Blockchain Technology to Enhance Integrated Blue Economy: A Case Study in Strengthening Sustainable Tourism on Smart Islands

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Abstract: Smart destinations require a management system that provides convenient real-time use of digital technology in creating, communicating, and delivering value to visitors. Research related to smart island destinations is still limited, let alone those that utilize blockchain technology to create the smartness of the destination. This research is an empirical study that captures the perceptions of stakeholders in the blue economy on smart islands and the use of blockchain technology in order to build smart islands, a destination that consists of many islands that lack connectedness, such as the Seribu Islands in Jakarta, Indonesia. Data were collected using qualitative and quantitative approaches (mixed methods). Qualitative data were collected from scientific journal publications and followed up with VOS viewer analysis, and quantitative data with the questionnaire survey responses from 150 blue economy industry players in the Seribu Islands and structural equation modeling showed that good digital literacy and blue economy management have significant influence on blockchain technology and impact smart islands. This study indicates that, for islands that have challenges in accessibility and connectivity, the presence of blockchain and smart technology is needed to integrate various resources from each stakeholder so that the blue economy in the islands can be developed more effectively and efficiently, while at the same time ensuring the achievement of sustainability.

Keywords: smart destination; blockchain technology; blue economy; digital literacy; sustainable tourism

1. Introduction

The rate of tourism developments and competitiveness today is highly dependent and cannot be separated from technological innovations [1], which is multidimensional [2] and cannot be separated from the digital context [3]. Technological innovations not only enable tourists to be more flexible and co-create experiences with destination stakeholders in all travel stages in real time but also integrate the stakeholders, allowing them to connect to each other and collaborate in the smart tourism service ecosystem [1]. This enables businesses to offer high-quality products and services, provide active interaction and communication within and across digital platforms, and get immediate response to the needs of potential tourists [4].

Smart tourism is one of the technological innovations made in the tourism industry in the last decade. It emerges from the smart city concept and is supported by technological perceptions on massive and open data, new approaches of connectivity, and how knowledge is exchanged. The intelligent systems in the smart city have compressed the world into a giant village, enhanced communication, and integrated and shared data, as...
well as interpreted and optimized complex analytical models [3]. In short, smart tourism builds experience infrastructure; improves interconnectivity and interoperability in tourist experience platform; and reengines processes and data to optimize stakeholders’ value through service, products, and procedure innovation [1].

Both the smart city and smart tourism use dynamic networks to involve all suppliers, parties, and stakeholders, including public sectors and consumers, in the co-production of value within the ecosystem [5], thus making the offerings more effective and efficient in meeting customers expectation. Smart tourism also increases inclusiveness and governance, as required by the smart city; in addition, smart tourism emphasizes providing access to attractions, amenities, and accessibility (the 3 A’s) in order to back up travelers and other stakeholders through advancement of experience platforms with mobility, visualization, audio, and reminders so they can cope with any barriers encountered during traveling [1].

As making a city and tourist destination smart becomes the goal for many cities and tourist destinations, the initiative to develop smart islands was initially proposed by the EU to achieve sustainability and digital connectivity in their islands. Despite the fact that the term “smartification” refers to the same techniques, results, concepts, software, or data applied to cities or islands, their application in the smartification process on an island may be quite different for a group of cities or villages that are closely related, isolated from the rest of the world, as they are connected only by sea and air routes or surrounded by blue sea, making them different from an in-land city [6]. The initiative was inspired by the smart cities and communities to improve life on islands through sustainable integrated solutions to communicate the significant potential of islands to function as laboratories for technological, social, environmental, economic, and political innovation. Despite the fact that islands face intrinsic challenges deriving from insularity and seasonality—with regards to energy production, transportation, natural resources management, access to markets, and economic diversification—there is growing evidence that these inherent characteristics can represent untapped potential for islands to develop a blue economy (BE).

BE is the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean [7]. While the EU defines it as an ocean economy, the sum of economic activities of ocean-based industries, together with the assets, goods, and services provided by the marine environment to seek balance to economic, social, and environmental objectives, is consistent with the Sustainable Development Goals (SDGs). It is the recognition of the ocean as a driver for national and regional sustainable development and innovation, as well as key principles to ocean health, sustainability, equity, and resilience [8]. In short, the BE concept is to manage water resources effectively and preserve them for current and future generations [9].

The Seribu Islands are a group of islands that are part of Jakarta Province that rely mostly on ocean economy. The largest revenue comes from the tourism sector. It is the area with the highest poverty rate in Jakarta. According to Central Bureau of Statistics (BPS) data, the Seribu Islands encounter high social disparity compared to Mainland Jakarta; climate-change-related natural occurrences, such as bad weather, increasing tides, and rising of sea level; a decline of fishing grounds (whereas fishing is the primary economic activity); finite water resources; the deterioration of nature and increase of pollution; and low residential welfare. The percentage of the poor accounts for approximately 15.06%, the highest percentage compared to the average of Jakarta’s poverty rate of 6.30%. The data also show that, compared to other areas of Jakarta, the human development index of the Seribu Islands is the lowest. The average HDI of Jakarta in 2019 was 80.76 while the HDI of the Seribu Islands was 71.4. This picture indicates that the capacity of people in the Seribu Islands is still low compared to other area because of a lack of education that consequently affects their welfare [10].

Consisting of dispersed small islands, the Seribu Islands offer white beaches and unique marine and cultural diversity that attract many tourists, especially as they constitute the nearest getaway and the only nature attraction of the Jakarta Province; therefore, tourism is the main industry generating income. Connectivity and mobility are the central issues of...
the Seribu Islands. The transportation is limited to local boats or ferries. Although most of
the inhabited island is connected by the Internet, Internet stability is still a big challenge,
especially in the sea. There is a need to be connected to people and businesses globally.
Tanuwidjaja states that the sustainability level of the Seribu Islands is still low, based on ten
parameters: the density of population density, the arrangement of building lay-outs and
density, construction, ventilation, roads, drainage, freshwater consumption, wastewater
discharge, and waste management [10].

Additionally, Pricewater house Cooper (PwC) exposed that blockchain technology
(BT) would disrupt many industries, including hospitality and tourism industry, that
consequently should be anticipated immediately. BT represents the latest technological
innovations that would become the tourism and hospitality industry’s turning point in the
near future [4], and some scholars have considered it to be a further development in the
smart city [11] or smart tourism [4]. As some scholars believe that applying BE to manage
water resources effectively and preserve them for current and future generations [9] and
overcome sustainability issues in coastal and maritime area, the use of BT would ensure
the implementation of sustainability that is demanded by BE [12]. Therefore, to be able to
build smart tourism and develop BT in remote islands, digital skills are needed, as well
as proficiency in the use of advance technology, commercial business mindset, and basic
workplace skills of technical and professionalism [13], along with green skills [14].

