

Lecture Notes on Data Engineering  
and Communications Technologies 161



Leonard Barolli *Editor*

# Advances in Internet, Data & Web Technologies

The 11th International Conference  
on Emerging Internet, Data & Web  
Technologies (EIDWT-2023)

 Springer

# **Lecture Notes on Data Engineering and Communications Technologies**

**161**

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The aim of the book series is to present cutting edge engineering approaches to data technologies and communications. It will publish latest advances on the engineering task of building and deploying distributed, scalable and reliable data infrastructures and communication systems.

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Leonard Barolli  
Editor

# Advances in Internet, Data & Web Technologies

The 11th International Conference on Emerging  
Internet, Data & Web Technologies  
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*Editor*

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ISSN 2367-4512                      ISSN 2367-4520 (electronic)  
Lecture Notes on Data Engineering and Communications Technologies  
ISBN 978-3-031-26280-7              ISBN 978-3-031-26281-4 (eBook)  
<https://doi.org/10.1007/978-3-031-26281-4>

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# **Welcome Message of EIDWT-2023 International Conference Organizers**

Welcome to the 11th International Conference on Emerging Internet, Data and Web Technologies (EIDWT-2023), which will be held from February 23 to February 25, 2023.

The EIDWT is dedicated to the dissemination of original contributions that are related to the theories, practices and concepts of emerging Internet and data technologies yet most importantly of their applicability in business and academia toward a collective intelligence approach.

In EIDWT-2023, topics related to Information Networking, Data Centers, Data Grids, Clouds, Crowds, Mashups, Social Networks, Security Issues and other Web implementations toward a collaborative and collective intelligence approach leading to advancements of virtual organizations and their user communities will be discussed. This is because Web implementations will store and continuously produce a vast amount of data, which if combined and analyzed through a collective intelligence manner will make a difference in the organizational settings and their user communities. Thus, the scope of EIDWT-2023 includes methods and practices which bring various emerging Internet and data technologies together to capture, integrate, analyze, mine, annotate and visualize data in a meaningful and collaborative manner. Finally, EIDWT-2023 aims to provide a forum for original discussion and prompt future directions in the area.

An international conference requires the support and help of many people. A lot of people have helped and worked hard for a successful EIDWT-2023 technical program and conference proceedings. First, we would like to thank all authors for submitting their papers. We are indebted to Program Area Chairs, Program Committee Members and Reviewers who carried out the most difficult work of carefully evaluating the submitted papers. We would like to give our special thanks to Honorary Chair of EIDWT-2023 Prof. Makoto Takizawa, Hosei University, Japan, for his guidance and support. We would like to express our appreciation to our Keynote Speakers for accepting our invitation and delivering very interesting keynotes at the conference.

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# **EIDWT-2023 Keynote Talks**

# Fueling the Data Engine to Boost the Power of Analytics

Wenny Rahayu

La Trobe University, Melbourne, Australia

**Abstract.** Data analytics is often considered in isolation. The attractiveness of the problems that need to be solved, the sophistication of the solutions, and the usefulness of the results are certainly the significant strengths of work on data analytics. However, the input data is often too simplistic, or at least the assumption that the data is already readily prepared for data analytics often neglects the fact that preparing such an input data is in many cases, if not all, actually the major work in the data life cycle. The pipeline from the operational databases that keep the transactions and raw data to the input data for data analytics is very long; it often occupies as much as 80% (or sometimes even more) of the entire life cycle. Therefore, we need to put much effort to this preparation and transformation work in order to value the work and the results produced by data analytics algorithms. Having the correct input data for the data analytics algorithms, or in fact for any algorithms and processes, is critical, as the famous quote “garbage in garbage out” had said. Even when the original data is correct, but when it is presented inaccurately to a data analytics algorithm, it may consequently produce incorrect reasoning. This talk will present a systematic approach to build a data engine for effective analytics.

# Impact of Uncertainty Analysis and Feature Selection on Data Science

Ricardo Rodriguez Jorge

Jan Evangelista Purkyně University, Ústí nad Labem, Czech Republic

**Abstract.** Data science applications usually need a previous preprocessing stage for feature extraction and data validation. The data needs to be preprocessed and analyzed to minimize the dataset while preserving variance and patterns in order to find the optimal feature vector configuration. The feature selection algorithm allows finding the feature vector configuration to ensure minimal uncertainty in mapping the corresponding outputs and feature vectors. In data science, feature vector designs can be performed by different techniques and the validation can be performed by uncertainty analysis. These considerations are timely because wearable devices are increasingly being used on a large scale in different scientific fields. This talk will contribute to recommendations for the use of signals and data as a means of informing the impact of different uncertainty analysis and feature selection methods for data science applications. Using this new knowledge together with machine learning, data science applications can be evaluated with more confidence.

