and easily verifiable, saving time, reducing costs, and simplifying the verification process [21]. Blockchain technology is a record of all transactions performed on the processing computer and shared among the participating parties. Every transaction on the blockchain is verified with an original digital signature. As it uses encryption and digital signatures, the data stored on the blockchain is sealed and immutable. Its technologies include distributed storage, peer-to-peer transmission, consensus mechanisms, and encryption algorithms, which are transparent, flexible, verifiable, stable, and secure. A blockchain is a distributed database shared by many parties and trusted by everyone. Each party participating in network interactions maintains a copy of their database to ensure reliability and prevent tampering.

Blockchain technology has been used in numerous studies. The following is a summary of the research guidelines. Abougalala et al. found blockchain technology to secure critical feedback, and present security features with no new vulnerabilities [22]. Abreu et al. found a blockchain-based architecture approach to help store and control access to student credentials for secure data sharing. It improves trust and transparency, and only basic information is audited. By creating smart contracts to help control the work, plagiarism is prevented [1]. Ataşen & Aslan found the use of blockchain technology to provide decentralization and the use of smart contracts to provide trust in data [23]. Shakan et al. found that blockchain technology provides data verification mechanisms that can be customized to different levels of access to data and stakeholders. This makes it possible to track grades, issue educational certificates, and protect information from falsification. This includes facilitating credit

transfers and checking progress [24]. Y. Wang et al. discussed the creation of a student learning tracking system from a blockchain perspective. They showed that the accuracy and reliability of the quality traceability data of student indoctrination can be ensured [25].

8.4 Artificial Intelligence

Researchers and scholars have provided conceptualized definitions of artificial intelligence. According to Singh et al., it is an automatic machine capable of automatically performing functions such as perception, learning, reasoning, and problem-solving. The various forms of artificial intelligence – machine learning, deep learning, and neural networks – are used to automate complex human problems and benchmarks involving reasoning, speech, and vision [26]. Kumar et al. referred to it as technologies capable of performing complex tasks that require human intelligence and have potentially super-human capabilities, becoming one of the main drivers of industrial development [27]. Adams et al. referred to several educational support technologies and services, automatic essay scoring, learning analytics, intelligent tutoring systems, intelligent assistive technologies, natural language processing, and automated teaching staff [28]. From the above definitions of artificial intelligence, it can be concluded that it is a technology used to process computers, robots, machines, or other electronic devices. It can simulate human intelligence and produce actionable results. The learning process of artificial intelligence is a memory that enables understanding, respond to language, decision making, and problem solving by relying on large amounts of information with the same repetitive characteristics. It uses existing and new data to compile an extensive database for continuous analysis and processing to make itself more intelligent and able to predict situations more accurately.

A lot of research has been done using artificial intelligence. The research guidelines are summarized as follows. Hu. found artificial intelligence and blockchain technology to enhance the training mode and deepen production and education integration [29]. Jantakun et al. divided the general framework for artificial intelligence in higher education into model development and evaluation [30]. Richard et al. found the combination of artificial intelligence models and blockchain applications to benefit from both technologies in terms of transparency, security, and efficiency [31]. R. Wang et al., Decentralized Blockchain, Cryptographic Algorithm Underlying. Using smart contracts to create automated models and incentive mechanisms contributes to successfully integrating artificial intelligence technology in training [32]. And Wei et al. mentioned the work of "Artificial Intelligence+Education" was found to help users improve their learning habits and enhance the social perception of technology. It stimulates the demand of new consumers and promotes the further development of the industry and related products [33].

8.5 Digital University

Many scholars and researchers have given definitions of the digital university. Meepung et al. relate the digital university to digital aspects, human capital, emotional intelligence, class genius, and lifelong learning. It means developing digital literacy skills to develop academic potential and self-improvement abilities. The learning environment is a combination of digital and physical spaces that exist inside and outside the university [34]. Ajigini refers to the digital transformation of higher education as a transformation of the entire model, including strategies, organizational structures, and processes for effectively leveraging the digital economy. Hence, digital transformation in higher education must be done consciously and consistently [35]. AI Hasani et al. refer to the use of modern digital technologies and the restructuring of the interconnected educational process. Several models have been developed worldwide to bring about the digital transformation of universities [36]. According to the above definitions of a digital university, modern digital technologies and the restructuring of the educational process connect both tools, quality information, and people. All of these must be developed simultaneously, resulting in every organization in every sector have to adapt or transform into a digital organization to keep pace with changes in digital technology and with the resultant changes in people's consumption needs and behaviors. Higher education institutions are also organizations that are affected by the changes in digital technology and must adapt to keep up with the changes, so that the organization can respond to educational management in a way that suits the needs of the learners, responds to the needs of the establishment, and can compete with competitors.