A lot of research has been conducted to develop models of smart cities [11,15–18] or
smart tourism [3–5,19–23], while research on smart islands is still limited [24,25], especially
those that focus on managing the blue economy as islands’ valuable resource [25]. Moreover,
empirical research on the use of BT to create the model fits for smart islands’ development
is still very rare. Islands have become favorite tourism destinations for tourists around the
globe, but islands tourism development and management have more complex challenges
than do in-land destinations [26]. There is an urgent need to develop a smart islands
model which employs BT to ensure the responsible implementation of BE. Therefore, this
study aimed at developing a blockchain-based smart island model that can manage a
sustainable blue economy. There is still limited research development related to smart
islands focusing on managing the blue economy as islands’ valuable resources. In addition,
currently a lot of empirical research is needed, especially by utilizing BT to create a novelty
model that is suitable for the development of smart islands, which are rarely carried out
where research development opportunities like this have high potential to be developed
in archipelagic countries. To address this potential, our research objective was to develop
a blockchain-based smart island model that is directed at managing the blue economy
effectively and responsibly.

2. Literature Review

2.1. Smart City, Smart Tourism, and Smart Islands

The smart concept has been applied in city management in order to increase city
governance in the last two decades. Many scholars propose the smart city as the panacea
to solve city problems through innovation and improved public services that result from
the use of ICT and other city resources effectively and efficiently. The smart city is also
intended to improve engagement from stakeholders, thus leading to increased participation,
integration, and collaboration [24].

As most cities are also tourist destinations, scholars then proposed smart applications
in tourism and destination management in order to improve citizen and tourist experience,
especially in utilizing infrastructure and facilities [16]. Smart tourism destinations serve
as innovative tourist places of interest that offer conveniences, services, facilities, and
tourist activities [27]. They are built on advanced digital technology’s infrastructure that
guarantees sustainable tourist areas accessible to everyone, facilitates visitor interaction
and integration into their surroundings, offers different activities from different tourism
service providers [28], increases experience quality [29], and, at the same time, improves
residents’ quality of life [30].
Many favorite tourism destinations are islands, which usually face challenges in maintaining a good quality of infrastructure, mobility, and connectivity. The challenges have become more complex as the marine environment is fragile and can easily be destroyed. That is why developing smart islands is assumed to be the answer to improve the economic and social growth of the islands, while also enhancing sustainability and connectivity. Smart islands are an integration platform developed through the ICT and other smart technology to engage and exchange with local stakeholders on innovative projects developed locally, which create sustainable growth and job opportunities and competitiveness, whilst respecting the environment and cultural heritage [6]. The use of smart technology enables destinations to provide the co-creation of information and infrastructure [31], which is supported by the development of smartphones and mobile devices that have changed the way people communicate and interact [32]; and mediate the creation of tourists’ experiences in all stages of travel [33]. While a variety of technologies, such as AI, Robotics, Cashless Payments, augmented reality, and virtual reality, are already prevalent in many smart destinations around the world and have caused disruptive changes, the massive use of big data will bring Web 3.0 (semantic web) to support computer-to-computer interoperability to link and integrate big data from various datasets that improve data management, stimulate creativity and innovation, and encourage collaboration across the social web [34].

While the emphasis of smartness is to integrate stakeholders, in islands tourism, it is also used to obtain easy access to information, attractions, available packages, transportation, packages, and amenities [35] that, in the end, would enhance tourists’ experience and interaction with a destination [36].

The operational dimensions of smart islands in this study refer to the dimensions proposed by [6,15], how the islands can encourage the emergence of smart economy and provide smart mobility, as well as to develop a smart society and smart governance to make smart living and maintain islands’ sustainability through smart environment in order to improve local people’s well-being and enhance tourists’ experience when visiting the islands.

Our focus was on the sustainability of resources; therefore, the dimension of the smart city that focus on areas such as the smart economy, mobility, governance, life, the environment, and society [15] was used in this study. Gretzel (2015) also mentioned the same dimensions in smart destination; however, the stress was on how the resources were valued by tourists [21].

2.2. Blockchain Technology in Tourism Industry

Initially, blockchain was acclaimed as the technology underlying cryptocurrencies, which employs a peer-to-peer electronic cash system that can eliminate intermediaries, including banks, as a trusted third party; increase the efficiency of transactions between parties involved in the system; and conduct a more trustworthy and transparent business without a central node of control. Blockchain is, in a nutshell, a digital decentralized and distributed ledger that serves as an irrefutable absolute record keeper for a variety of transactions. Transparency is provided through a transparent ledger for all network-based transactions, but the secrecy of the persons involved is maintained by a cryptographic protocol and encrypted messaging [37]. The second generation of BT entails the creation of smart contracts for all economic, market, and financial applications, whereas the third generation entails the application of BT to sectors outside of business, such as government, health, and science [38]. These features define Blockchain as a novel, value-adding solution for managing verifiable dependable and permanent data in blocks [39].

The adoption of BT is assumed to be a solution to improve island destinations’ performance, as well as solving problems and challenges faced by the destination, involving interconnectivity, businesses integration, and more efficient management; it is also assumed that it can overcome sustainability issues in a more effective and efficient manner. As BT is an insistent, transparent, distributed, affix-only ledger that records blocks and a sequence of events that not only can be applied to financial transactions [40] but also could
easily be used to record supply chain [41], manage tourism and hospitality businesses and membership [42], and ensure the implementation of sustainable practices [43]. In the smart city, BT can be applied in smartization of healthcare, supply chains, mobility, energy, administration and services, e-voting, housing, and education [11], whilst in the destination, BT adoption can be used to build future ambient intelligence [44] and manage supply chains’ loyalty and sustainability programs [45].

Erceg et al. [19] also noted that BT is distinguished by the elimination of middlemen (dis-intermediation), security, automation, immutability, trust, cost-effectiveness, and traceability characteristics [20]. Other BT potentials include an innovative loyalty program, tracking and customization, an integrated management system, a validated rating and review system, due diligence [19], and the creation of smart cities or smart tourism [20]. Treiblmaier adds the prospects for BT applications in inventory management, reservation and ticketing, payment and tax compliance, tokenization, and credential management, as well as coordination and competition [46].

In this study, the components of BT include decentralization, trust, efficiency, and a creative loyalty program. Decentralization involves the equal participation of peers, communication across digital networks, and collaborative consensus [19], thus enabling supply and value chain traceability and governance [47]. BT promotes company trust by integrating all parties and fostering a transparent environment. The BT platform is reliable since it is a peer-to-peer system, can support multiple interfaces, and operates naturally and autonomously. BT supports data flow optimization and traceability, real-time transaction reconciliation, and network member collaboration. Transparency, influence, and control are indications of business trust [48].

