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Fostering inclusive welfare and Islamic financing through Islamic social finance digitalization strategy

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Abstract: Islamic Social Finance (ISF) is one solution for poverty alleviation, which is a major concern in developing countries like Indonesia. However, the performance of ISF in Indonesia, both in terms of collection and management, is still far from expectations. To address this problem, a digital transformation of ISF is needed by leveraging technologies that come with both advantages and disadvantages. This study employs a Delphi ANP-BOCR analysis to determine the most optimal technology for ISF digitalization, which result is supported by meta-analysis findings. The result shows that cloud computing is the most optimal technology when only benefits and costs are evaluated. When all factors, including benefits, opportunities, costs, and risks, are considered, digital platform proves to be the most optimal technology for both the short and long term. BOCR analysis also confirms that digital platform and cloud computing are the most optimal technology. Meta-analysis further supports the contribution of digital platform in improving social finance performance. To optimize the implementation of ISF digitalization in Indonesia, this study provides an alternative model that incorporates multiple technologies.
Keywords: *ANP-BOCR, Digitalization, Islamic social finance, Meta-analysis.*

1. Introduction

As a developing country, poverty is a substantial issue in Indonesia. The total number of poor people in Indonesia in September 2022 was 26.36 million people. This means that 9.57 percent of Indonesians have an average monthly expenditure below the poverty line. The disparity between poor people in urban and rural areas is also high [1].

Limited aid fund mobilization, including inclusive financing for underprivileged communities, is one of the factors causing the high poverty rate. Aid fund mobilization and financing are needed in order to maximize the distribution and redistribution of wealth so as to improve community welfare [2]. Islamic Social Finance (ISF) is one of the tools that can promote the redistribution of wealth. It is a social finance instrument based on Islamic principles, including *zakat*, *infaq*, alms, and *waqf*, with the goal of promoting inclusive welfare [3].

A study by Ben Jedidia and Guerbouj [4] found that *zakat* affects economic growth because it encourages wealth redistribution and increases aggregate demand. *Zakat* could also alleviate inequality by increasing the purchasing power of *mustahiq* [5]. Bouanani and Belhadj [6] reported that *zakat* has a significant role in reducing poverty in the Republic of Tunisia. Likewise, Lestari, et al. [7] stated that *waqf* could be a solution to overcome poverty. ISF's role in overcoming poverty can be strengthened by digitalization as it increases the effectiveness of aid collection and distribution [8], including financing for impoverished communities.

In addition to streamlining the management of ISF funds, it is also essential to increase public awareness of ISF in order to increase ISF fund collection. As stated by Ben Jedidia and Guerbouj [4],

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muzakki's knowledge of *zakat* is important to increase their willingness to pay *zakat*. The low level of awareness of ISF can be improved through digitalization, as the use of technology has been shown to be effective in increasing literacy [9], [10].

Digitalization to the end, will broaden the scope of ISF and further optimize its potential [11]. Aziz, et al. [12] reported that there is a correlation between digitalization and financial inclusion. Mohd Nor, et al. [13] argue that the usage of technology such as blockchain, could support ISF if there is a proper socialization and education. Digitalization also has an important role in reducing the number of unbanked people by providing accessibility, which could ease ISF fund collection [14]. This remarkable potential could be attained by developing countries if it is implemented accordingly.

Following the same spirit, Usman, et al. [15] reported the enthusiasm of Muslims to implement digitalization within ISF. This, combined with the underutilized ISF potential and the substantial Muslim population in Indonesia, creates opportunity for ISF development in Indonesia Widiastuti, et al. [16]. Nevertheless, there will be high upfront investment costs to implement such technology [17]. Moreover, digitalization means exposure to cyberattacks [18], which becomes a threat in the management of ISF funds.

Despite numerous studies discussing ISF, there are few studies that further evaluate ISF as a whole [16]. Several studies only focus on *waqf* implementation [19]–[21] and *zakat* performance [22]–[24]. To the best of my knowledge, there is no study that further assesses digitalization on ISF. One study that shares some similarities comes from Usman, et al. [15], but it only covers the willingness to use fintech in the context of Islamic philanthropy, not further strategies for ISF digitalization.

Given by the gaps above, this study builds an ANP-BOCR model to assess the suitable technology for ISF digitalization to foster inclusive welfare and Islamic financing. Adopting from Lai, et al. [25] and OECD [26], technologies that will be examined in this study are artificial intelligence, blockchain, cloud computing, big data, QR code, and digital platform. The result of ANP-BOCR analysis will be supported by meta-analysis findings.

Indonesia is chosen as the research object for several reasons. First, Indonesia is a country with the largest Muslim population worldwide, with the potential for *zakat* and cash *waqf* of USD 26.1 billion and USD 12.6 million, respectively [27], [28]. However, the realization is still far from the expectation, which is only 3 percent for *zakat* and 0.21 percent for cash *waqf*. Indonesia is also regarded as the most philanthropic country in the world [29].

This study finds that cloud computing is the most optimal technology for ISF digitalization when only benefits and costs are considered. On the other hand, considering all factors, including benefits, opportunities, costs, and risks, digital platform proves to be the most optimal technology for ISF digitalization for both the short and long term. BOCR analysis also confirms that digital platform and cloud computing are the most optimal technology. Meta-analysis further supports the contribution of digital platforms in improving social finance performance.

This research comprises five sections. This section introduces fundamental concepts. The subsequent section provides related literature. Followed by a description of the methodology used in this study. The fourth section contains results and analysis. Conclusion and recommendations are presented in the fifth section.

2. Literature Review

2.1. The Concept of ISF Digitalization

ISF is a social finance instrument based on Islamic principles that aims to support impoverished communities [3]. ISF comprises Islamic philanthropy institutions responsible for managing *zakat*, *infaq*, alms, and *waqf*, as well as cooperative-based institutions that offer financial products based on Islamic contracts, such as *qardh* and *kafalah* [30]. In recent years, there has been a growing interest about Islamic social finance, especially following the Covid-19 pandemic. Islamic Finance Development Report

2022 by ICD Refinitiv [31] highlighted that due to the impact of Covid-19, Islamic social finance, particularly *zakat*, has been a major focus of Islamic finance research as it plays a significant role in supporting the impacted communities. Islamic financial technology was also noted as one of the topics that gained a lot of attention in 2021.

Digitalization can be defined as the use of digital technology to generate innovation in forming new business models or new revenue streams, that can open up more opportunities for companies [32]. In general, the application of digital technology is aligned with the objectives and principles of the ISF act in Indonesia [33]. The nature of digital technology, which encourages efficiency, transparency, and access widening, is symmetrical with the objective of the *zakat* act, which aims to increase the efficiency and effectiveness of ISF operations and services, as well as amplify the impact of ISF on poverty alleviation and public welfare. Some examples of digitalization within ISF include the utilization of digital platforms for donation and investment purposes, the use of social media to increase awareness of ISF [34] and to implement online marketing [35].

Indonesia is deemed ready for implementing ISF digitalization, as evident from its workforces' digital skills and the availability of supporting infrastructures. About 1 percent of Indonesian workers have digital-related certifications, while 31 percent use digital devices, and 26 percent are internet users. Indonesia's digital infrastructure is well developed, with cellular networks coverage of 93 percent of the country's territory, 4G network coverage of 74 percent, and 1.1 million merchants accepting digital payments [36]. These factors provide a solid foundation for the successful implementation of ISF digitization in Indonesia.

2.2. Benefits and Urgencies of ISF Digitalization

Digitalization is able to radically change the business processes [37], including in the financial sector, fostering greater transparency and efficiency. Transparency of ISF management would increase donors' trust. Efficiencies that come from digitalization will lead to cost reductions [38], [39]. For example, by automating administrative and manual tasks. Furthermore, digitalization in the form of data analytics [40] can accelerate the fundraising process and expand its distribution reach, as data-driven decision-making enables ISF institutions to make more accurate judgments. Characteristics of digitalization, as discussed earlier, are factors that contribute to its ability to encourage financial inclusion, which is in line with ISF's goals of alleviating poverty and inequality [3].

2.3. Limitations and Challenges of ISF Digitalization

Despite the positive aspects, digitalization also presents limitations and challenges. Some of the limitations are the risk of widening the digital divide, as certain demographics might encounter difficulties in accessing technology and the internet [41], [42], and there are groups of people with low digital financial literacy [43], which hinders their participation in ISF digitalization. Another limitation to consider is that some consumers may prefer traditional methods [44] due to their concern about the security of online transactions [45]. The digital transformation of ISF can also be complex, yet it must still comply with Sharia rules [46].

Challenges associated with ISF digitalization come from costs and risks. Digitalization requires high investment cost [47]. This includes, but is not limited to, the cost of infrastructure, IT helpdesk, servers, and so on. In terms of legal issues, digitalization is considered new in several countries, thus their legal framework has not been created. Following der Meulen [48], 81 percent of legal departments are unprepared for digitalization. To that end, costs related to legal construction must be considered due to the massive reformation within the legal framework. Furthermore, costs in implementing digitalization may continue to increase due to the rapid development of technology, resulting in quick replacement of the current technology with newer alternatives in the short term [49].

Turning to risks, since digitalization is closely related to the internet, it raises cyberattack issues [50], especially as data becomes increasingly commoditized and some institutions may see this as an opportunity to exploit user data and expect them to ignore it [51]. The same goes for energy resources, digitalization relies heavily on electrical sources [52], which implies that power outages will disrupt the operation of companies implementing digitalization. Adding relevance, digitalization requires a well-structured internet coverage area [53], [54], while Indonesia is an archipelago country with numerous remote areas that may not be covered by the internet. To this end, a comprehensive approach and collaboration between stakeholders is essential to address these limitations and challenges.