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# Zakat Management Model Based on ICT

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**Abstract.** The study of the role of technology to support is very important and attracted many types of research. However, their approach is still partially and less comprehensive which does not involve important variables such as credibility, transparency, accountability, and trust as the main values. Therefore, this study aims to design a model of *Zakat* development backed up by ICT which combines various elements of *Zakat* management in order to make it more comprehensive. This study seeks to design a conceptual model of ICT-based *Zakat* management that involves 350 respondents in three areas of Indonesia which involve *Zakat* Management Units (UPZ), Muslim scholars, academics, activists of *Zakat*, *Muzakki*, and selected *Mustahiq*. By involving these stakeholders, a comprehensive model is expected to achieve. The results of this research showed that of the five important factors in *Zakat* management to boost the *Zakat* volume ICT is the most factor. Followed by trust, credibility, transparency, and accountability. From the five variables, 21 indicators were gained, of which with further IDC (intelligence, Design, and Choice) modeling design method resulted from a conceptual *Zakat* model based on ICT. Based on the interview results Blockchain technology is the most appropriate means to support *Zakat* management in order to meet the *Zakat* requirement, besides that Fintech, IoT, and AI are also important to support *Zakat* Management. Further research is needed to detail the design of the Blockchain model implemented in *Zakat* management.

**Keywords:** *Zakat* management · Trust · Credibility · Transparency · Accountability · ICT

## 1 Introduction

Indonesia has a great number of Muslim populations. The strengthening economics for *Ummah* through *Zakat*, therefore, has a promising potential to be developed [1] According to [2] *Zakat* has been proven to make a large number of contributions in advancing the life of Muslim [2] Alongside with [2, 3] indicated that if Islamic Finance instruments (includes *Waqaf* and *Zakat*) can be managed properly and seriously it is possible for Muslim countries to reduce drastically their foreign debt as *Zakat* funds can be mobilized to build some infrastructures.

Some researchers, however, indicate that the collection of *Zakat* fund in Indonesia has been far from the target [4]. Regarding with this, the president of Indonesia stated

that the large *Zakat* potential in Indonesia must be optimized, from the potential of IDR. 252 trillion (USD 17,25 Billion), it was just collected in IDR. 8.1 trillion (USD 620 million) by BAZNAS, the Indonesia *Zakat* National Agency (*Badan Amil Zakat Nasional*/BAZNAS). Due to that situation, some significant efforts are needed to upgrade the revenue of *Zakat* in Indonesia [5].

Several studies indicate that the low collection of *Zakat* in Indonesia is caused by one important factor that the *Zakat* management system is not yet modern and the demands for *Zakat* payer have not been accommodated. Several studies have been carried out, especially those related to the importance of increasing the management and professionalism of *Zakat* institutions, for example [6, 7] who claimed that high public trust in *Zakat* institutions can increase the volume of *Zakat*. Whilst, [8] explains that public trust in *Zakat* institutions can be increased by boosting the credibility of *Zakat* institutions through transparent reporting of *Zakat* management. This indicates that there are still flaws in current *Zakat* management as in line with the findings of [9] research where *Zakat* institutions need to develop good *amil* governance so that people consider *Zakat* management institutions to be credible and professional.

The collection of *Zakat* has been regulated by some Acts and Regulations in Indonesia to promote people and agencies to pay, collect, and distribute *Zakat*. It is important because *Zakat* are undertaken by the respective religious authorities according to Shariah requirements. According to several research papers, however, there are still several challenges such as inefficiency, a lack of transparency in how the funds are collected, managed and distributed. According to [10] these factors are the main causes which make *Zakat* cannot work properly and efficiently.