Businesses can design a reward-based co-creation process involving the distribution and exchange of services, events, and offers by exchanging the tokens with retail partners or other ecosystems. Customers could not only earn loyalty points for their platform contributions, but they could also convert, buy, sell, or exchange reward points with other network users. BT creates the foundation for the establishment of a C2C market in which transaction possibilities overlay a wide range of loyalty-program components [20]. Additionally, BT could boost the analytical skills of travel companies and facilitate data-exchange procedures. As a result of data and record management, a loyalty program might become more exact and personalized. The BT-based reward system for tourism allows businesses to increase goodwill and establish links between tourists and locations. In addition, as modern travelers rely on prior customer reviews to confirm service quality before making travel purchase decisions, BT enables these reviews to establish a new form of social communication that facilitates information sharing among networks, such as review website organizers and customers, and among consumers [49]. BT provides a realistic solution for the online review system to guarantee potential passengers of the authenticity, reliability, and fairness of online evaluations by implementing a decentralized, trustworthy, impartial, and transparent review system. BT would help online reviews operate in a more trustworthy, resilient, and high-integrity environment by preventing the modification or removal of ledger entries.

Based on the significant contribution of BT to smart islands, the following hypothesis is proposed accordingly.

**Hypothesis 1 (H1).** Blockchain technology has a significant effect on smart islands.

### 2.3. Sustainable and Integrated Blue Economy

The term “blue economy” (BE) was first mentioned officially in 2012 by the United Nations at Rio +20, or the Earth Summit; however, it was first introduced by Pauli in 1994 [50]. The BE comprises ocean-based activities [51]; it is a broader green movement in ocean governance [50,52] and part of blue recovery and blue growth strategy [53] that covers fisheries, marine logistics, shipping and ports, coastal and recreational tourism, renewable energy, offshore extraction of oil and gas, blue biotechnology, aqua culture, seas
and ocean surveillance, and marine research. The BE includes all economic acts which correlate directly with the oceans, such as fishing, water transportation, shipbuilding, or marine and coastal tourism. As oceans serve as a major geographic form of the earth, credited with numerous variables which promote life on the planet, the emergence of BE must be rooted to the sustainable-development concept [9].

The intention of BE is to ensure business growth and social welfare from the coastal and marine industry development in a sustainable manner [50]; therefore, there is an emerging need to preserve marine resources responsibly [53], implement a blue circular economy [54], and recover coastal and ocean health from litter and pollution [55]. The circular economy is a restorative and regenerative economy that intends to create value through extending product lifetime and promoting zero waste for every activity in the value chain [56]. In BE, marine litter is a cost to not only the environment but also public finance, the economic sector, and social life. To the environment, it creates growing pressure on marine biodiversity and the ecosystem; to public finance, it creates economic burdens through clean-up costs and the potential loss of income from tourism and recreational activities; and to the economic sector, plastic waste represents a loss of material value and economic pressures on the shipping sector because of fouled motors, repair costs, ghost fishing, etc. Socially, marine litter creates risks to human health; for example, it can cause injuries and accidents through the release of chemical substances and the ingestion of microplastics.

Based on the above consideration, marine resource preservation becomes the first dimension of BE management through responsible fisheries, sustainable marine tourism practices, non-polluted aquaculture, environmentally friendly sea transportation, and renewable energy usage. The blue circular economy becomes the second dimension that is indicated by the availability of laws to encourage bio-based materials, packaging regulation to ban petroleum plastic, the practice of the circular economy based on waste management, and economic incentive for circular economic practices. Marine-ecosystem health recovery is gained by sustainable fishing culture, regular litter fishing, awareness campaigns, and the responsible utilization of ocean resources. As BT can support business ecosystems in ensuring the implementation of sustainable practices because of the peer-to-peer control system, the following assumption is proposed.

**Hypothesis 2 (H2).** The blue economy has significant effect on blockchain technology in smart islands.

A good BE management can support the development of smart island, as smartness in island management not merely depend on the adoption of ICT and digital technology but also in managing the islands’ resources and infrastructures, which are the building blocks of BE. The preservation and responsible use of ocean resources as the basics of BE concept are the important aspects of smart islands; consequently, the third hypothesis as follows:

**Hypothesis 3 (H3).** The blue economy has a significant effect on smart islands.

2.4. The Importance of Digital Literacy to Support Smart Destination

IT strives to understand consumer behavior by developing various activities, including the collection, management, analysis, and interpretation of various data in order to support travelers making decisions in planning potential tourist destinations. IT is also directed to plan various stages of the travel process so as to make it flexible and simplify the experience [57]. Having the ability to use digital gears as an urgent need for digital literacy in using digital technology, as well as the ability to think critically and agility to adapt in a digital environment that affects not only everyday personal, educational institution, or professional lives [58]. Digital literacy describes the minimum level of ability in technology and digital skills that can be embedded in the educational curriculum [59].
In the tourism sector, tourists experience needs more empowerment, trust, and ownership, which are developed through tour packages that are expected to fulfill their expectations and needs through complete information; incomplete information in tourism products can frustrate and discourage tourists when making purchasing decisions [60]. The rapid development of digital technology enables the industry to obtain and share information in various digital platforms in real time. That is why digital literacy is a very imperative competence in today’s lives.

Digital literacy was first proposed by Gilster [61], who identified four key digital literacy competencies: knowledge assembly, evaluating information content, searching the Internet, and navigating hypertext [62]. It is important to find valuable information online in an effective way; for that, digital literacy becomes a building block to expand economic opportunities that can be directed at human development and poverty alleviation [63]. Digital literacy skills are needed in developing an entrepreneurial attitude [64]. Digital literacy skills have tendencies related to various uses of technology to make it easier for users in the process of finding, evaluating, managing, creating, and communicating various information obtained and developing digitally through the use of technology in a responsible manner [65]. The basic literacy includes basic computer skills, network literacy, digital problem-solving, information literacy, and media literacy.

Saari et al. [13] mentioned that, according to World Economic Forum (WEF), 4IR is developed through a combination of technologies that utilize digital, physical, and biological systems that are expected to be able to change life patterns and working conditions for sustainability in the future, where the skills to utilize digitalization include the ability to optimize various digital devices, various communication applications, and network needs for easy access and management information. Furthermore, Reference [66] mentioned that a dimension of digital literacy is information literacy, media literacy, and ICT literacy. Some of the skills needed in the development of information literacy consist of the ability to gain access to information efficiently and effectively, to be critical in evaluating information, and to be accurate in managing it. The building blocks of media literacy are understanding the purpose for media messages’ construction, examining how individuals interpret messages, and having an understanding of ethical issues that can be applied to media use. ICT literacy includes the use of technology as an information tool, the use of digital technology as networking tools/social networks, the use of technology as a knowledge economy function, and the understanding of ethical/legal issues surrounding the use of information technologies.