A number of research papers have studied approaches to the digital university. These are summarized as follows. Akhmetshin et al. presented the development of a digital university model suited to current conditions, using the game's rules in the market and all social interactions to create some incentive. It found that developing ideas for

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digitizing education and the economy requires closing the digital gap between universities because the digital university is an essential component of the overall digital education system [37]. Doroshenko et al. identified the digital university model in the modern higher education reform process. It was found that the form of digital technologies used in education is not arbitrarily selected according to one's personal preferences but is dictated by the socio-economic characteristics of the activities of a particular educational organization [38]. Koskin et al. found the digitization of the educational system has an apparent influence on the collaboration process between academic institutions and therefore is supported by global digitization. The transition to a digital university is expected to lead to more flexible and smooth process implementation, a change in corporate culture, and process optimization [39]. Panket et al. found that risk assessment with intelligent data in information technology of digital universities has a component that has risk factors occurring in the university that are both internal and external [40]. Verkhova and Akimov discussed the continuous information support over the course life cycle within the digital university. It was found that this concept is based on using a multidimensional model that provides coordinated management of all processes and a significant reduction in routine work. The proposed model focuses on supporting an interactive educational model considering the students' unique characteristics [41].

9. RESEARCH METHODOLOGY

9.1 Process synthesis e-portfolio for digital universities using smart contracts on intelligence blockchain technology.

Table 1: Electronic portfolio workflow synthesis

Structure	Process of E-Portfolio									
	Personal information	Attitude/ Recognition/	Experience/ Lifelong skills	Comment/ Convenience	Formative Feedback/ Feedback and marks	Prior Knowledge	Monitoring/ Self-Assessment/ Reflection/ Evaluation/ Peer review	Professional development	Learning	Profile and Digital Identity/ Artefacts
[2]	✓	✓	✓	✓				✓	✓	✓
[42]	✓	✓	✓	✓				✓	✓	✓
[43]	✓	✓	✓	✓				✓	✓	✓
[44]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
[45]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
[46]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
[47]	✓	✓	✓	✓			✓	✓	✓	✓
[48]	✓	✓	✓	✓			✓	✓	✓	✓
[49]	✓	✓	✓	✓			✓	✓	✓	✓
[50]	✓	✓	✓	✓			✓	✓	✓	✓
[51]	✓	✓	✓	✓				✓	✓	✓
[52]	✓	✓	✓	✓				✓	✓	✓
[9]	✓	✓	✓	✓				✓	✓	✓
[53]				✓	✓		✓			
[54]				✓	✓		✓			
[55]				✓	✓		✓			
[6]				✓	✓		✓			

Table 1 is the synthesis of the working process of electronic portfolios. The researcher used all synthesized selection criteria presented as content in preparing the electronic portfolio. It includes personal information, academic results, experiences, external testimonials, personal information, student skills, strengths, and weaknesses. This is a collection of students' general information to create electronic portfolios.

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Table 2: Synthesis of smart contract workflow

Title	Process	Refer
Smart Contracts	1) Creation of an agreement between contractors 2) An event or objective is identified using a trigger. 3) It is published and distributed to users who have registered to trade according to the conditions specified. 4) Termination of the contract when the trade occurs 5) Reporting works when users report violations after the deposit has been transferred to the published contract.	[56]-[62]

As shown in Table 2, the synthesis process of smart contracts is as follows: smart contracts are a computer code executed without any redundancy and a decentralized consensus model that is safe, automatic, and standard. Smart contracts are one of the essential features of blockchain applications, which perform transactions reliably without a third party and can be performed automatically on the blockchain platform. There are five workflows: 1) Creation of an agreement between contractors 2) Events or objectives are identified 3) Dissemination and dissemination to users 4) Termination of the contract when a trade occurs 5) Reporting works when users report abuse.

Table 3: Synthesis of the components of blockchain technology

Title	Component	Refer
Blockchain	1) Block is a data store, where each block is always linked to the previous block with the previous block's Hash Function value. 2) Chain is an interconnected data chain of blocks. Essentially it remembers every transaction of everyone in the system and records new information in a distributed ledger. 3) Consensus is the process of setting rules and conditions that govern the integrity of data. The data is stored sequentially and has the same storage order, where each record is tested and digitally signed to ensure its accuracy. 4) Validation is system-wide confirmation.	[57], [63]-[68]

From Table 3, the synthesis of the elements of blockchain technology, the researchers can conclude that the components of blockchain technology consist of 1) Block 2) Chain 3) Consensus and 4) Validation [57], [63]-[69].