Alongside with that, some study found that the *Zakat* management is consistent with the current technology development. It is believed that the application of the technology on the *Zakat* management include monitoring, reporting, and evaluating. Technology can strengthen the management system, thus provide better management of *Zakat* ([11] Another study conducted by [12] concluded that the detailed and transparent movement of *Zakat*, from the moment of collection to the point of disbursement could soon be tracked via *Zakat tech*. Then it can be concluded that *Zakat tech* based on sophisticated and modern technology would enable the tracking of funds throughout the whole process of *Zakat*. Furthermore, in the disruption Technology Era 4.0, Indonesia *Zakat* National Agency (*Badan Amil Zakat Nasional*/BAZNAS) as Indonesian *Zakat* authorized agency has developed a collecting *Zakat* online in web [www.baznas.go.id](http://www.baznas.go.id).

Nevertheless, some weaknesses of the applied technology of *Zakat* are still partial and not yet integrated with inherent factor in the *Zakat* institution agency. From the description above, it can be said that the technological factors that can guarantee the efficiency of collection, distribution and reporting of *Zakat* are very important in the effort to increase the revenue of *Zakat* in Indonesia. In addition, from the demand perspective of *Zakat* payer, *Zakat* management institutions want to improve *Zakat* management to be efficient, open, and accountable. Thus, accountability, transparency, and trust turn out to be very important factors to be built along with the collecting *Zakat* technology factor. Hence, this paper seeks to answer the current issues by proposing an integrated ICT-based *Zakat* management design.

## 2 Literary Review

### 2.1 Potential of Zakat

Indonesia has a large potential of *Zakat* because Indonesia is the biggest Islamic country in the world with 250 million people as a Muslim community. The realization of *Zakat*, however, is still little as amounted as 3.5% [4, 13, 14]. The big gap is basically due to various factors such as supply and demand. The supply factors include, for example, supportive government regulations, trust in *Zakat* management institutions, and the role of scholars in teaching the society about contemporary *Zakat* obligations and explaining what types of incomes are obliged to be paid for its *Zakat* is growing [15, 16].

Meanwhile, the demand factors come from trust, willingness, and awareness in the law of Muslim obligations in paying taxes. The awareness of people's preferences in paying *Zakat* is influenced by several factors, including the ease of paying *Zakat*, public trust in *Zakat* management institutions, and other factors such as the credibility and accountability of *Zakat* management institutions. Besides, the factors of the revenue report transparency and the distribution of *Zakat* are also important.

Several previous studies show that these factors have not been optimized. The study of [15] for example, shows that there is still a lack of public understanding in *Zakat* awareness. *Zakat* has not become a special subject in Islamic educational institutions (universities) as an integrated curriculum. This is what according to [2] and [16] is that *Zakat* has not been understood as a tool to develop civilization. However, there are many *Zakat* institutions in every region in Indonesia. The shariah/*da'wah* for *Zakat* is carried out intensively by *Zakat* institutions. The socialization is carried out by understanding the importance of *Zakat* and the urgency of the obligation to pay *Zakat*. Besides, the introduction of *Zakat* institutions and how to calculate and pay *Zakat* are also given. In addition, there are many *Zakat* institutions which have implemented various innovations related to *Zakat* collection and management strategies. Traditional and conventional methods are being upgraded to be more modern, innovative and expansive. The *Zakat* collection strategy carried out by institutions is usually by visiting *Muzakki* door to door, serving *Muzakki* through service offices, or opening outlets or stands in public places.

Furthermore, *Zakat* service institutions have improved online *Zakat* transaction services through mobile applications or net banking. This institution also create collaboration with marketplaces such as bukalapak.com, as well as create online websites for social or crowdfunding fundraising. This strategy is expected to increase *Zakat* donations and bring *Zakat* institutions closer to the community. This model is in accordance with the millennial generation who is projected to be a new market for *Zakat* movement [9].

The strategy for increasing the volume of *Zakat* donations, therefore, is necessary to upgrade some factors from the demand side such as the role of technology which makes *Zakat* efficient and makes it easier for *Zakat* payers to make *Zakat* donation transactions either way through internet technology such as mobile banking or other forms. In addition, it is also important to improve *Zakat* management from the *Zakat* institution perspective, such as trust of *Zakat* institutions, transparency in *Zakat* management, accountability, and credibility of *Zakat* institutions. The combination with governance of *Zakat* institution and technological aspect is very crucial to be developed.