The use of digital technology has never been so dominant in the tourism industry as it is today [51], not only to support a destination in achieving competitiveness but also to connect its products and services to global markets, as well as enable it to integrate the whole supply and value chains into the destination’s ecosystem [67]; therefore, digital literacy (DL) is an essential competency to strive toward in the digital era [68]. It is imperative for destinations and nations to improve DL amongst their people, so that they can more easily adapt to the new and innovative technology later.

Various efforts are needed to propose digital literacy as part of a process that can focus on developing the concepts of knowledge literacy, Internet literacy, and web literacy [68]. In the process of literacy, the various steps that are passed require digitization where digital literacy has now become a systematic part, especially in the development of various technologies and mass structures. A conceptual model that develops the concept of digital literacy in a comprehensive manner requires several skills that accommodate the cognitive challenges faced, which include literacy in the form of photo/visual, reproduction, branches, information, socio-emotional, and real-time thinking.

The digital literacy of islands’ human resources will therefore affect the success of BT adoption, as well as support the development of smart islands. The resultant hypotheses are as follows:

Hypothesis 4 (H₄). Digital literacy has a significant effect on blockchain technology.
Hypothesis 5 (H₅). Digital literacy has a significant effect on smart islands development.

2.5. Previous Research on Smart Destination and Blockchain Technology

Table 1 below shows the previous research on smart destination and blockchain technology in the blue economy.

<table>
<thead>
<tr>
<th>Scholars</th>
<th>Concept</th>
<th>Similarity</th>
<th>Difference</th>
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<tbody>
<tr>
<td></td>
<td><strong>Smartness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[3]</td>
<td>Smart tourism as important part and practical attempt of the smart city strategy that benefits from ICT as digital dimensions of smart living, smart mobility, smart governance, smart people, smart environment, and smart economy; thus, these dimensions can also be applied directly in tourism destinations.</td>
<td>Dimension of smart destination that refer to smart city</td>
<td>Concept exploration and empirical study</td>
</tr>
<tr>
<td>[5]</td>
<td>Smart tourism as a complex amalgamation of all technological tools (soft and hard smartness) that bridges digital and physical element of tourism destination and creates a dynamic network tourism ecosystem in order to co-create value and experience for tourists and local people.</td>
<td>See smartness in destination of tourist interest</td>
<td>Qualitative to mixed-methods research</td>
</tr>
<tr>
<td>[6]</td>
<td>Smart sustainable island has the same meaning as the term “smart sustainable city”, but it is applied to the entire region of an island, and that the entire island follows all the good practices to preserve the sustainable development and the protection of the environment, natural and urban, including the culture heritage, in a holistic and integrated manner.</td>
<td>Dimension of smart islands is smart economy, smart resources use, smart society, smart quality of life, and smart infrastructure</td>
<td>Case study to empirical study</td>
</tr>
<tr>
<td>[15]</td>
<td>Smart city is a city related with technology, people, and technology</td>
<td>Dimensions used</td>
<td>Island as research object</td>
</tr>
<tr>
<td>[20]</td>
<td>Smart tourism destinations are applying different ICTs in developing tourism processes, interconnecting all stakeholders, co-creating experiences and personalized services with customers, and supporting local people participatory and information governance for data openness and privacy.</td>
<td>BT application in smart destinations</td>
<td>Conceptual paper to empirical research</td>
</tr>
<tr>
<td>[24]</td>
<td>Smart islands are the insular territory that are implementing smart and integrated solutions to the management of infrastructures, natural resources, and the environment as a whole, supported by the use of ICT to promote innovative and socially inclusive governance in order to create sustainable local economic development and a high quality of local people’s lives.</td>
<td>Empirical research on islands destination</td>
<td>Focus on identifying islands readiness to develop smart islands model</td>
</tr>
<tr>
<td>[33]</td>
<td>Smartness in smart city or smart tourism destination is the combination of hard and soft components. The hard smartness component is advanced technological info/infrastructure, while soft smartness is ICT, leadership, innovation, and social capital.</td>
<td>Considering smart city concept could be applied to any type of tourism destination</td>
<td>Empirical research on island, while Boes et al. analyzed case-study mapping on smart cities in EU</td>
</tr>
<tr>
<td>[36]</td>
<td>Smart tourism destination is the management of destination through interconnecting multi-stakeholders in a dynamic platform mediated by ICT to support a prompt information platform.</td>
<td>Exploring smart destination</td>
<td>Conceptual paper to empirical study to create smart islands’ model</td>
</tr>
<tr>
<td>Scholars</td>
<td>Concept</td>
<td>Similarity</td>
<td>Difference</td>
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<tr>
<td>[4]</td>
<td>Blockchain Technology is a distributed, replicated, and immutable digital ledger allowing different parties to conduct business in a more trustful and transparent manner without the need for a central node of control.</td>
<td>• Application of BT for integrating and simplifying business processes and control</td>
<td>• Conceptual paper on BT application in tourism industry to blue economy management model in smart islands</td>
</tr>
<tr>
<td>[11]</td>
<td>Blockchain as digital, decentralized, and distributed ledger in which transactions are logged and added in chronological order, with the goal of creating permanent and tamperproof records.</td>
<td>Blockchain for smart city development</td>
<td>Systematic literature review to empirical research for BT-based smart island model</td>
</tr>
<tr>
<td>[19]</td>
<td>BT is a new way of organizing, recording, and processing information in blocks, which are provable, reliable, and long-lasting.</td>
<td>BT adoption case study in</td>
<td>BT adoption case study to BT-based smart islands model development</td>
</tr>
<tr>
<td>[20]</td>
<td>Blockchain is a new disruptive technology with an improved ability to verify and record the exchange of assets among an interconnected set of users while all digital events are performed and shared among all participating members.</td>
<td>Demonstrating blockchain process</td>
<td>Focus on BT processes while other focus on BT acceptance in blue economy industry</td>
</tr>
<tr>
<td>[69]</td>
<td>Blockchain is a distributed digital transaction and data management system in which all users of the system have a common consensus.</td>
<td>The potential implementation of BT in Indonesia</td>
<td>Readiness and acceptance of BT implementation to empirical BT model in smart islands</td>
</tr>
<tr>
<td>[70]</td>
<td>Blockchain is a decentralized and immutable database storage that gives the peers in chain network equal roles and provides a decentralized communication and transaction in its chain networks.</td>
<td>Discussed decentralization dimension of blockchain.</td>
<td>Conceptual paper on BT decentralization methods to empirical model development in smart islands</td>
</tr>
</tbody>
</table>