2.4. Technology Alternatives for ISF Digitalization

2.4.1. Artificial Intelligence (AI)

AI is a computer-based system capable of generating information from its accumulated knowledge of historical data. AI performs activities that generally require human intelligence [55]. The use of AI could overcome system-related vulnerabilities in a much better and faster way than humans [56]. AI's applications are generally divided into data analytics, natural language processing (NLP) for understanding human language, image recognition, and anomaly detection [57]. Through the use of data analytics, AI could provide insights into data patterns [58], which in turn enable the prediction of individual behavior. Whereas image recognition and NLP are beneficial for providing online ISF services, eliminating the need for in-person office visits [59]. Hence, the utilization of AI could drive the evolution of businesses. Despite the benefits it brings, the use of AI technology involves high costs to build infrastructure, expand internet networks, establish an adequate legal framework, and enhance the quality of human resources [60]–[62]. There are also associated risks, including unstable internet networks, cyberattacks, power outages, and misuse of consumer data [26], [61], [63].

2.4.2. Blockchain

Blockchain technology offers real-time and efficient automation of activity execution. Information regarding these actions is immutable and can be monitored by users [64]. Technically, blockchain refers to a sequence of blocks that hold a list of completed transaction records [65]. Transactions within the blockchain network are automated based on rules specified in a smart contract, which is a computer program consisting of codes. In the occurrence of a transaction, its information is distributed to all relevant parties in the network, referred to as nodes, who will validate the transaction. Once validated, the transaction details are stored in a block and linked to other blocks containing information about prior transactions, thus forming a chain [66]. These blocks are protected by cryptographic hash algorithms and digital signatures to ensure that transaction data is verified and unalterable [67]. Moreover, the distribution of data can mitigate the risk of single point of failure situations [68]. Therefore, businesses that require high reliability and honesty may adopt blockchain technology to attract customers.

The best practice of ISF management using blockchain technology comes from Finterra, one of the leading tech startups, which leverages blockchain technology to manage *waqf* funds based on a crowdfunding system [69]. Finterra creates a digital platform, known as myWAQF, where several parties are involved, including platform providers, waqf institutions, waqf authorities, and donors or *waqif* [70]. However, adopting blockchain for ISF digitalization involves significant costs related to the establishment of legal frameworks, infrastructure, human resources and internet network development [63], [71]–[73].

2.4.3. Cloud Computing

Cloud computing technology is a form of service that provides network access to a shared set of configurable computing resources, such as servers, storage, applications, and so on [74], that can be accessed anytime and anywhere, as long as an internet network is available. The characteristics of cloud computing, which offer a multi-tenancy system where tenants with similar needs will share system software [75], ease of implementation, efficient distribution of computing resources, and on-demand service, all contribute to its low cost [76].

Three main types of cloud computing services are Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) [77]. IaaS, which provides infrastructure such as storage, servers, and networks, can be utilized by companies that do not have sufficient computing resources [78]. Examples of IaaS products are Microsoft Azure, IBM Softlayer, and Google Compute Engine [79]. Whereas PaaS offers a platform or environment that enables developers to build, test, launch, and manage their applications [80] using built-in software components, thereby removing the cost of purchasing software licenses, infrastructure, and other resources [81]. Microsoft Azure, IBM Bluemix, and Google App Engine are a few examples of PaaS products [79].

Following, SaaS service offers a cloud-based application software, eliminating the need for installation, which in turn enhances efficiency and practicality [79]. For instance, SaaS products such as enterprise resource planning (ERP), customer relationship management (CRM), and warehouse management, can be leveraged to streamline business management [82]. ISF institutions could employ SaaS services for website hosting, incorporate CRM to enhance marketing, and automate accounting records through cloud-based accounting software that integrates with payment gateways. All data generated from website, marketing, and financial activities can be securely stored within a dedicated cloud service for data storage.

2.4.4. Big Data

Big data technology is a comprehensive information source that is essential for doing in-depth analysis. It comprises large sets of complex data, including both structured and unstructured, that cannot be managed by traditional processing techniques or algorithms [83]. Miskam and Eksan [84] discussed the application of big data for decision-making in Islamic financial institutions. Big data aids Islamic financial institutions in understanding customer behavior, enabling the provision of personalized services. It also helps to prevent fraud, assists in auditing, reporting and compliance issues, which will ultimately reduce overhead costs. Adopting big data technology for ISF digitalization entails costs for infrastructure and internet network development, as well as for human resources [85]–[87].

2.4.5. Quick Response (QR) Code

QR code technology is a type of optical tag that is capable of storing various data, such as media files, links to a website, social media, and mobile payment details. The data can be decoded by only scanning it using either a machine or a smartphone [88]. Due to its convenience, QR code is quickly being accepted as a means of payment for mobile transactions [89]. One of the most common uses of QR code in ISF is for *zakat, infaq, sadaqah, and waqf* (ZISWAF) payments. QR code enables a more efficient and convenient payment method, as users are no longer required to carry cash or manually type the account numbers. Tagoranao, et al. [90] found evidence that by placing QR code in some strategic locations, *waqf* and *zakat* fund collection increased by six times as a result of the cashless contributions made by individuals through the QR code. In terms of costs, QR code implementation incurs minimal costs for establishing the necessary legal framework, building digital infrastructure, and developing human resources, however, there are still costs associated with internet network development, especially in remote areas [91], [92].

2.5.5. Digital Platform

A digital platform can be defined as a technology that connects stakeholders on a single platform through which information can be gathered, combined, and computed [93]. It provides an efficient way for businesses to interact with information quickly, decrease information asymmetry, and lower expenses related to searching for resources and conducting transactions [94]. Digital platform technology allows users to easily access many types of products that are aggregated on one digital platform anytime and anywhere [38]. ISF institutions that utilize a digital platform must adhere to sharia principles in providing their services [95]. Digital platform adoption for ISF digitalization makes operations, coordination, and consolidation within organizations easier and more efficient. It also improves communication among donors, partners, and beneficiaries [96], promotes transparency, and increases donors interest in donating [46]. Similar to cloud computing, digital platform technology comes with low costs for infrastructure development, legal framework establishment, and human resource training [39], [81].

3. Research Methodology

This study employs three distinct research methodologies, i.e. Delphi ANP-BOCR, meta-analysis, and BOCR analysis. Delphi ANP-BOCR analysis is used to examine Delphi ANP-BOCR is used to examine the most optimal technology for ISF digitalization in Indonesia. To strengthen the research results, this study adopts meta-analysis as a form of empirical evidence. Lastly, to support the implementation of ISF digitalization in Indonesia, the author also provides own insights through the evaluation of each technology in terms of its benefits, opportunities, costs, and risks (BOCR).

3.1. Data

There are three different data sources for three different methodologies. Data for the Delphi ANP-BOCR analysis are gathered from experts (academics) opinions in several regions in Indonesia, including Yogyakarta, East Java, North Sumatera, West Sumatera, and South Sulawesi, by conducting in-depth interviews. Data for the meta-analysis is obtained from research papers acquired from Google Scholar, as it includes papers from various journal websites and indexing agencies. In the case of BOCR analysis, the data are based on related previous literatures.

3.2. Methods

3.2.1. Delphi ANP-BOCR

The Delphi procedure is a well-known structured communication technique to solve complex issues by relying on a group of experts [97]. At present, numerous studies use the Delphi procedure for problem decompositions and constructions of ANP framework [98]–[101]. Analytic Network Process (ANP) is a mathematical theory that examines effects through the application of assumption-based problem-solving technique [102]. The ANP method is chosen as each technology has its own characteristics and functions, thus, assessment from experts is necessary to determine the most optimal technology. The BOCR model is utilized based on its ability to evaluate both advantage (benefits and opportunities) and disadvantage (costs and risks) aspects of activities [103].

Initially, the ANP-BOCR framework, as illustrated in Figure 1, is developed by conducting literature studies of related topics from credible sources and in-depth interviews with experts. The ANP-BOCR model is then quantified based on questionnaires answered by experts, followed by analysis to determine the priority value of each technology and BOCR aspect.