## 2.2 Information Communication Technology (ICT)

Information and Communication Technology is a term that covers all technical equipment for processing and conveying information. ICT consists of two aspects, namely information technology and communication technology. Information technology includes everything related to the process, use as a tool, manipulation, and management of information. Information technology is the study or use of electronic equipment, especially computers to store, analyze, and distribute any kind of information, including words, numbers, and pictures [17].

Moreover, ICT can be divided into information technology and communication technology. Information technology is used to process information. Communication technology is used to transfer information from source to receiver. According to [18] in general the media has the following advantages: (1) Clarify the presentation of the message so that it is not too formalistic. (2) Overcoming the limitations of space, time, and senses. In addition, [19] argues that ICT has a function: Capturing rare objects and events that can be immortalized with photos, films, and recorded via video or audio, then the events are stored and used when needed.

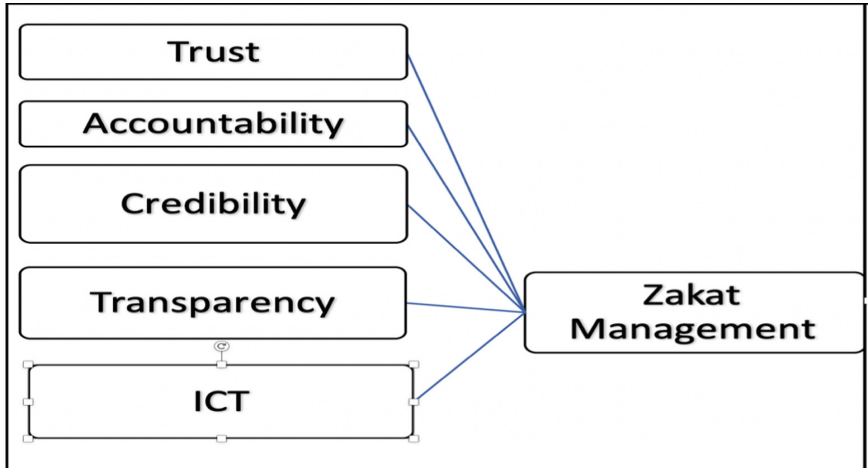
The ICT systems are premised on the centrality of information technology in everyday socio-economic life to support meanings, tacit understanding, experiences, interconnections, process of change, and positive effects. ICT Focuses either on human interactions and social structure, then the theory tries to resolve in efficiency. The proposition has resulted from the ICT theory as above: **Proposition:** ICT is a Power to Facilitate Communication in Order to boost any Activities Based on Some Values i.e., Speed, Efficient, Big Capacity, Lower Cost, and effectiveness Significantly.

## 2.3 The Importance of Transparency, Credibility, and Accountability in Zakat Management

Research related to the above issue have been carried out one of which by [7] who explained that the wider beneficiaries of *Zakat* are, the more the public trust will increase. Thus, it can be said that the success of *Zakat* collection is determined by how widely the community feels the benefits of the *Zakat*. Another research related to the importance of trust was conducted by [6] He stated that trust can increase people's intention to pay *Zakat* through *Zakat* institutions. Furthermore, the trust of this community can be achieved through effective *Zakat* management methods [8]. Whereas [20] found that increasing trust can be done through accountability and transparency. A similar study was conducted by [21] who concluded that transparency can increase *Zakat* payers.

One indicator of good *Zakat* management is transparency. As stated by [22] transparency can maintain community loyalty to the institution. This was confirmed by [23] Transparency is a part of good governance which must be owned by all agencies or institutions. Such transparency can be in the form of report which can also be accessed by the community [8] Related to the issue of credibility as one of the important factors in *Zakat* management is reviewed by [6] They concluded that the credibility of the *Zakat* institution affects the behavior of the people to pay *Zakat*. Furthermore, the transparency of *Zakat* management significantly influences the trust of *Muzakki* in paying *Zakat*. This is reinforced by the previous study that the credibility of *Zakat* institutions influences

people's behavior to pay *Zakat*. The research conducted by [24] revealed the importance of service and technology facilities that accommodate the payment of *Zakat*. From the earlier description in relation to the important factors influencing effective *Zakat* management can be described in the figure as follows (Fig. 1):



**Fig. 1.** Factors affected *Zakat* management

From the description above, it can be concluded that accountability, credibility, transparency, and effective management can increase public trust where the increased trust will result in the expansion of the *Zakat* payer segment, loyalty, satisfaction, and community behavior, as well as community preferences towards *Zakat* institutions. Many researchers suggest that realizing the effectiveness of those variables such as accountability, credibility, and transparency is essential to be backed up by an information system and effective management of *Zakat* collection. Information technology in *Zakat* management can be an effective tool in increasing the amount of *Zakat* collection.