### 3. Material and Methods

#### 3.1. Research Area

The Seribu Islands are an administrative regency of Jakarta Province that is geographically located between 5°39′46.44″ S and 106°34′5.88″ E. With a total area of 4745 km², the islands consist of only 8.76 km² land, while the rest is water. It is a group of more than 110 small islands; the lowlands have an average elevation of ±2 m above sea level. The territory of the Seribu Islands has a northern border with the Java Sea or Sunda Strait, the east with the Java Sea, the south with the North Jakarta Administrative City, and west with the Java Sea or Sunda Strait. Administratively, the territory of the Seribu Islands’ administrative district government is divided into 2 sub-districts, consisting of the South Seribu Islands Subdistrict and the North Subdistrict, and 6 wards: Untung Jawa Island, Tidung Island, Pari Island, Panggang Island, Kelapa Island, and Pulau Harapan [71]. Figure 1 below refers to the Seribu Islands’ administrative regency map.

The ocean economy is the main economic force of the Seribu Islands. The marine tourism sector becomes the focus of economic activities in order to improve the welfare of local residents, taking advantage that the location of islands that is closed to the capital city of Jakarta and making the islands designated as one of National Tourism Strategic Area [72]. The second economic sector is fisheries, as fishing is the traditional livelihood of locals, while seaweed cultivation is a potential aquaculture, besides salt, crab-processing industries, and home industries for souvenirs and local specialties. Some larger industries, such as resorts, and ferry and fast boats rentals are also available to serve tourists [71].
3.2. Variables Operationalization and Research Paradigm

Based on the literature review above, the dataset on variables’ dimensions and indicators is operationalized in Table 2 below.

Table 2. Operationalization of variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dimension</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Islands</td>
<td>Smart economy</td>
<td>• Entrepreneurship</td>
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<td></td>
<td></td>
<td>• Sharing economy</td>
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<td></td>
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<td>• Global connectivity</td>
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<td></td>
<td></td>
<td>• Innovation driven economy</td>
</tr>
<tr>
<td></td>
<td>Smart society</td>
<td>• Culturally vibrant and happy society</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Community inclusion in public-life activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Community creativity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Community motivation for long-life learning</td>
</tr>
<tr>
<td>Smart governance</td>
<td></td>
<td>• Transparent government system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participatory decision-making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• E-governance service</td>
</tr>
<tr>
<td>Smart environment</td>
<td></td>
<td>• Green building</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Green consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Green destination planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Environmental health</td>
</tr>
<tr>
<td>Smart mobility</td>
<td></td>
<td>• Efficient transport system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Availability of ICT infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Availability to various transport mode (accessibility)</td>
</tr>
<tr>
<td>Smart living</td>
<td></td>
<td>• Quality of living</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High tolerance community</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Social cohesion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adequate education and culture services</td>
</tr>
</tbody>
</table>

Figure 1. Seribu Islands’ map.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Dimension</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blockchain technology</td>
<td>Trust</td>
<td>Data transparency for stakeholders</td>
</tr>
<tr>
<td>adoption</td>
<td></td>
<td>Self-governed ecosystem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trustworthy digital network platform</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides full reliable protection to customer information (tracking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capability/traceability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disintermediation in blue economy activities</td>
</tr>
<tr>
<td></td>
<td>Efficiency</td>
<td>Speed transaction processing among geographically dispersed entity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lowest cost transaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traceability over loyalty reward points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reliable online review</td>
</tr>
<tr>
<td></td>
<td>Creative</td>
<td>Able to exchange points/rewards in digital business ecosystem</td>
</tr>
<tr>
<td>loyalty program</td>
<td></td>
<td>Enhanced analytics (algorithm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trustworthy network that integrates all parties in the business ecosystem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traceability supply chain system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparent transaction infrastructure to ensure meeting law enforcement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(due diligence)</td>
</tr>
<tr>
<td></td>
<td>Decentralization</td>
<td>Compliance collaborative traceability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue economy</td>
<td>Marine</td>
<td>Responsible fisheries</td>
</tr>
<tr>
<td>preservation</td>
<td>resources'</td>
<td>Sustainable marine tourism practices</td>
</tr>
<tr>
<td>preservation</td>
<td></td>
<td>Non-polluted aquaculture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmentally friendly sea transportation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renewable energy usage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laws to encourage bio-based materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Packaging regulation to ban petroleum plastic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine</td>
<td>Circular-economy-based waste management practice</td>
</tr>
<tr>
<td>circular economy</td>
<td></td>
<td>Economic incentive for circular economy practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sustainable fishing culture</td>
</tr>
<tr>
<td></td>
<td>health</td>
<td>Regular fishing for litter</td>
</tr>
<tr>
<td>recovery</td>
<td></td>
<td>Awareness campaign</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Responsible utilization of ocean resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operate basic computer skill (Microsoft Office)</td>
</tr>
<tr>
<td>Digital Literacy</td>
<td>Basic ICT</td>
<td>Ability to manage email</td>
</tr>
<tr>
<td>literacy</td>
<td></td>
<td>Ability to use Internet browser</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ability to utilize social media for business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ability to utilize marketplace platform for business transactions</td>
</tr>
<tr>
<td></td>
<td>Network</td>
<td>Ability to create e-community to enhance business</td>
</tr>
<tr>
<td>literacy</td>
<td></td>
<td>Ability to access information effectively</td>
</tr>
<tr>
<td></td>
<td>Information</td>
<td>Ability to evaluate information effectively</td>
</tr>
<tr>
<td>literacy</td>
<td></td>
<td>Ability to use information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understanding the purpose for which media messages are constructed</td>
</tr>
<tr>
<td></td>
<td>Media</td>
<td>Ability to filter messages from social media (interpret messages)</td>
</tr>
<tr>
<td>literacy</td>
<td></td>
<td>Fundamental understanding of the ethical issues on the use of media to create messages</td>
</tr>
</tbody>
</table>
Alfano believes that blockchain is today’s IT hype, for which cryptocurrency was the first implementation, known as Blockchain Era 1.0 [39,60]. The inability to utilize blockchain technology in Indonesia and the Seribu Islands is because the ICT infrastructure is not yet evenly available, and there is a lack of ICT skill in the local human resource [73]. Those premises, therefore, support the idea that digital literacy affects blockchain technology application, as in Hypothesis 4. Ramadhan et al. mentioned that blockchain technology becomes the gamechanger of sustainability and green practices as the technology enabler for transforming green innovation, culminating sustainable economic practices, and business models [69]. This statement can also apply in blue-economy practices, as it is a sustainable practice in ocean economy. Furthermore, the research by Polas et al. supports the same idea, as it argues that blockchain can be the answer for managing sustainability business [12]. These statements support Hypotheses 2, which states that good blue economy management influences the success of blockchain application. Meanwhile, Tijan et al. [74] argued that digital technology application will support the goals of the blue economy namely economic use of the sea and oceans, preserving ecosystems, and improving the quality of life and work or what we acknowledge as smart sustainable destination, as is in line with the base thinking of Hypotheses 1, which states that blockchain technology will affect the smart island. Blockchain technology influences smart tourism destination [20], smart city [11], and industry, e.g., tourism [19]. Ref. [75] argued that digital literacy is one of the building blocks to create a smart tourism village or destination as the basic, and this is the premise for Hypothesis 4, while [25] proposed the smart strategy for blue and bio economy that is the basic premise of Hypotheses 5. The model framework for this research is shown in Figure 2 below.