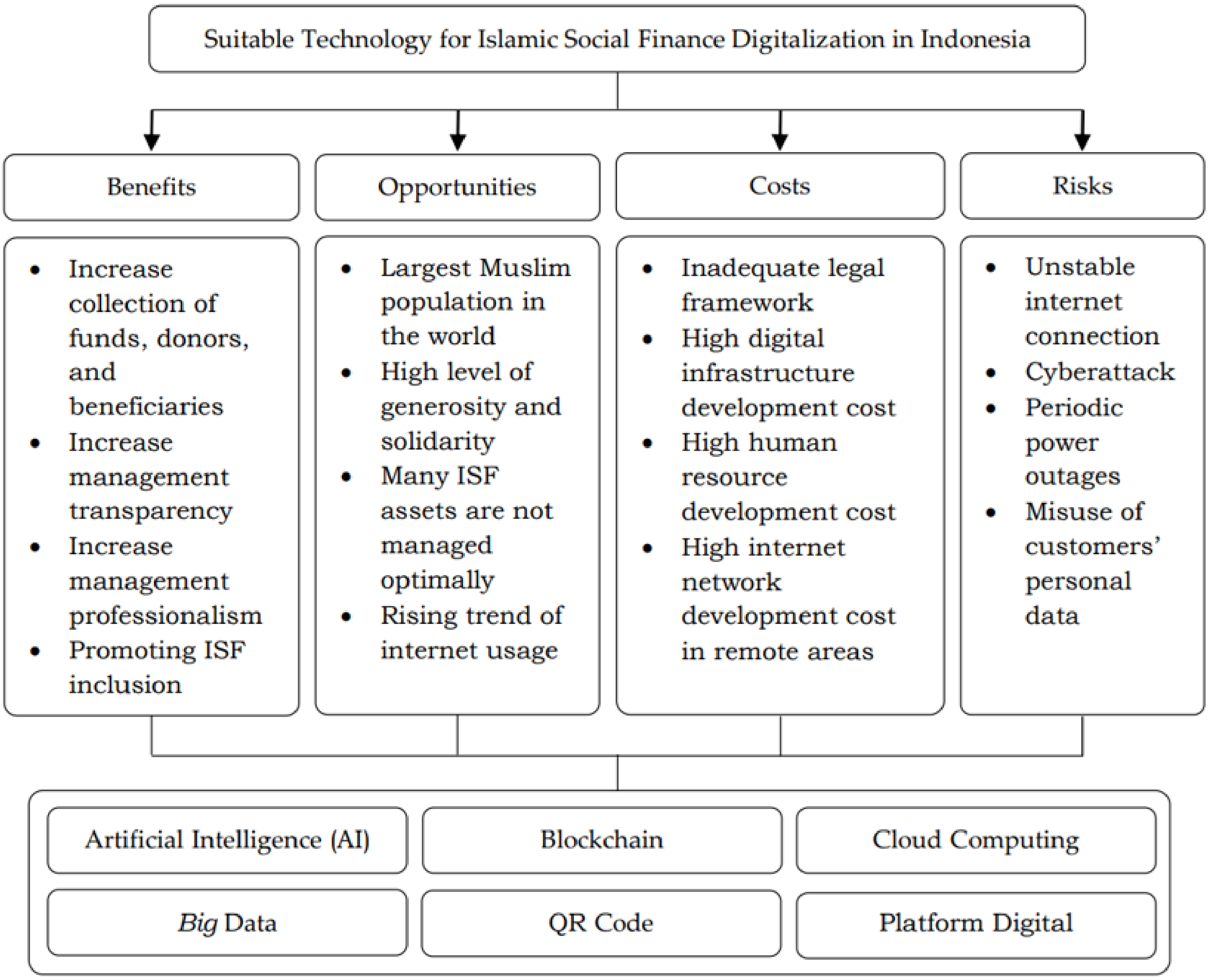

Figure 1.
ANP-BOCR model.

Following Saaty [104], three formulas to decide which technology is prioritized or the most optimal to adopt are as follows.

Standard formula: (1)
Multiplicative formula: (2)
Additive formula: (3)

Where *B*, *O*, *C*, *R* represent the priority weight of the benefit, opportunity, cost, and risk of each technology, while *b*, *o*, *c*, *r* are the priority weight of the benefit, opportunity, cost, and risk criteria, respectively. The multiplicative formula is used to measure short-term priority and the additive formula is used to measure long-term priority. To obtain a robust result, a sensitivity analysis is usually conducted. However, sensitivity analysis is omitted in this study, as ANP-BOCR analysis is deemed robust through the Delphi procedure, which involves experts [99].

3.2.2. Meta-Analysis

Meta-analysis is a statistical method used to combine results from multiple similar studies [105]. This approach can therefore be used to support the findings of the ANP-BOCR analysis. This method offers the benefits of systematically summarizing findings from multiple studies in a more advanced way than procedures such as qualitative summary or vote counting, as well as identifying relationships that might be unobserved in other research summary methods [106], [107].

In order to confirm the impact of the selected technology from the ANP-BOCR analysis on fundraising or donation performance, this study employs a meta-analysis of correlations using JASP software. Initially, the correlation coefficient of each study is transformed into an effect size value. The next step is a heterogeneity test to decide whether a fixed-effect model or a random-effect model is used to calculate the summary effect. The last step is to assess the presence of publication bias.

A summary effect size of ±0.1 to ±0.3 is considered weak, while ±0.3 to ±0.5 is moderate, and ±0.5 to ±1 is strong [108]. A positive value indicates that both variables increase or decrease in parallel. On the contrary, a negative value suggests that as one variable decreases, the other increases, and vice versa. A *p*-value of the summary effect that is less than 0.001 represents a significant relationship between independent and dependent variables.

3.2.3. BOCR Analysis

The BOCR model is a widely used strategic management framework for decision analysis [109]–[111]. The compatibility of the characteristics of each technology with the BOCR aspects is quantified based on arguments in related studies. The quantification of BOCR aspects is shown in Table 1 below. The BOCR score of each technology is then summed up to determine the most optimal technology for ISF digitalization.

Table 1.
Quantification of BOCR aspects.

	Description	**Benefits**	**Opportunities**	**Costs**	**Risks**
Yes	Technology's characteristics possess absolute attributes that are unaffected by other characteristics.	+1	+1	-1	-1
Quasi Yes	Technology's characteristics endorse the BOCR aspects, but some weaknesses are apparent.	+0.75	+0.75	-0.75	-0.75
Depend	Technology's characteristics support the BOCR aspects by heavily relying on other characteristics.	+0.5	+0.5	-0.5	-0.5
Quasi No	Technology's characteristics give minimal supports for the BOCR aspects.	+0.25	+0.25	-0.25	-0.25
No	Technology's characteristics do not support the BOCR aspects.	0	0	0	0

4. Results and Discussion

4.1. Delphi ANP-BOCR

4.1.1. Priority of BOCR Criteria

Benefits, opportunities, costs, and risks are four aspects to be considered in evaluating the most optimal technology for ISF digitalization. Based on Figure 2, the benefit criterion has the highest geometric mean value. This highlights the importance of prioritizing benefits in determining the most optimal technology for ISF digitalization in Indonesia. As stated by Zakariyah, et al. [112], technology utilization in the financial sector is growing due to its direct benefits for users.

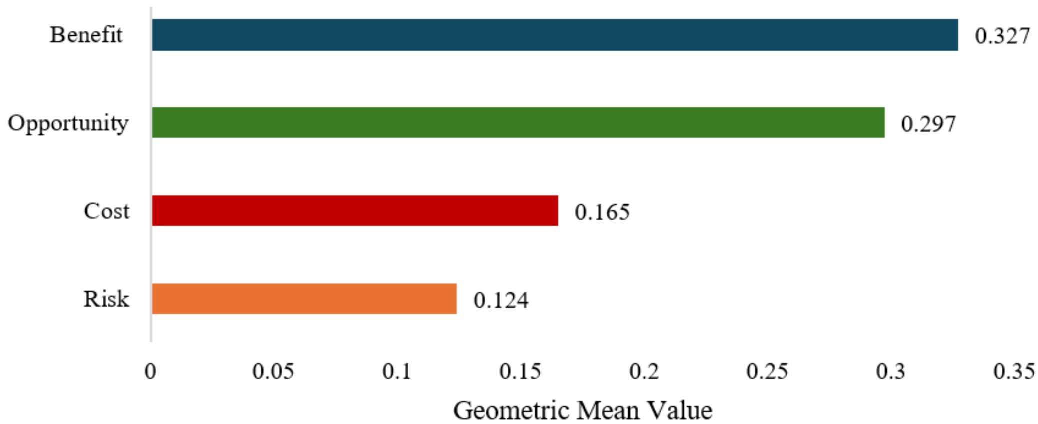

Figure 2.
Geometric mean value of each BOCR criteria.

4.1.2. Priority of Sub-Elements in Each BOCR Criteria

Each BOCR criteria consists of four sub-elements to be considered, as shown in Figure 3, 4, 5, and 6. The highest geometric mean value within each of the BOCR criteria is prioritized in the assessment of the most optimal technology for ISF digitalization in Indonesia.

Based on Figure 3, the priority in the benefit criteria is that the use of technology must increase the collection of funds, donors, and beneficiaries. Zakariyah, et al. [112] state that technology enables the development of innovative models for more streamlined financial services, providing convenience to donors, beneficiaries, and ISF institutions [16]. This will encourage donors to increase the amount of their donations and expand the reach of ISF beneficiaries.

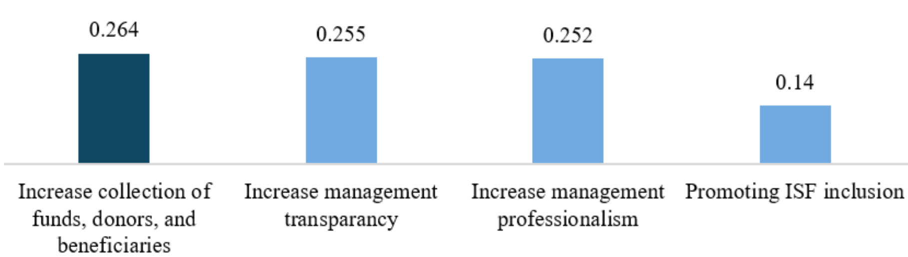

Figure 3.
Geometric mean value of benefit sub-elements.

Turning to opportunities, as depicted in Figure 4, the rising trend of internet usage holds an important role in supporting ISF digitalization. In line with the growing number of internet users in Indonesia, which reached 78.19 percent in 2022 [113]. It facilitates the adoption of technology to improve information dissemination and accessibility [114]. Furthermore, the internet enables online transactions [115], thereby contributing to the increase in ISF fundraising.

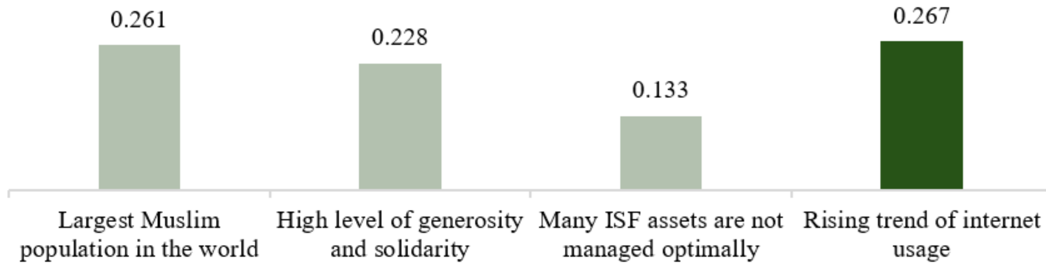

Figure 4.
Geometric mean value of opportunity sub-elements.