Table 4: Characteristic synthesis of blockchain technology

Features of Blockchain Technology															
Structure	Absence of forgeries	Distributed	Decentralized	Immutability of the Ledger	Transparency	Safe storage of information	Trust	Verification/ Validation	Mechanism of consensus	Smart contracts	Traceability	Currency	Cryptographic Link	Hashing	Peer-to-Peer Network
[12]		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		
[21]	✓						✓	✓							
[63]	✓	✓	✓	✓					✓						
[70]		✓	✓						✓	✓			✓	✓	✓
[71]	✓		✓			✓		✓	✓	✓					
[72]			✓	✓	✓				✓	✓	✓	✓			
[58]		✓	✓	✓	✓	✓	✓	✓					✓		
[73]			✓		✓		✓								
[68]		✓	✓		✓	✓	✓	✓	✓						
[74]			✓	✓						✓	✓	✓			
Sum		✓	✓	✓	✓		✓	✓	✓	✓					

As shown in Table 4, characteristic synthesis of blockchain technology, the researchers used the synthesized data to support the research in terms of research consistency, including: Decentralization, Transparency, Verification, Mechanism of consensus and Smart contracts

Table 5: Synthesis of artificial intelligence application properties

Title	Features	Refer
Artificial Intelligence	1) Information security has been improved. 2) Improved decision-making reliability 3) Shared decision-making 4) Decentralization of different functions 5) High efficiency	[31],[75]-[77]

As shown in Table 5 , the synthesis of artificial intelligence application features means that artificial intelligence and blockchain work together to create a secure, immutable, decentralized system for compassionate information. It consists of five components: 1) Improved information security 2) Improved decision-making credibility 3) Shared decision-making 4) Decentralization 5) High efficiency

Table 6: Synthesis of the components of a digital university

Title	Component	Refer
Digital University	1) Students, Personnel, Communities 2) Basic information 3) Secure data access 4) Information technology enhancement 5) Smart technology	[78]-[85]

As shown in Table 6 , the synthesis of digital university components entails the idea of building a digital university as an organization of digital learning and innovation, and the creation of a digital society. Personnel must help drive and better manage digital technology for the university's sustainable development. It consists of five components: 1) students, staff, and communities; 2) basic information; 3) secure access to information; 4) information technology enhancement; and 5) intelligent technology.

9.2 Development of an electronic portfolio format for digital universities using smart contracts based on intelligence blockchain technology.

The results of the synthesis of the documents in Table 1 to Table 6 analyze the design and development of an electronic portfolio model using smart contracts based on intelligence blockchain technology for digital universities.

9.3 Assessing the Suitability of Electronic Portfolio Formats for Digital University Using Smart Contracts on Technology intelligence Blockchain.

The researcher used an electronic portfolio model for a digital university using smart contracts on intelligence blockchain technology that was evaluated by nine expert appraisers. The appraisers have expertise in Information Technology, Educational Information, and Communication Artificial Intelligence and have at least five years of relevant experience.

10. RESULT OF RESEARCH

10.1 The result of the electronic portfolio format synthesis process for digital universities using smart contracts on intelligence blockchain technology.

Table 7 analyzes the use of electronic portfolio formats using smart contracts on intelligence blockchain technology. It has been found that e-portfolios using smart contracts on intelligence blockchain technology support a digital university. The objectives of the synthesis of the conceptual framework and the development of the model were set to assess the suitability of the eSCi-BCT Model.

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Table 7: Analysis of E-Portfolio for digital universities using Smart Contracts on Intelligence Blockchain Technology

Analysis of *E-Portfolio using Smart Contracts on Intelligence Blockchain Technology*			**Technology**													
			Blockchain							**Artificial Intelligence**						
			Distributed	Decentralized	Immutability of the Ledger	Transparency	Trust	Verification/ Validation	Mechanism of consensus	Smart contracts	Data security	Credibility	Data Transparency	Decision	Decentralization	Authorization
eSCi-BCT Model	**E-Portfolio**	1) Profile development and digital identity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		2) Each registered student must present a lifelong skill.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		3) Student personal life information	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Smart Contract Create an agreement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Smart Contract Specify objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Smart Contract Distribution	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Smart Contract Termination of contract	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Smart Contract Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Blockchain Block	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Blockchain Chain	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Blockchain Consensus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Blockchain Validation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Evaluation		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