![Diagram](image.png)

**Figure 2.** Research paradigm in the development of smart destinations on the Seribu Islands.

The methodology for this research is sequential mixed-method research. Qualitative research was conducted initially to obtain the latest discussion on each variable, which was later confirmed with the phenomena and previous research regarding each observed variable. The qualitative review describes scientific journals that have contributed greatly to the development of blockchain technology and the blue economy that allows it to be further enhanced, along with the development of science and technology to create smart islands. Approaches that are applied qualitatively can be used through mapping as an effort to increase the understanding of the constructs that will be developed in the future [76]. VOSviewer was used for the analysis of knowledge mapping data in the form of scientific evolution results [77], and it was able to display the results of the research data analysis with an attractive and elegant visualization in the form of concept mapping [78]. VOSviewer was also used to display the visualization of the results of data analysis originating from a collection of scientific journals according to the research theme under study. The data were obtained through a systematic search of a database of various scientific journals with the theme of blockchain technology and blue economy in the 2016–2021 publication period.
The construct variable, dimension, and indicators become the output of the initial qualitative research. After obtaining the construct indicators, empirical research on the idea of managing the integrated blue economy through the adaptation of blockchain technology in order to create smart destination was conducted. This involved a survey for the business players in the blue economy in the Seribu Islands. There are 150 entities representing the fishermen families, hotel and accommodation, restaurants, transports, creative industry, and so on. The data were collected through the questionnaire circulation and analyzed using structural equation modeling (SEM) to obtain the integrated blue economy model for the Seribu Islands. An SEM analysis was used to test the hypothesis of the influence between constructs, and it was carried out through direct or indirect channels as mediation which are processed simultaneously [79] and then used to examine the relationship between variables [80]. The analysis developed SEM (Lisrel) to determine the effect between dimensions and variables tested as analysis to test data with high level of complexity and carried out simultaneously [81]. The SEM was used to analyze constructs together in the form of a structural model that examines the relationship between constructs independently or dependently and a measurement model that examines the relationship between indicators and constructs. Lisrel is more optimally useful if it is used to confirm the tested construct. Figure 3 below shows the mixed method flowchart used in this research.

![Mixed-method flowchart](image)

**Figure 3.** Mixed-method flowchart.

4. Results

4.1. Qualitative Mapping by Utilizing VOSviewer

The concept of blockchain technology and blue economy is fully explained through several visualizations presented in the form of a network, density, and classification of data obtained from scientific publications. The data refer to a collection of scientific publications obtained by entering keywords based on the variables used in this study, including blockchain technology, blue economy, smart tourism, and digital literacy. The process of searching for articles is based on themes that are adjusted to research variables by classifying publication periods to produce mapping in developing indicators. To produce interesting and interactive quality mapping, it can be implemented in the form of networks and density levels, using database analysis by utilizing VOSviewer.

The visualization analysis shown refers to the database obtained through network visualization in journal publications between 2018 and 2021 on the concept of blockchain
technology shown in Figure 4. The mapping results show several topics that have been widely used and implemented in this period which can be identified in the form of nodes with a larger size and a certain color type. The same color indicates that the node has the same classification or belongs to one family. Cryptocurrency, challenges, IoT, bitcoin, transactions, and security are some of the topics that have been widely developed in this publication. Although some of these topics are still relevant to be developed in the diversification of future research, it is also necessary to find some novelties on the topic to support the continuity of scientific evolution. There are several topics found in the mapping that have not been widely published and identified as having novelties, including big data analytics, artificial intelligence, digital currency, cryptography, and convergence. For this reason, topics that are found and have not been widely published need further research to develop knowledge, especially in the development of smart tourism.

Figure 4. Visualization of scientific publication data analysis on blockchain technology concepts: (a) network visualization and (b) density visualization.

Concepts that have an important contribution in supporting the development of smart destinations in the tourism sector include the blue economy. In addition to network visualization, the analysis results presentation also shows patterns in the form of overlay visualizations. The overlay visualization is shown in the color display (refer to Figure 5), with the identification that the color is brighter or shows a yellow color, so the publication time is in the latest range, such as the concepts of performance economy, biomimicry, SDGs, transformation, marine tourism, and coastal and marine tourism. Derivatives of the blue economy concept are further investigated in an effort to find out various indicators that can leverage the development of smart destinations. Several derivatives of the blue economy concept that have been widely published in various scientific publications include circular economy, fishery, strategy, ocean, policy, system, and industry. In addition, there are several derivative concepts that have not been widely published, so they have high novelty opportunities, including maritime cooperation, economic performance, biomimicry, conservation, and coastal and marine tourism. The tendency of the opportunity for concepts that have a novelty to the blue economy concept seems to have similarities between scientific journals published in the latest timeframe and journals that are slightly published, as is indicated by the relatively small size of the nodes.
The results of data processing in standardized solutions displayed through structural equation modeling calculations based on variables tested.
The most significant dimensions of blockchain technology are the creative loyalty program and decentralization that can be created through blockchain technology. The creative loyalty program that can be created by adopting blockchain technology is real-time loyalty reward tracking system, reliable customer online review, and the opportunity for exchanging rewards or points within the ecosystem and improving the accountability of business algorithm analysis. Decentralization factors that are provided from blockchain technology are an interactive platform that can integrate all active parties into the blockchain ecosystem, the ability to track product source in a value chain system, the ability to track all transactions in accordance with governance, and the ability to check the compliance aspects of business collaboration.