Moving to the cost aspect, according to the data presented in Figure 5, digital infrastructure development cost becomes the primary factor in selecting the technology for ISF digitalization, as adequate digital infrastructure is necessary to ensure the realization of ISF digitalization [62].

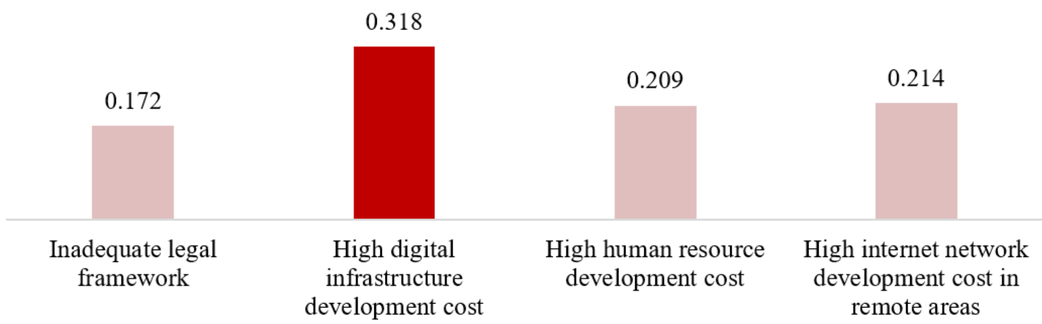

Figure 5.
Geometric mean value of cost sub-elements.

In terms of risks, as illustrated in Figure 6, the crucial aspect in determining technology for ISF digitalization is prioritizing technology that can effectively prevent the misuse of customers' personal data, given the current heightened customers' concerns regarding the processing and potential misuse of their personal data [116], [117], as the use of technology allows for more extensive data sharing with various third parties [118].

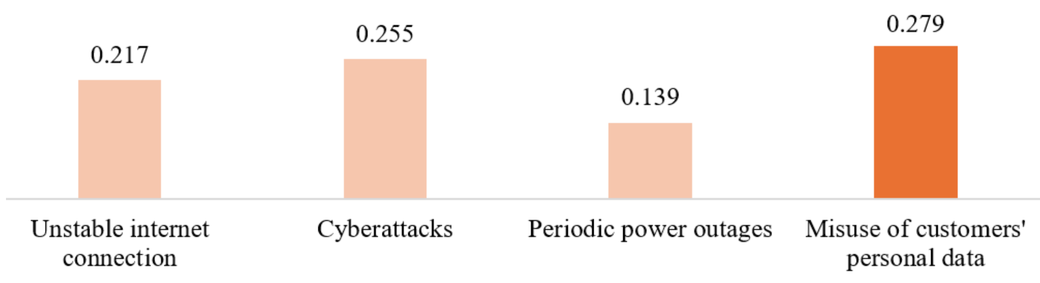

Figure 6.
Geometric mean value of risk sub-elements.

4.1.3. Priority Technology for ISF Digitalization

This section will discuss the selected technology for ISF digitalization using ANP-BOCR analysis, employing standard formula, multiplicative formula, and additive formula. Following Saaty [104], a standard formula is computed by dividing the geometric mean value of benefit by the geometric mean value of cost (B/C) of each technology. On the other hand, the geometric mean values of benefit, opportunity, cost, and riks are included in the multiplicative formula (B*O/C*R) and additive formula (bB + oO - cC - rR). As shown in Figure 7, the standard formula suggests that cloud computing is the most optimal technology, while according to multiplicative and additive formulas, digital platform is the most optimal technology in both the short and long term.

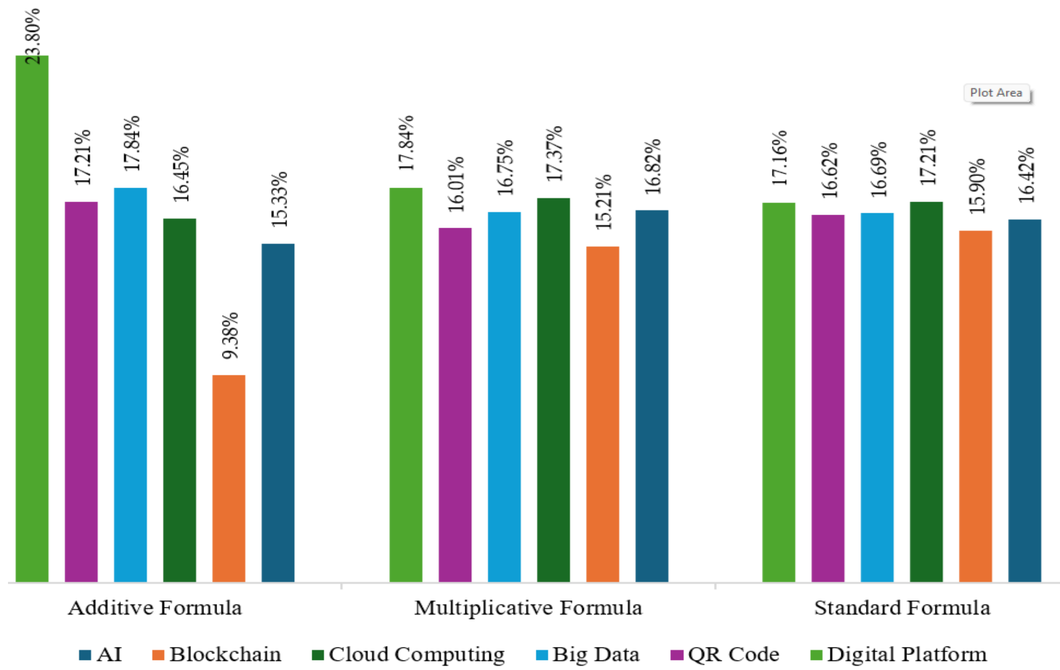

Figure 7.
Priority technology for ISF digitalization.

Digital platform and cloud computing were chosen due to their advantages over other technologies in terms of ease of implementation and accessibility, promoting management professionalism and transparency [38], [78], [119], [120]. Implementation of both technologies is supported by rapid and affordable digital infrastructure development costs [121], [122], as well as Indonesians' familiarity with using mobile phones and computers [123], which facilitates the adoption of these technologies. However, in order to provide digital ISF services to a wider area, it will incur significant costs for internet network development in remote areas.

4.2. Meta-Analysis

To support the ANP-BOCR analysis results, this study adopts meta-analysis as a form of empirical evidence. The meta-analysis in this study is categorized as a correlational meta-analysis, which aims to examine the relationship between two variables. The selection criteria for studies to be included in the meta-analysis are (a) articles published in either English or Bahasa Indonesia; (b) articles focusing on the use of digital platform and its effect on fundraising or donation performance; and (c) articles containing a correlation coefficient value. Through the search outcomes on Google Scholar, five research papers that meet the predetermined criteria are identified. Table 2 describes the sample size (*N*) and correlation coefficient (*r*) from each study.

Table 2.
Summary of studies for meta-analysis.

No	Author	*N*	*r*
1	Binsaeed, et al. [124]	325	0.389
2	Yousaf, et al. [125]	324	0.320
3	Sargeant, et al. [126]	819	0.300
4	Sargeant, et al. [126]	819	0.360
5	Beier and Wagner [127]	740	0.080

The first step is to convert the *r* value, as presented in Table 2, into an effect size. Following this, a heterogeneity test is conducted to determine the appropriate model to calculate the summary effect. With the τ^2 and τ values of 0.016 and 0.125, respectively, both greater than zero, an I^2 value of 90 percent, which falls within the range of 60 to 95 percent, and an H^2 value of 10 that is greater than one, it is evident that heterogeneity is present. This implies that the summary effect will be calculated using the random effect model.

Table 3.
Summary effect calculation (Wald test).

	Estimate	Standard error	*z*	*p*	95% confidence interval	
					Lower	Upper
Intercept	0.299	0.059	5.052	< 0.001	0.183	0.416

Table 3 presents the result of the summary effect calculation. The effect size value of 0.299 and *p*-value less than 0.001 indicate a moderate and significant effect of the use of digital platform on fundraising or donation performance. Kasri and Yuniar [128] state that easy access is the most important aspect for donors to make online payments. Digital platform technology has the ability to facilitate this ease of access. It has been widely used by Muslims in Indonesia for donation due to its convenience and swiftness [129]. Lastly, through Egger's test, the *p*-value of 0.438, which is greater than 0.05, indicates the absence of publication bias. This finding suggests that the outcomes of omitted studies are in line with the results of this study.

4.3. BOCR Analysis

To strengthen the results, this study analyzes each technology in terms of its benefits, opportunities, costs, and risks, by quantifying the compatibility of the characteristics of each technology with the BOCR aspects based on arguments in related previous studies. The calculation is summarized in Table 4, and the supporting references can be seen in the Appendix.

Table 4.
BOCR matrix calculation.