The previous researchers were aware that if the *Zakat* institutions wanted to increase their collection, then there should have been obvious evidence that they were quite trustworthy in managing *Zakat* funds. The mandate and responsibility not only merely record financial reports, the total collection and distribution of *Zakat* funds each year to the government and the national *Amil Zakat* Agency, but also must be conveyed to the wider community as a party that has the potential to pay their *Zakat-to-Zakat* institutions. The public expects transparent and credible reporting. The transparent standardization can actually be seen if we intend to look for the financial statements of *Zakat*-related institutions, and also open the websites of *Zakat* institutions to find out the *Zakat* distribution area and what activities are carried out by them (*Zakat* distribution activities). Here, it is visible that there is a gap where people have the convenience to pay *Zakat* anywhere and anytime, yet it will be rather difficult to obtain information related to the distribution of *Zakat* funds.

Moreover, the distribution of *Zakat* funds must be classified according to the area of the beneficiary, based on the agreement for the donation of *Zakat* and charity received,



as well as various types of other distribution program specifications such as for mosque construction programs, scholarships, *Da'wah* to prevent the Christianization of poor Muslim communities, venture capital assistance for the poor, and community economic empowerment programs.

#### 2.4 Indicators Development of the Variables Zakat Management

Based on the analysis of the previous sub-chapter, it is found that the important factors in effective *Zakat* management involve trust, accountability, transparency, credibility, and the use of IT. According to the previous researchers, the five factors need to be derived in indicators as a tool to measure the variables shown in the following table (Table 1).

**Table 1.** Factors influencing the success of *Zakat* management

Variable	Indicators	CODE
Trust [25, 26]	Trust in ICT	T1
	Trust in the future of <i>Zakat</i>	T2
	Trust in service quality	T3
	Trust in <i>Zakat</i> management	T4
Accountability [25]	Responsible motivation	A1
	Understanding of social obligations	A2
	The Importance of audit knowledge	A3
	The importance of experience	A4
Transparency [25]	Reliable system availability	T1
	Report accessibility	T2
	Report publication	T3
	Report availability	T4
	Availability of <i>Zakat</i> information	T5
Credibility	Reliability of the <i>Zakat</i> system	C1
	The relevance of the <i>Zakat</i> system	C2
	Ease of understanding	C3
Management and information technology [27]	Accuracy	ICT1
	The relevance of the system	ICT2
	Speed of results	ICT3
	Completeness/Features	ICT4
	Convenience	ICT5

### 3 Research Method

The sampling method used in this research is purposive stratified sampling combined with accidental purposive sampling. The questionnaire method collected 350 data was collected in Indonesia divided into three areas, namely: the east part of Indonesia 50 respondents, the middle part of Indonesia = 100 respondents, and the western part of Indonesia equal to 200 respondents. The Respondents include *Zakat* institutions, *Zakat* collection units, Muslim scholars, scientists, *Zakat* payers, and selected *Zakat* recipients. The respondents were asked to fill out a questionnaire based on the above indicators on a scale of 1–9 by using google Forms and they were asked to assess the important factors which affect the effectiveness of *Zakat* management in Indonesia. Besides that, some selected respondents were interviewed online to assess ICT platforms that deal to increase trust, accountability, transparency, efficiency, and credibility. Based on the respondent's views then will be developed the conceptual model by using the IDC method (Intelligent, Design, and Choice).

## 4 Results and Discussion

### 4.1 The Determinant Variable

The collected questionnaire data were processed by using descriptive statistical method consisting of the average for each indicator, the minimum value, the maximum value, the standard deviation, and the average value for each variable. The results of the data processing are presented in the following table.

From the results of the analysis above, the most dominant variable is the use of ICT in *Zakat* management, then followed by public trust, credibility, transparency, and finally, accountability. Thus, *Zakat* institutions need to prioritize the use of information technology, the increase of public trust, the credibility and transparency of *Zakat* management, and the accountability of *Zakat* management report. The order of rank of the most important factors can be seen in the following table (Table 3).