Both digital literacy and integrated blue economy implementation influence blockchain technology adoption, with a total contribution of 60%, while the other 40% is contributed by other factors. The most significant dimensions of digital literacy are information literacy and media literacy. Information literacy is formed by the ability to access information from social media effectively, critically, and accurately, while media literacy is constructed by the ability to understand message objective, the ability to screen messages from social and digital media, and the understanding of ethical issues for digital and social media’s messages.

The results can be determined to have a goodness-of-fit model if they have at least three index criteria which conclude that a good fit is determined based on the results of the multivariate test analysis carried out (refer to Table 3). Minimum requirements must be met for the model being measured in order to obtain the suitability of the model being tested. The model criteria measured using structural equation modeling analysis can be categorized as a good fit if the index number is $\geq 0.9$. From the results of testing the criteria, there are five criteria that are stated as constituting a good fit, namely NFI, NNFI, CFI, IFI, and RFI, while the other two criteria are stated as having a marginal fit.

Table 3. Goodness-of-fit index criteria.

<table>
<thead>
<tr>
<th>Goodness-of-Fit Index</th>
<th>Fit Index Criteria (Cut of Value)</th>
<th>Result</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFI</td>
<td>$\geq 0.90$</td>
<td>0.91</td>
<td>Good Fit</td>
</tr>
<tr>
<td>NNFI</td>
<td>$\geq 0.90$</td>
<td>0.94</td>
<td>Good Fit</td>
</tr>
<tr>
<td>CFI</td>
<td>$\geq 0.90$</td>
<td>0.95</td>
<td>Good Fit</td>
</tr>
<tr>
<td>IFI</td>
<td>$\geq 0.90$</td>
<td>0.95</td>
<td>Good Fit</td>
</tr>
<tr>
<td>RFI</td>
<td>$\geq 0.90$</td>
<td>0.90</td>
<td>Good Fit</td>
</tr>
<tr>
<td>GFI</td>
<td>$\geq 0.90$</td>
<td>0.83</td>
<td>Marginal Fit</td>
</tr>
<tr>
<td>AGFI</td>
<td>$0–1$</td>
<td>0.76</td>
<td>Marginal Fit</td>
</tr>
</tbody>
</table>

We tested the hypothesis by utilizing the influence value between variables, which include digital literacy, blue economy, blockchain technology, and smart islands (refer to Table 4). The results stated that five hypotheses tested were significant where the values obtained exceeded standard value, which was greater than 1.96. Based on the results obtained, it is stated that all hypotheses are acceptable and have a significant effect on the variables tested. The results of the analysis state that digital literacy has a significant effect on blockchain technology, the blue economy has a significant effect on blockchain technology, blockchain technology has a significant effect on smart islands, digital literacy has a significant effect on smart islands, and the blue economy has a significant effect on smart islands. Significant study results have an important role in encouraging tourism development in various areas that have the attractiveness of smart islands that require the participation of information technology by developing a blockchain system. In addition, the development of smart islands requires the active role of local communities in the development of the blue economy and digital literacy supported by optimizing the blockchain system to encourage increased knowledge of tourists so that they are more familiar with tourist destinations on smart islands.
Table 4. Results of hypothesis testing are based on the influence between variables tested.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Significancy Value</th>
<th>Standardize Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₁ = BT → SI</td>
<td>2.28</td>
<td>0.19</td>
</tr>
<tr>
<td>H₂ = BE → BT</td>
<td>3.58</td>
<td>0.34</td>
</tr>
<tr>
<td>H₃ = BE → SI</td>
<td>4.85</td>
<td>0.50</td>
</tr>
<tr>
<td>H₄ = DL → BT</td>
<td>2.49</td>
<td>0.23</td>
</tr>
<tr>
<td>H₅ = DL → SI</td>
<td>2.50</td>
<td>0.20</td>
</tr>
</tbody>
</table>

5. Discussion

The results of qualitative mapping by utilizing VOSViewer show that derivative concepts of blockchain technology and the blue economy have novelties and important value for the development of knowledge and technology in the future. Derivative concepts have an opportunity to be followed up on for the development of knowledge evolution, including cryptocurrency, IoT, security, maritime cooperation, biomimicry, conservation. The resulting novelty needs to obtain high appreciation in order to encourage the development of smart islands through efforts to utilize the latest technology and efforts to optimize the economy based on sustainability efforts. The derivative concepts found have begun to be widely studied by various parties, including efforts in developing cryptocurrency [82,83], the optimal use of IoT [84,85], strengthening security systems [86,87], maritime cooperation [88,89], biomimicry [90,91], and conservation [92–94]. The development of derivative concepts that have novelty values is urgently needed in future studies to encourage the strengthening of tourist attractions, especially in smart destinations, through increasing our understanding of the variables studied.

The analysis from SEM shows that the smart society and smart environment are the most important dimensions of smart islands, as the creative, motivated, happy, and culturally vibrant society will have the spirit to learn about anything and something new, as well as be happily participating in any activities to make their islands a better place and help sustain the unique marine environment. These findings supports the idea that the world now increasingly focuses on sustainability aspects and the development of smarter human capital, as the techno and infrastructure focus is no longer enough [22]; moreover, focusing on community well-being and quality of life becomes the central objective that impacts not only social but also economic and environmental aspects in the smart city and destination [30]. A similar notion is mentioned by [95] that there is a high pressure placed on considering a more-than-human approach in regard to the environmental and social aspects of the smart city as the result of climate and global-warming issues in smart city development. What is surprising is the fact that, even though the local people of the Seribu Islands are the poorest and have the lowest education level compared to other areas in Jakarta, their perception complies with the global trend of moving from the smart city, which mostly integrates IT and infrastructure into urban planning, to a super smart society, which is more people centered [96] and becomes about knowledge.

BE accounts for 50% of the success of smart islands. It implies marine ecosystem health recovery, the preservation of marine resources, and the marine circular economy. It implies that protecting the blue economy as the input will become the fuel for smart islands. This complies with the OECD report that the blue economy is a driver for urban and regional development especially in coastal, delta, and fluvial cities that rely on marine and freshwater resources [97], involving smart, sustainable, and inclusive economic and employment. The BE, through emerging technologies that integrate and create value chains, triggers the introduction of new forms of production, technologies, logistics, labor processes, organizational relations, and networks [98].

Although the concept of BT is still in its early stage, it has the potential to create smart islands and especially to support smart islands and community to create a loyalty program that is able to trace and exchange rewards in a digital business ecosystem, create reliable reviews, and enhance overall business analytics, as also mentioned by [42], as well as the decentralization that makes the platform more trusted and transparent, as it can integrate
all parties in the platform, and all parties can control the activities with traceability in both a support system and collaboration amongst parties [70,99]. The same opinions were also conveyed by [12] that BT is a game changer for green innovation, as it can support islands and destinations in implementing sustainability or green programs, and it can support supply chain management and integration [41].