BOCR	AI	Blockchain	Cloud computing	Big data	QR code	Digital platform
Benefits						
• Increase collection of funds, donors, and beneficiaries	+1	+1	+1	+1	+1	+1
• Increase management	+0.5	+1	+0.75	+0.5	+0.25	+0.75

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transparency						
• Increase management professionalism	+1	+1	+0.75	+0.75	+0.25	+0.75
• Promoting ISF inclusion	+1	+1	+1	+1	+1	+1
Total Benefits	+3.5	+4	+3.5	+3.25	+2.5	+3.5
Opportunities						
• Largest Muslim population in the world	+1	+1	+1	+1	+1	+1
• High level of generosity and solidarity	+1	+1	+1	+1	+1	+1
• Many ISF assets are not managed optimally	+1	+1	+1	+1	+0.25	+1
• Rising trend of internet usage	+1	+1	+1	+1	+1	+1
Total Opportunities	+4	+4	+4	+4	+3.25	+4
Costs						
• Inadequate legal framework	-1	-0.75	0	0	0	0
• High digital infrastructure development cost	-1	-1	-0.25	-0.75	0	-0.25
• High human resource development cost	-1	-1	-0.5	-1	0	-0.5
• High internet network development cost in remote areas	-1	-1	-1	-1	-1	-1
Total Costs	-4	-3.75	-1.75	-2.75	-1	-1.75
Risks						
• Unstable internet connection	-1	-1	-1	-1	-1	-1
• Cyberattack	-1	0	-1	-0.25	-1	-1
• Periodic power outages	-1	-1	-1	-1	-1	-1
• Misuse of customers' personal data	-0.75	-0.5	-0.75	-0.75	-1	-0.75
Total risks	-3.75	-2.5	-3.75	-3	-4	-3.75
Total of BOCR	-0.25	1.75	2	1.5	0.75	2

From the BOCR analysis, digital platform and cloud computing have the highest scores. Hence, it is selected as the most optimal technology for ISF digitalization. These two technologies enable users to conveniently access information anytime and anywhere [38], [78], [119], [120], thereby enhancing the transparency, inclusiveness, and professionalism of ISF management.

In terms of cost, digital platform and cloud computing do not require high legal costs to be adopted in Indonesia. Their characteristics also allow them to be developed with affordable infrastructure [121] and human resource development costs [122]. It should be noted that the use of these technologies comes with risks, including reliance on stable internet connections [39], [130], vulnerability to cyberattacks [122], [131] and power outages [132], [133], as well as the potential to misuse customers' personal data [134], [135].

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Although digital platform and cloud computing are considered the most optimal technologies for ISF digitalization, other technologies can also be used depending on the ISF institutions' objectives and financial capabilities. If the aim is to automate the transaction process, adopting blockchain technology is recommended. For enhanced data-driven decision-making, ISF institutions could leverage AI and big data technology, while QR codes can be utilized to simplify ZISWAF payments.

4.4. Alternative Model for Implementing ISF Digitalization in Indonesia

In order to optimize ISF activities, this study builds an alternative model of ISF digitalization by incorporating several technologies, including blockchain, AI, cloud computing, big data, and digital platform. The combination of these technologies is necessary, as each technology has its own advantages and disadvantages [77]. Figure 8 is the scheme for implementing ISF digitalization in Indonesia.

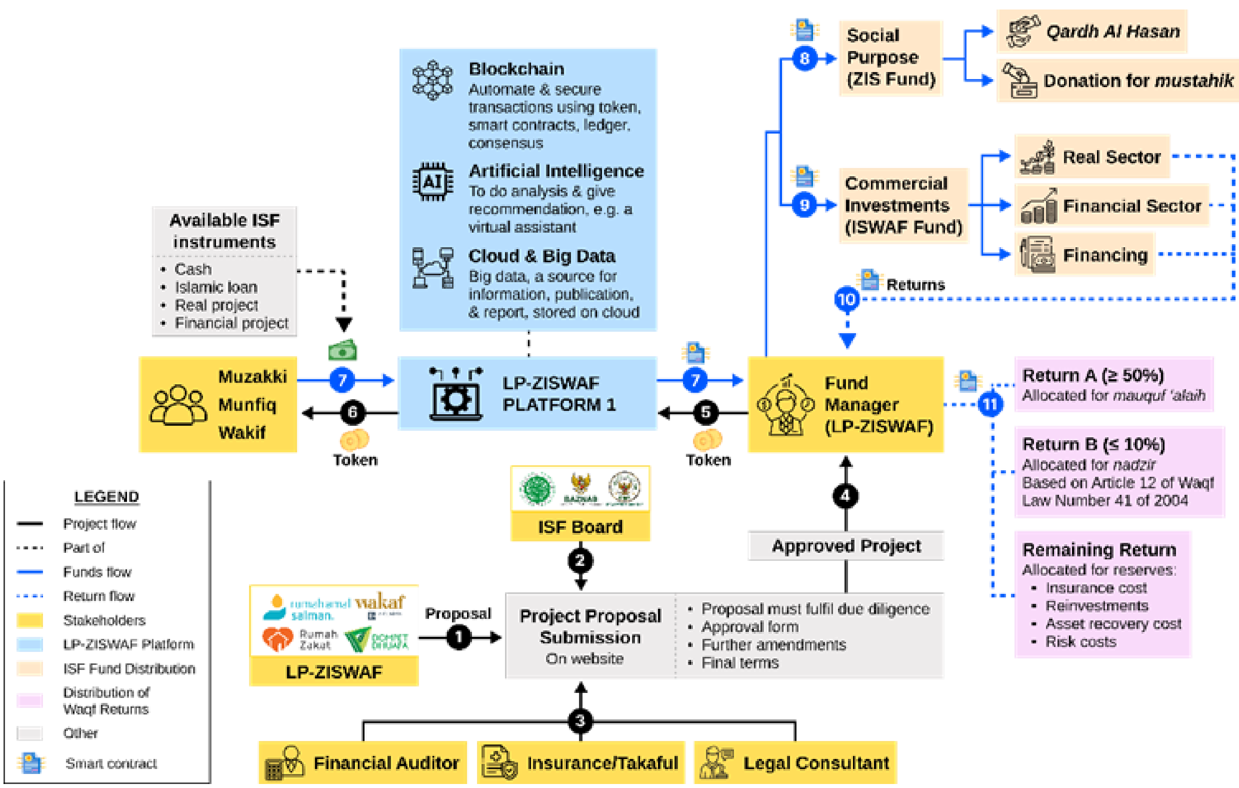

Figure 8.
Alternative model for the implementation of ISF digitalization in Indonesia.

In the alternative model above, a digital platform owned by a single ZISWAF collecting institution, or *Lembaga Pengumpul* (LP), labeled as LP-ZISWAF Platform 1, is utilized to facilitate *muzakki* (individuals who are required to fulfill zakat payments), *munfiq* (individuals who contribute to *infaq*), and *waqif* (individuals who donate an asset for *waqf*) to make online donations to specific programs. Access to this platform is possible via a mobile application and a website. The model involves several stages, as follows:

1. Initially, LP-ZISWAF, which acts as a *nazhir* or *amil*, will submit proposals related to ISF fund management programs to a designated website. These proposals need to encompass the operational

framework and legal aspects of the programs, such as the business model, legal entities involved, parties conducting the Initial Coin Offering (ICO), and comprehensive information about the tokenomics (issuance, distribution, type, governance, price, token supply, as well as incentives for participants contributing to the blockchain system).

2. The ISF board is composed of authorities that have functions to regulate and supervise ZISWAF activities, including the National Amil Zakat Agency or *Badan Amil Zakat Nasional* (BAZNAS), the Indonesian Waqf Board or *Badan Wakaf Indonesia* (BWI), and the National Sharia Board-Indonesian Ulama Council or *Dewan Syariah Nasional-Majelis Ulama Indonesia* (DSN-MUI). They will assess the proposed programs and their adherence to Sharia law.
3. Apart from the ISF board, financial auditors and legal consultants will examine and endorse proposals, as well as make recommendations to ensure the programs' validity. Insurance will be applied to provide assurance for the success of productive *waqf* projects, as stipulated in Article 43 of Law of the Republic of Indonesia Number 41 of 2004 [136].
4. Proposals approved by the ISF board, financial auditors, and legal consultants will be forwarded to the fund manager.
5. The fund manager will organize an ICO, a procedure aimed at raising funds from contributors through the sale of cryptocurrency assets or tokens [71]. The fund manager will issue tokens based on the funding needs of each program.
6. *Muzakki*, *munfiq*, and *waqif* who have registered on the LP-ZISWAF Platform 1 can purchase the issued tokens using fiat money.
7. Funds raised from token sales will be held in the fund manager's escrow account until all available tokens are sold. In the event that fundraising goal is not reached, the collected funds will be returned to *muzakki*, *munfiq*, or *waqif*.
8. Once the purchase of tokens reaches the available limit, the fund manager will allocate the tokens to specified programs. Tokens, which originate from *zakat*, *infaq*, and *sadaqah* funds, will be allocated towards social programs, specifically for *qardh al hasan* financing and donations. This allocation follows the guidelines regulated in Law of the Republic of Indonesia Number 23 of 2011 [137], which states that *zakat* is utilized for productive purposes only after fulfilling the basic needs of *mustahik*.
9. Tokens belonging to *infaq*, *sadaqah*, and *waqf* funds will be allocated for commercial programs. These programs can be directed at the real sector, Islamic financial securities, or return-bearing financing.
10. Commercial ISF programs will generate returns.
11. Up to 10% of returns from productive *waqf* programs will be distributed to *nazhir*, while a minimum of 50% will be assigned for *mauquf 'alaih*, or individuals who have the right to benefit from the management of *waqf* assets. The remaining returns will be divided among insurance costs, reinvestments, asset recovery costs, and costs for risks associated with *waqf* asset management. This return allocation is regulated by the Indonesian *Waqf* Board Regulation Number 01 of 2020 [138].

Table 5 describes the application of each technology in the alternative model shown in Figure 8.

Table 5.
Technology application in the alternative model for ISF digitalization.