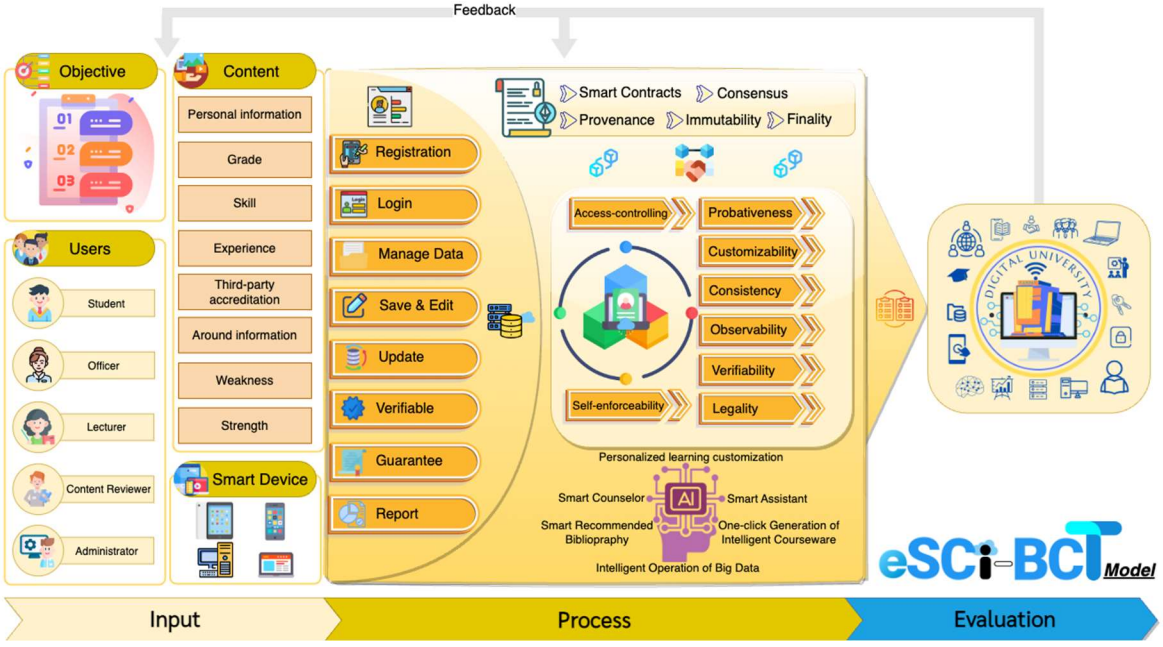

Figure 2. E-Portfolio using Smart Contracts on Intelligence Blockchain Technology

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Table 8 Approach table (Approach of Model)

Process	Description	Technology	Evaluation
1. Determine the purpose of the information recorded in the electronic portfolio.	1) I am determining content and details, including skills and private and non-disclosed personal information, in the preparation of electronic portfolios. 2)Content improvement and development.	1) They present a collection of the best student projects to showcase their talents. 2) ADDIE Model, SDLC.	Assessment of goals and thematic summaries.
2. Learn how to use electronic portfolios.	1. Use of electronic portfolios 2. The use of information intended to be publicly available and not intended to be published. 3. Adding, updating, editing information 4. Verification of the correctness of information. 5.Data reporting through electronic portfolios.	The electronic portfolio format contains technology: 1. Electronic portfolio 2. Smart Contracts 3. Blockchain 4. Artificial Intelligence.	Evaluation of the use of the electronic portfolio format.
3. Evaluate the use of electronic portfolios.	It assesses the suitability of the electronic portfolio format for the specified objectives and summarizes the assessment results according to the purposes.	Electronic portfolio format using smart contracts on intelligence blockchain technology for digital universities.	It assesses the suitability of electronic portfolio formats for specified purposes.
4. Data sent back for analysis and improvement	Submit the results of evaluating the appropriateness of the electronic portfolio format to be used as a model for development as a guideline according to the mission to step into the digital university.	Electronic portfolio format using smart contracts on intelligence blockchain technology for digital universities.	All information is complete and available through electronic portfolios.

10.2 The result of developing an electronic portfolio format for digital universities using smart contracts on intelligence blockchain technology.

A synthesis of documents in Table 7 and an electronic portfolio for digital universities using smart contracts on intelligence blockchain technology are provided, as shown in Figure 2.