The current results also show that DL is very important to the success implementation on BT [100] and smart islands or destinations [101]. These facts support the finding that DL will lead to the better adoption of BT in the BE ecosystem [102] and be a building block of the smart society [103] as the important dimension of smart islands [104].

Based on the research findings developed through the elaboration of variables, dimensions, and indicators, this study produced a novelty called the smart islands model as an effort to develop blockchain technology in achieving smart islands destination. One thing that needs to be emphasized in developing the smart islands model is the importance of considering the strengthening of smart destinations, which can be achieved by optimizing in adapting blockchain technology. In addition, efforts to adapt blockchain technology on smart islands need encouragement and the development of the blue economy and digital literacy. The existence of attraction, accessibility, and amenities that have added value and are unique is needed as an effort to develop smart destinations. For this reason, the development of smart destinations requires involvement from various dimensions, including the smart economy, smart society, smart governance, smart environment, smart mobility, and smart living (refer Figure 7).

![Smart island model: efforts to develop blockchain technology in achieving smart destinations.](image)

Figure 7: Smart island model: efforts to develop blockchain technology in achieving smart destinations.

From the above model, it can be observed that attractions, amenities, and accessibilities are the building blocks of island destinations that should be managed in a sustainable way by employing integrated blue economy approaches. In order to improve economic
growth significantly, islands should be smart, therefore improving digital literacy and employing blockchain technology in regard to integrating all stakeholders and co-creating experience within the smart platform and ecosystem. The need directed at the development of blockchain technology is an important factor in the development of islands so as to create smart goals that are carried out through trust business, efficiency, creative local programs, and the growth of decentralization in the pattern of people’s lives. Several factors in the effort to develop blockchain technology can be used as benchmarks to get target destinations according to needs and improve the welfare of the lives for surrounding community.

In addition, blue economy development efforts have an important role in strengthening blockchain technology implementation and are also indirectly able to encourage an increase in the quality of tourism destinations, especially with regard to the development of tourist islands that lead to ecosystem sustainability. For this reason, the support of marine resources preservation, marine circular economy, and marine ecosystem health recovery has dominant value to elevate the quality of the economy, which is generally marked by rapid technological developments, including in the blockchain technology scheme. The contribution of digital literacy in driving the development of smart destinations is felt indirectly through the development of blockchain technology. Basic ICT, digital networking, information management, and media utilization are able to form the concept of digital literacy in improving the quality of tourism in line with technological developments. Digital literacy and the blue economy are two concepts that have been confirmed to have a dominant role in the development of the Seribu Islands as a smart tourist destination. The optimal implementation of two concepts is able to encourage the improvement of blockchain technology in forming smart destinations that are able to guarantee an increase in the welfare of people living in the Seribu Islands.

Blockchain technology is the enabler of the smart destination in island destination, as also mentioned by Tyan et al. [20]. Buhalis [1] even argued that blockchain technology is not the only technological innovation that will enrich smart destinations in the upcoming future, but other ambient intelligence (AmI) will take strategic places in smart destinations, such as mobile devices, wearable smartphones and devices, 3D printing, and apps, along with APIs, Cryptocurrency, sensor and beacon networks, pervasive computing, and gamification, as well as robotics and AI or ML capabilities. The blue economy itself will become the differentiator of the smart island destination [105], for which seven types of BE business activities will considerably be the main business activities, while marine tourism is expected to become the largest economy sector in the ocean economy of the islands [106,107]. As smartness and blockchain technology depend on ICT and digital technology, digital literacy becomes basic competence that should be owned by all stakeholders in the BE ecosystem. The similar findings are also proposed by Yakovenko et al. [100] and Pranita et al. [101].

6. Conclusions

This study succeeded in building a relevant and suitable smart islands model to be implemented in the Seribu Islands in which the central ideas are managing blue economy potentials, including marine tourism as the largest industry in its BE ecosystem. The smart islands model results from efforts to manage the 3 A’s of the islands destination as the core industry that is supported by blue economy resources in order to create smart destinations, while continuous development of blockchain technology is adopted in order to build a more transparent, trusted, and efficient ecosystem that is supported by the high level of digital literacy amongst stakeholders. The smart society, smart environment, smart living, smart governance, smart mobility, and smart economy become the important parts that form smart destinations that can be applied to build smart islands.

In further development of blockchain technology for the Seribu Islands, active involvement in the development of digital literacy and integration of each business into the blue economy can encourage the creation of important added value as an effort to optimizing the use of blockchain technology. The creation of added value has an important meaning in generating attractiveness and uniqueness that is different from what has been shown
before which can create interest for tourists to enjoy it. The development of digital literacy and the blue economy can effectively drive added value radically toward the creation of smart islands, which are widely known globally for their uniqueness.

A positive contribution is made through the smart island model to be implemented in people’s lives through strategic steps in the form of business diversification, and the use of the latest technology is expected to help improve the economic sector in which people are living. In addition, the results of this study state that digital literacy and the blue economy have a significant influence on blockchain technology and have an impact on smart destinations. Information literacy is the dimension that has the highest influence in shaping digital literacy, while the marine ecosystem health recovery has an important impact on strengthening the blue economy. The creative loyal program and the sustainable decentralization of marine ecosystems have contributed to optimally compiling the adaptation of blockchain technology. The development of various aspects, including digital literacy, the blue economy, and blockchain technology can participate in driving the sustainability of the tourism industry. Furthermore, it is necessary to develop several derivative concepts for sustainable tourism development in the form of future studies, especially on the concepts of maritime cooperation, economic performance, biomimicry, conservation, and coastal and marine tourism. The limitations of the study conducted only apply to tourism development in the Seribu Islands region in order to achieve smart destinations and support the concept of tourism sustainability. Limitations apply to the constructs applied, including disclosure of the blue economy, digital literacy, and blockchain technology, which are directly carried out by people who have businesses in tourism development to further grow the economic sector and achieve business sustainability.

**Author Contributions:** Conceptualization, D.P.; methodology, D.P., S.S. and H.K.; validation, S.S., H.K., B.M.M. and M.S.R.; writing—original draft preparation, D.P. and S.S.; writing—review and editing, S.S., B.M.M., M.S.R. and H.K. All authors have read and agreed to the published version of the manuscript.

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**Conflicts of Interest:** The authors declare that they have personal relationships that may have inappropriately influenced them in writing this article.

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Sustainability 2023, 15, 5342


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