Technology	Application
Blockchain	a. Maintains a transparent and immutable record of transactions. b. Allows platform users to trace the ISF fund's flow. c. Utilizes smart contracts to carry out transactions automatically upon meeting specific conditions, removing the necessity for intermediaries. As an example, it automates the distribution of ISF funds to each

Technology	Application
	program, deliver confirmation of successful transactions to donors, and distribute returns to the allocated parties, and oversee Anti-Money Laundering and Counter-Terrorist Financing (AML CTF).
Big Data	a. Integrates structured and unstructured data. b. Following Saleh, et al. [139], apart from storing transaction data within a decentralized blockchain system, big data will also be stored within a centralized database. These big data sets can then be utilized to generate reports.
Cloud Computing	a. Offers data storage services for storing big data that are accessible anytime and anywhere, as long as an internet connection is present.
AI	a. Carries out automatic descriptive, predictive, and prescriptive analyses, enabling LP-ZISWAF to make decisions based on data. b. Suggests programs according to the interests of *muzakki*, *munfiq*, and *waqif*. c. Facilitates the implementation of a chatbot or virtual assistant to automate interactions between *muzakki*, *munfiq*, *waqif*, and customer support. d. Identifies irregularities in transactions.
Digital Platform	a. An online platform for LP-ZISWAF to upload its ISF management programs. b. An online platform for *munfiq*, *muzakki*, and *waqif* to contribute to their favored ISF programs. c. An online platform accessible to both registered and unregistered users to view reports on the management of ISF funds.

Data collected from digital platforms, including data about *mustahik*, *muzakki*, *waqif*, fundraising, distribution, and other relevant data, will be sent to an independent institution in charge of ISF data management through a data collection platform, as illustrated in Figure 9. Data distribution could help realize the integration of national ISF data, which is essential to facilitate ISF policy formulation and analysis of ISF conditions in Indonesia. For instance, evaluating the performance of *amil* and *nazhir*, as well as identifying the ISF fund distribution across regions [140].

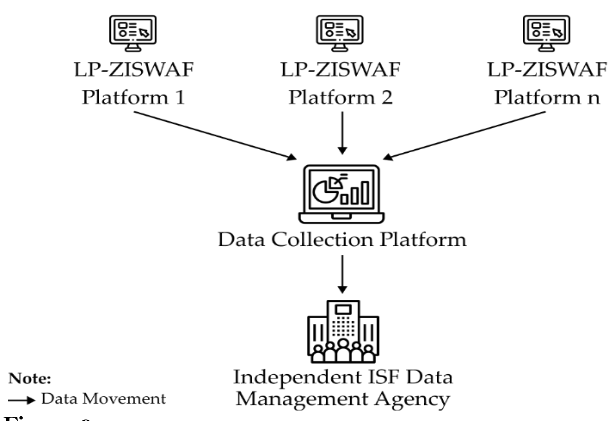

Figure 9.
ISF data distribution scheme.
Source: Modified from Gleason [141].

The data collection platform above can be developed by employing cloud computing services, namely Software as a Service (SaaS). Eightwire is a company with a SaaS product that provides efficient and secure data sharing services. They have built a digital data sharing platform to streamline data exchange between the New Zealand government and non-governmental organizations [141].

5. Conclusion

Through the ANP-BOCR analysis, cloud computing emerges as the most optimal technology for ISF digitalization when considering only benefits and costs. However, in a comprehensive assessment that includes benefits, opportunities, costs, and risks, digital platform is the most optimal technology for both the short and long term. These results are supported by the BOCR analysis. Meta-analysis further confirms that the use of digital platform has an impact on fundraising and donation performance. The adoption of digital platform and cloud computing technology demands substantial expenditures for internet network development in remote areas. These two technologies also pose risks that need to be mitigated, such as unstable internet connection, cyberattacks, and the misuse of customers' personal data.

As each technology has different advantages and disadvantages, this study builds an alternative model to optimize the implementation of ISF digitalization in Indonesia, by leveraging multiple technologies, including blockchain, AI, cloud computing, big data, and digital platform. Regarding the costs to implement the proposed ISF digitalization model, it includes technology such as blockchain and AI that require high initial investment costs, particularly for digital infrastructures, legal frameworks, and human resources development. Thus, collaborative efforts between the Indonesian government with other interested stakeholders could help in distributing the costs and risks related to these technologies. Establishment of an adequate legal frameworks is also crucial. At present, there are minimal regulations in place that oversee the use of blockchain technology for fundraising through means such as an ICO [71].

To accomplish the realization of national ISF data integration, there will be a digital data collection platform to facilitate data sharing among LP-ZISWAFs and an independent ISF data management agency. Establishing such institution necessitates a well-defined plan. Last but not least, education and training about technology usage must be provided for human resources within LP-ZISWAF.

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Appendix

Note for Table 6:
B1 = Increase collection of funds, donors, and beneficiaries
B2 = Increase management transparency
B3 = Increase management professionalism
B4 = Promoting ISF inclusion
O1 = Largest Muslim population in the world
O2 = High level of generosity and solidarity
O3 = Many ISF assets are not managed optimally
O4 = Rising trend of internet usage
C1 = Inadequate legal framework
C2 = High digital infrastructure development cost
C3 = High human resource development cost
C4 = High internet network development cost in remote areas
R1 = Unstable internet connection
R2 = Cyberattack
R3 = Periodic power outages
R4 = Misuse of customers' personal data

Table 6.
BOCR analysis of each technology for ISF digitalization

Technology	BOCR	Description	Score
AI	B1	AI technology has the capability to perform predictive analysis on large amounts of data with high accuracy [142]. Predictive analysis is useful to identify donors' preferences and motivations for donating, analyze marketing strategies that suit each donor's personality, and to indetify the needs of beneficiaries [143] to design appropriate ISF fund distribution programs.	+1
	B2	AI's applications in the financial sector are generally divided into data analytics, natural language processing (NLP) for understanding human language, image recognition, and anomaly detection [57]. Thus, the benefits of AI point towards enhancing the efficiency of a process typically carried out by humans. Transparency using AI can be achieved through utilizing the predictive analysis capability, which will then be reported. However, it needs a platform to publicize the report.	+0.5
	B3	Automation offered by the use of AI technology [57] is highly advantageous to save time and resources in ISF management. AI is also able to prevent issues that arise from human errors and fatigue [143].	+1
	B4	AI can identify the needs of beneficiaries [143], enabling ISF institutions to create suitable programs for the unbanked. By leveraging the natural language processing abilities of AI, it eliminates the need for in-person visits (Mhlanga, 2020). Hence, extending service reach and reducing operational costs [144], which allow more of the funds raised to be used for beneficiaries.	+1

	O1	Being a country with the world's largest Muslim population [145], Indonesia has the potential for zakat and cash waqf collection of USD 26.1 billion and USD 12.6 million, respectively [27], [28]. This potential can be greatly enhanced through the utilization of technology such as blockchain, AI, big data, and digital platform [146].	+1
	O2	Indonesia is considered a country with the world's highest level of generosity, as assessed by the World Giving Index (WGI) released by the Charities Aid Foundation [147]. ISF not only has the potential to empower the economy but also strengthen social solidarity [148]. The high level of generosity and solidarity will be a catalyst for donating and encouraging peers to donate as well [149].	+1
	O3	AI can improve the underutilized ISF assets by tailoring marketing efforts according to each donor's preference [143]. This approach will attract individuals to make donations through authorized ISF institutions.	+1
	O4	The use of the internet will improve donation collection and fundraising, as it enables online transactions [115], and makes information distribution broader and easily accessible [114]. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Thus, the growth of internet users is an opportunity that can support the implementation of these technologies in ISF management.	+1
	C1	AI has no legal regulations concerning its usage in Indonesia [60]. Several challenges in formulating legal frameworks for AI include addressing accountability for AI-induced losses or biases, data security, and ensuring that AI is utilized correctly and responsibly [151].	-1
	C2	The costs associated with digital infrastructure development for operating large-scale AI systems are high, especially if resources are limited [143], as AI implementation demands significant computing power [63].	-1
	C3	To adopt AI technology, there is costs for recruiting human resources skilled in data science to ensure the operational aspects of AI are maintained efficiently [143].	-1
	C4	The connectivity of internet networks to provide digital financial services is a challenge for countries with vast territories, particularly archipelagic nations [62] like Indonesia. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Hence, in order for these technologies to be accessible to people in remote areas, a significant investment is needed to develop internet networks.	-1
	R1	Without an internet connection, users won't be able to utilize AI-based systems [143].	-1
	R2	The use of AI technology has the potential to autonomously	-1

		launch attacks on vulnerable systems, directly affecting data confidentiality [26]. Cyberattacks on AI technology can occur at both the data storage and data processing levels, such as input attacks involving input manipulation to alter outputs, and poisoning attacks that undermine the AI system, affecting learned data, algorithms, or models [63].	
	R3	Periodic power outages can have negative impacts on IT devices, such as disrupting server performance, causing data loss, and damaging computer components [152]. AI technology needs sufficient data storage [86], [153] using IT devices. Data processing tasks such as data analysis also require efficient computing resources [154], making power outages potentially disruptive to computational performance.	-1
	R4	AI learns private user data for analysis. Proper data protection procedures must be implemented to mitigate risks to user privacy data security [143].	-0.75
Blockchain	B1	Blockchain technology allows all donation transactions to be tracked [139], enabling donors to be aware of how their funds are utilized. This will increase donors' trust and subsequently, boost the number of donations, which will help more beneficiaries.	+1
	B2	The characteristics of blockchain enable transaction records to be unalterable by anyone [64], making it a superior technology for enhancing ISF management transparency.	+1
	B3	The time-consuming manual verification process of proposal submissions in social financial institutions [155] can be shortened through the use of smart contracts, thus enhancing management efficiency [63] and reducing uncertainty or *gharar* in transactions, as transactions can only occur when certain conditions are fulfilled [73].	+1
	B4	Blockchain enables money transactions without intermediaries, such as banks [149]. This can save time and reduce operational costs, making financial services more affordable [156]. Issues in financial inclusion caused by geographical factors can also be addressed using blockchain technology, which is accessible online [119].	+1
	O1	Being a country with the world's largest Muslim population [145], Indonesia has the potential for zakat and cash waqf collection of USD 26.1 billion and USD 12.6 million, respectively [27], [28]. This potential can be greatly enhanced through the utilization of technology such as blockchain, AI, big data, and digital platform [146].	+1
	O2	Indonesia is considered a country with the world's highest level of generosity, as assessed by the World Giving Index (WGI) released by the Charities Aid Foundation [147]. ISF not only has the potential to empower the economy but also strengthen social solidarity [148]. The high level of generosity and	+1