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The eSCi-BCT model consists of four parts, the first part being the input data: determined objectives, users, content, and devices used. The second part is the workflow, meaning the workflow of the electronic portfolio format using smart contracts on intelligence blockchain technology. Part three, evaluation, refers to the review of each objective test. The fourth part, feedback to work, means submitting evaluation results for suggestions to develop and improve the model for a digital university. The process is as follows:

Part 1, Import Information:

- Set the purpose of importing content into categories of personal information, lifelong learning skills, non-disclosed and non-disclosable personal information, and peer opinions.
- Users include: Student, Officer, Lecturer, Content Reviewer, and Administrator
- Content details include: Personal Information, Grade, Skill, Experience, Third-party accreditation, Around information, Weakness and Strength
- Smart Devices include: Tablet, Mobile, Personal computer and Notebook

Part 2 , Workflow of electronic portfolio format using smart contracts on intelligence blockchain technology:

- Blockchain technology has a data storage element in a block and a chain. Consensus is a process that relies on data integrity to sort and store data. There will be validation to verify the information.
- Uses of smart contracts include the creation of agrements between contracts, identification of purposes, dissemination of information, termination of contracts, and reporting of results.
- The use of artificial intelligence brings information security features. These are: improving the work on the blockchain by providing transparency, decentralization, and permission to use data.

Part 3, Evaluation:

- Submit a questionnaire for nine information technology professionals and information and communications technology specialists for education to assess the model. I am using a specific sample group and summarizing the results according to the objectives set.

Part 4, Feedback:

- Respond to work evaluation results of the electronic portfolio format using smart contracts on intelligence blockchain technology as a prototype to be developed, to guide the mission to becoming a digital university.

10.3 Results of evaluation of electronic portfolio format for digital universities using smart contracts on intelligence blockchain technology.

The researcher gathers information from the evaluation form that was filled out by specialists in order to process the results and present them in Table 9.

Table 9: The appropriateness of E-Portfolio using Smart Contracts on Intelligence Blockchain Technology (eSCi-BCT Model)

Appropriateness of eSci-BCT Model				
Assessment Items		Result		Rate of propriety
		Mean	S.D.	
1.	Input data			
	1.1 Research objectives	4.78	0.44	Excellent
	1.2 Users in the system	4.78	0.44	Excellent
	1.3 Content imported into the system	4.78	0.44	Excellent
	1.4 Smart Device	5.00	0.00	Excellent
Total		4.83	0.22	Excellent
2.	System work process			
	2.1 E-Portfolio workflow	4.67	0.71	Excellent
	2.2 Working process of blockchain technology	4.67	0.71	Excellent
	2.3 Workflow of Smart contracts	4.33	0.87	Good
	2.4 Workflow of artificial intelligence	4.44	0.73	Good
Total		4.53	069	Excellent
3.	Results of work			
	3.1 eSCi-BCT Model evaluation form by experts.	4.67	0.71	Excellent
	3.2 eSCi-BCT Model developed according to objectives.	4.67	0.71	Excellent
Total		4.67	0.71	Excellent
4.	Feedback			
	4.1 This eSCi-BCT Model can be used as a model for developing an E-Portfolio.	4.56	0.73	Excellent
	4.2 This eSCi-BCT Model can be adapted to be a guideline to meet the mission to become a digital university.	4.67	0.71	Excellent
Total		4.61	0.70	Excellent
Sum total steps 1-4		4.67	0.49	Excellent

11. DISSCUSSION AND CONCLUSION

The attractiveness of blockchain technology in various application sectors can be attributed to several key properties, including decentralization, distributed and Peer-to-Peer technology, utilization of hashing, smart contracts, and consensus algorithms. The results of the evaluation of e-portfolio using smart contracts on intelligence

blockchain technology for digital universities are as follows. Part 1: Data import is excellent. Part 2: Workflow, consisting of a portfolio section, and the technology used in workflows, such as blockchain, smart contracts, and artificial intelligence, is excellent. Part 3: the expert evaluation and the assessment results are consistent with the objectives and are excellent. Finally, Part 4: the reversal of the whole process is excellent. In summary, this shows that the eSCi-BCT model can be used as a prototype of an electronic portfolio to guide the mission of educational institutions, as a guideline towards a digital university in the future. In their evaluation of the results, the experts commented that "the model is complete and can be developed further" because of the data security advantages of the technology used in model development using artificial intelligence technology for enabling the necessary data management options. [2]

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13. DECLARATIONS

Conflicts of Interest: The authors declare no conflict of interest.

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