		solidarity will be a catalyst for donating and encouraging peers to donate as well [149].	
	O3	Blockchain allows all transactions to be traceable [139] by *munfiq*, *muzakki*, and *waqif*. This can enhance the professionalism of ISF institutions in managing assets.	+1
	O4	The use of the internet will improve donation collection and fundraising, as it enables online transactions [115], and makes information distribution broader and easily accessible [114]. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Thus, the growth of internet users is an opportunity that can support the implementation of these technologies in ISF management.	+1
	C1	One application of blockchain technology is digital currency products, which serve as transaction tools within the blockchain system [66]. Regulations concerning digital currencies in Indonesia currently only address their prohibition as payment instruments and their permission to be traded as commodities. Many rules are yet to be determined, for instance, activities involving fundraising with crypto assets, such as Initial Coin Offerings (ICO), Security Token Offerings (STO), and Initial Exchange Offerings (IEO) [71].	-0.75
	C2	There are two costs if ISF adopts blockchain technology, namely operational costs for network and data storage expenses and electricity costs for continuous mining to validate transactions, computers used for mining must also be of high specification[63], [73]. The transition of financial systems from the current infrastructure to a new blockchain infrastructure also incurs costs, as financial institutions have undoubtedly invested significant funds in the current infrastructure [72].	-1
	C3	If a financial institution intends to implement blockchain technology, it needs a substantial investment in human resources to hire experts. As a reference, the annual income of blockchain developers in the United States in 2019 was approximately $126,000 [157].	-1
	C4	The connectivity of internet networks to provide digital financial services is a challenge for countries with vast territories, particularly archipelagic nations [62] like Indonesia. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Hence, in order for these technologies to be accessible to people in remote areas, a significant investment is needed to develop internet networks.	-1
	R1	In blockchain technology, the time required to execute a request varies depending on the internet connection and the speed at which the machine responds to the request [150].	-1
	R2	Cyberattacks such as data deletion are highly unlikely in	0

		decentralized systems like blockchain [68], as each node in the network holds a copy of the ledger and attackers would need to target every node in the network [63].	
	R3	One of the factors leading to power outages is the rise in electricity consumption and disruptions in energy supply, resulting in the complete interruption of power in a particular area [158]. Mining activities in blockchain implementation require significant electricity consumption, hence demanding electrical stability, which involves maintaining a balance between electricity consumption and supply (Ullrich et al., 2018).	-1
	R4	The data risks associated with using blockchain technology stem from the type of blockchain utilized. In a public blockchain, there's a risk of data privacy violations since everyone has equal rights to participate in the network. In a private blockchain, data privacy is ensured due to access restrictions and unequal participant roles. Meanwhile, consortium blockchain combines features of both public and private blockchain [63].	-0.5
Cloud Computing	B1	Cloud computing is a scalable service that allows data to be stored, processed, and shared over the internet [79], enabling customers to easily access information online [78]. Therefore, cloud computing technology is able to increase the effectiveness and scalability of ISF management, resulting in increased donors' trust and donation number, ultimately benefiting more beneficiaries.	+1
	B2	The computational resource distribution using cloud computing allows stakeholders to share information efficiently, promptly, and transparently [120]. However, there is a risk of information manipulation in data shared through cloud computing services [159].	+0.75
	B3	The implementation of cloud computing enables ISF institutions to centrally manage databases [139], which include data about donors, donations, donation distribution, and so on. This can enhance the efficiency of the management system, thereby reducing operational costs, which ultimately impacts the sustainability of institutions' management [39]. However, when compared to blockchain technology, which allows for more automation of operational activities through smart contracts, the operational efficiency offered by cloud computing for ISF is not as optimal.	+0.75
	B4	The characteristics of cloud computing that provide flexible, affordable, and scalable on-demand services [62] facilitate ISF institutions to easily implement digitalization and broaden their services due to its online accessibility.	+1
	O1	Being a country with the world's largest Muslim population [145], Indonesia has the potential for zakat and cash waqf	+1

		collection of USD 26.1 billion and USD 12.6 million, respectively [27], [28]. This potential can be greatly enhanced through the utilization of technology such as blockchain, AI, big data, and digital platform [146].	
	O2	Indonesia is considered a country with the world's highest level of generosity, as assessed by the World Giving Index (WGI) released by the Charities Aid Foundation [147]. ISF not only has the potential to empower the economy but also strengthen social solidarity [148]. The high level of generosity and solidarity will be a catalyst for donating and encouraging peers to donate as well [149].	+1
	O3	The significant potential of underutilized ISF assets can be supported by leveraging cloud computing technology for online data storage [139]. Cloud computing also allows users to access a program without the need for installation, thereby increasing efficiency and practicality [160] in ISF management.	+1
	O4	The use of the internet will improve donation collection and fundraising, as it enables online transactions [115], and makes information distribution broader and easily accessible [114]. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Thus, the growth of internet users is an opportunity that can support the implementation of these technologies in ISF management.	+1
	C1	Cloud computing is regulated in the Regulation of the Minister of Communication and Information Technology Number 5 of 2020. This regulation encompasses definitions, providers, provider responsibilities, as well as administrative penalties for providers who fail to grant access to law enforcement agencies or maintain an audit trail record.	0
	C2	Cloud computing comes with low infrastructure development costs [121].	-0.25
	C3	Cloud computing offers the ease of utilizing its services [122], making it sufficient to provide initial training for ISF institution employees on how to operate these cloud computing services. However, if the utilized cloud computing services still demand skilled personnel for application or website maintenance, additional costs will be necessary.	-0.5
	C4	The connectivity of internet networks to provide digital financial services is a challenge for countries with vast territories, particularly archipelagic nations [62] like Indonesia. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Hence, in order for these technologies to be accessible to people in remote areas, a significant investment is needed to develop internet networks.	-1
	R1	Cloud computing technology is able to store data that can be	-1

		accessed over the internet (Wang et al., 2016). Thus, it relies heavily on an internet connection to access its services [134].	
	R2	Cloud computing service providers are responsible for maintaining the security of the cloud, its infrastructure, and operational performance, while service users are responsible for safeguarding the security of their content, applications, systems, and networks [62]. This division of responsibilities helps protect the cloud system from cyberattacks. For instance, if a cloud service user employs a browser with low security measures, there's a potential risk of account hijacking [122].	-1
	R3	The implementation of cloud computing technology can be indirectly affected by power outages. Power outages can impact the data centers owned by cloud computing service providers, as these data centers rely on electrical power for their operations [132].	-1
	R4	Data misuse can occur when data stored in cloud computing experience leakage due to a lack of authentication and authorization mechanisms. Authentication involves identifying users entering the cloud environment, while authorization controls the level of data access for each authenticated user [122]. Companies aiming to adopt cloud computing technology should select service providers with robust security systems [134].	-0.75
Big Data	B1	Big data can be used for descriptive, predictive, or prescriptive analysis [40]. Based on these analyses, ISF institutions can adjust their strategies to increase donors and donations, thereby enhancing the support provided for their beneficiaries.	+1
	B2	Utilization of big data enables the integration of reports regarding the activities of ISF institutions [161]. This enables donors to monitor the collection and distribution of ISF funds as well as the effectiveness of programs. However, a platform is necessary to disseminate these reports.	+0.5
	B3	The examination of big data can generate accurate information that is useful for corporate decision-making [78], identifying potential risks, and obtaining effective solutions to problems. The utilization of big data technology is also cost-efficient [162]. However, when compared to blockchain technology, which enables more operational activities to be automated through smart contracts, the benefits offered by big data for ISF are not yet fully optimized.	+0.75
	B4	Big data has the potential to enhance the inclusivity of ISF services through data analysis [78]. This involves identifying areas where beneficiaries have yet to receive assistance, as well as determining the forms of aid that can be provided [143].	+1
	O1	Being a country with the world's largest Muslim population [145], Indonesia has the potential for zakat and cash waqf collection of USD 26.1 billion and USD 12.6 million,	+1

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		respectively [27], [28]. This potential can be greatly enhanced through the utilization of technology such as blockchain, AI, big data, and digital platform [146].	
	O2	Indonesia is considered a country with the world's highest level of generosity, as assessed by the World Giving Index (WGI) released by the Charities Aid Foundation [147]. ISF not only has the potential to empower the economy but also strengthen social solidarity [148]. The high level of generosity and solidarity will be a catalyst for donating and encouraging peers to donate as well [149].	+1
	O3	Through the utilization of big data, it becomes feasible to perform descriptive, predictive, and prescriptive analyses [40]. This data allows for the measurement of how effectively ISF assets are managed, leading to more precise strategic decision-making.	+1
	O4	The use of the internet will improve donation collection and fundraising, as it enables online transactions [115], and makes information distribution broader and easily accessible [114]. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Thus, the growth of internet users is an opportunity that can support the implementation of these technologies in ISF management.	+1
	C1	Big data is a collection of very large amount of data, encompassing both structured and unstructured forms [83], which carries the risk of being misused. Thus, regulations are needed to oversee its implementation. In Indonesia, regulations concerning data and its protection are outlined in Government Regulation of the Republic of Indonesia Number 71 of 2019 regarding the activities of Electronic System Operators (ESOs) [163], Law Number 27 of 2022 regarding personal data protection [164], and Law Number 11 of 2008 regarding information and electronic transactions [165].	0
	C2	A well-equipped infrastructure is essential for collecting, processing, and storing vast amount of data [86], [153]. By employing cloud computing services, the costs of storing big data can become more affordable [166].	-0.75
	C3	Optimizing big data technology requires experts to process and analyze the big data to yield valuable insights [87].	-1
	C4	The connectivity of internet networks to provide digital financial services is a challenge for countries with vast territories, particularly archipelagic nations [62] like Indonesia. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Hence, in order for these technologies to be accessible to people in remote areas, a significant investment is needed to develop internet networks.	-1
	R1	The collection and transmission of big data can be conducted	-1

		when an internet connection is available [85].	
	R2	Big data is a compilation of extensive and diverse information, including sensitive data that is stored on third-party servers due to security concerns, which raises the risk of cyberattacks [167]. Thus, the cybersecurity risks associated with big data are not inherently linked to the use of big data technology itself but to the use of third parties to store the data.	-0.25
	R3	Periodic power outages can have negative effects on information technology devices, including disruptions in server performance, data loss, and damage to computer components [152]. The adoption of big data technology brings about the necessity for sufficient data storage [86], [153] using information technology devices. Data processing tasks like data analysis also require efficient computation resources [154], making power outages potentially disruptive to computational performance.	-1
	R4	Integrating data from all ISF institutions raises the risk of data misuse. Therefore, it's crucial to understand how data is acquired, whether it's stored in the cloud, locally, or via third-party server services, and ways to ensure data confidentiality [168].	-0.75
QR Code	B1	One of the applications of QR codes in ISF is to link to the destination account during payments, simplifying the process for donors. This can enhance the donation collection, as demonstrated in the study by Tagoranao, et al. [90]. As the total donation amount grows, the number of beneficiaries receiving the distribution of these donations also increases.	+1
	B2	By scanning a QR code containing the account number of the ISF institution, donors can access information about the destination of their donation transfer [90]. The transparency provided by the QR code is limited to the specifics of the donation destination and does not encompass the overall transparency of ISF activities.	+0.25
	B3	The efficiency of employing QR codes is evident in the convenience of accessing the stored data within them [88]. This data can encompass details of donation payment information [90] or information about the beneficiaries [169]. Spreading QR codes containing payment details eliminates the need for extensive human involvement in fundraising efforts. Likewise, generating beneficiary QR cards can enhance administrative efficiency. However, in comparison to five other alternative technologies, the operational efficiency provided by QR codes for ISF is not yet fully optimized.	+0.25
	B4	The key to improving financial inclusion lies in the digitization of payment processes [62]. One form of payment digitization in Indonesia is through the use of the Quick Response Code Indonesian Standard (QRIS) , which enables the elimination of	+1

		transaction fees, thus sparing individuals from incurring costs when making payments [170].	
	O1	Being a country with the world's largest Muslim population [145], Indonesia has the potential for zakat and cash waqf collection of USD 26.1 billion and USD 12.6 million, respectively [27], [28]. This potential can be greatly enhanced through the utilization of technology such as blockchain, AI, big data, and digital platform [146].	+1
	O2	Indonesia is considered a country with the world's highest level of generosity, as assessed by the World Giving Index (WGI) released by the Charities Aid Foundation [147]. ISF not only has the potential to empower the economy but also strengthen social solidarity [148]. The high level of generosity and solidarity will be a catalyst for donating and encouraging peers to donate as well [149].	+1
	O3	QR codes only serves to simplify the process of ISF fund payments [90]. In other words, the QR code doesn't truly support the significant potential of unoptimized ISF assets.	+0.25
	O4	The use of the internet will improve donation collection and fundraising, as it enables online transactions [115], and makes information distribution broader and easily accessible [114]. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Thus, the growth of internet users is an opportunity that can support the implementation of these technologies in ISF management.	+1
	C1	The utilization of QR codes in Indonesia is regulated by Board of Governors regulation number 21/18/PADG/2019 on implementing the National Quick Response Code Standard for Payments [171].	0
	C2	The implementation of QR codes doesn't come with hefty infrastructure costs. QR codes only require a smartphone to process data transmissions, consuming minimal electricity [172]. Utilizing QR codes for purposes other than payment transactions can be easily generated at no cost through online platforms [92].	0
	C3	The adoption of QR codes in ISF institutions doesn't require specialized experts to generate these codes [92]. In Indonesia, the majority of the population already owns or is familiar with mobile phones, reaching 72.41 percent in urban areas and 57.24 percent in rural areas [123].	0
	C4	The connectivity of internet networks to provide digital financial services is a challenge for countries with vast territories, particularly archipelagic nations [62] like Indonesia. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Hence, in order for these technologies to be accessible to people in remote areas, a significant investment is needed to develop internet	-1

		networks.	
	R1	QR codes cannot be used to transfer data without an internet connection [91].	-1
	R2	The data within QR codes can lead to malicious websites, and there's a risk of QR code forgery [173]. For instance, a case in Indonesia involved the substitution of a mosque's QR code with a counterfeit one claiming to be for mosque restoration, however it wasn't registered as a place of worship or a social donation [174].	-1
	R3	QR codes require a scanner, such as a smartphone, to encode the data within [88]. A smartphone is dependent on rechargeable battery power, meaning it requires a source of electricity to recharge its battery.	-1
	R4	The misuse of customer privacy data can occur with QR codes containing personal information, such as beneficiary personal information [169]. This personal data must be secured by allowing only authorized parties to extract the confidential information from the QR code [175].	-1
Digital Platform	B1	Digital platforms enable users to access various types of programs within a single platform at any time and from anywhere [38]. This ease of access will enhance donor interest in contributing to the LP-ZISWAF, thus enabling a greater number of beneficiaries to benefit from the donations.	+1
	B2	Operational transparency on crowdfunding digital platforms involves providing campaign outcome reports to donors, while conventional transparency ensures that a campaign conducted on the platform is directed to a certified institution [176]. However, it's important to note that the reports uploaded on the platform also have the risk of being manipulated [159].	+0.75
	B3	A digital platform can be defined as a technology that connects stakeholders on a single platform [93], enabling the rapid transmission and exchange of information or data to all parties while reducing coordination costs [38]. However, when compared to blockchain technology, which allows for more operational activities through smart contracts, the operational efficiency offered by digital platforms for ISF is still not optimal.	+0.75
	B4	Digital platforms can enhance the inclusivity of ISF services by reaching beneficiaries in various locations [119]. ISF can also leverage digital platforms, such as social media, for marketing and providing education to communities with lower levels of digital literacy [35].	+1
	O1	Being a country with the world's largest Muslim population [145], Indonesia has the potential for zakat and cash waqf collection of USD 26.1 billion and USD 12.6 million, respectively [27], [28]. This potential can be greatly enhanced through the utilization of technology such as blockchain, AI, big data, and digital platform [146].	+1

	O2	Indonesia is considered a country with the world's highest level of generosity, as assessed by the World Giving Index (WGI) released by the Charities Aid Foundation [147]. ISF not only has the potential to empower the economy but also strengthen social solidarity [148]. The high level of generosity and solidarity will be a catalyst for donating and encouraging peers to donate as well [149].	+1
	O3	Digital platform can optimize the management of underutilized ISF assets, as they enable all stakeholders to connect within a single platform [93] and access it anytime and from anywhere [38].	+1
	O4	The use of the internet will improve donation collection and fundraising, as it enables online transactions [115], and makes information distribution broader and easily accessible [114]. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Thus, the growth of internet users is an opportunity that can support the implementation of these technologies in ISF management.	+1
	C1	Digital platform is regulated by the Regulation of the Minister of Communication and Information Technology Number 5 of 2020 [74] and Government Regulation of the Republic of Indonesia Number 71 of 2019 [163].	0
	C2	Digital platforms can leverage cloud computing services such as Platform as a Service (PaaS), which offers a platform or environment that allows developers to build, test, deploy, and manage applications [80] using pre-existing software components without the need for substantial expenses to purchase software licenses, infrastructure, and other resources [81]. Cloud computing services have low infrastructure development costs with significant digitization impacts [121].	-0.25
	C3	ISF institutions can either create their own platform, incurring high costs to pay for experts, or utilize cloud computing services like Platform as a Service offered by major IT companies at a lower expense [39]. On the other hand, the development costs of ISF human resources in Indonesia to use digital platforms are low, as the majority of the Indonesian population already owns or is proficient in using mobile phones [123].	-0.5
	C4	The connectivity of internet networks to provide digital financial services is a challenge for countries with vast territories, particularly archipelagic nations [62] like Indonesia. All technologies examined in this study require the internet to operate [85], [91], [130], [134], [143], [150]. Hence, in order for these technologies to be accessible to people in remote areas, a significant investment is needed to develop internet networks.	-1
	R1	A working internet connection is essential for the functioning	-1

		of digital platforms [130]. The loss of internet connectivity is a common risk for companies using digital platforms [133].	
	R2	An example of a cyberattack on a digital platform involves unauthorized access to accounts on that platform, aiming to illicitly acquire confidential information without the owner's permission [131].	-1
	R3	A digital platform is made up of software and hardware components that integrate various heterogeneous technologies to achieve the desired objectives of establishing the platform [177]. The hardware utilized for the operation of the digital platform demands electrical power. As a result, a power outage can have a substantial impact on the implementation of digital platform technology. Bartczak [133] found that hardware disruptions are a frequent risk for companies utilizing digital platforms.	-1
	R4	Despite the proliferation of digital platforms and the evolution of their security measures [178], ensuring data privacy continues to be a matter of concern in the development of digital platforms. Iwaya, et al. [135] analyzed 27 digital platforms and uncovered data privacy concerns, including personal data leaks in logs and web requests. Moreover, data sharing with third parties increases the potential misuse of customers' personal data.	-0.75