From the table above, it can be seen that in realizing good *Zakat* management, the public requires the existence of a reliable ICT, the level of trust in the *Zakat* institution, the credibility of the *Zakat* management institution, the transparency of the system, the transparency of *Zakat* source, the distribution report, and at last the accountability regarding with how important the *Zakat* institution is in its responsibility.

### 4.2 The Conceptual Design of ICT-Based *Zakat* Management

Based on the description in the previous sub-chapter and by using the Intelligent Design and Choice (IDC) method from [28] the intelligent Phase includes collecting data and information related to the issue. The phases of design involve experts in the fields to attain the dominant variable into some possible models. Then, the choice is the appropriate selection phases. This design method model is an analytic subjective deductive, which connects some information and data collected so that the conceptual design model for management *Zakat* based on ICT is obtained as follows (Fig. 2).

**Table 2.** Descriptive statistics

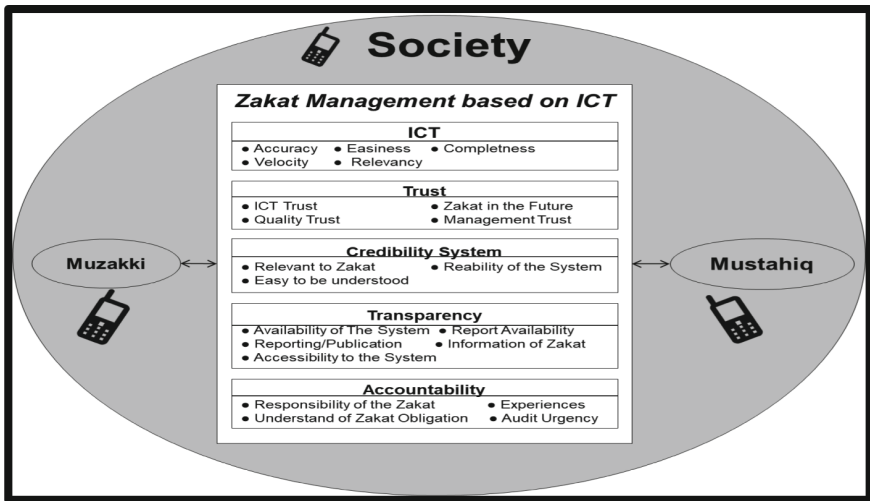
Variable	Indicator	CODE	Mean	Min	Max	Std.	Average
Trust	Trust in ICT	T1	9,01	1	9	1,80	<b>8,49</b>
	Trust in the future of <i>Zakat</i>	T2	8,11	1	9	1,91	
	Trust in service quality	T3	8,92	1	9	1,78	
	Trust in <i>Zakat</i> management	T4	7,94	1	9	1,77	
Accountability	Responsible motivation	A1	7,23	1	9	1,50	<b>6,22</b>
	Understanding of social obligations	A2	6,43	1	9	1,61	
	The importance of audit knowledge	A3	6,31	1	9	1,83	
	The importance of experience	A4	4,92	1	9	0,49	
Transparency	Reliable system availability	T1	8,80	1	9	0,88	<b>8,42</b>
	Report accessibility	T2	9,68	1	9	0,97	
	Report publication	T3	8,62	1	9	0,86	
	Report availability	T4	8,44	1	9	0,84	
	Availability of <i>Zakat</i> information	T5	6,59	1	9	0,66	
Credibility	Reliability of the <i>Zakat</i> system	C1	8,80	1	9	0,88	<b>8,43</b>
	The relevance of the <i>Zakat</i> system	C2	7,80	1	9	0,78	
	Ease of understanding	C3	8,70	1	9	0,87	
Information and communication Technology	Accuracy	ICT1	8,30	1	9	0,83	<b>9,18</b>
	The relevance of the system	ICT2	9,70	1	9	0,97	
	Speed of results	ICT3	8,90	1	9	0,89	
	Completeness/Features	ICT4	9,20	1	9	0,92	
	Convenience	ICT5	9,80	1	9	0,98	

### 4.3 Respondents' View of the Appropriate ICT Platform to Increase Zakat Management

Based on a study conducted by interviewing 20 respondents which includes ten Academicians including Professors and Doctors who are well informed regarding *Zakat* (AC1 to AC10), three ICT practitioners (ICT1 to ICT3), and four *Zakat* Institutions

**Table 3.** The rank of the importance variables

Ranking	Variables
1 <sup>st</sup>	Information technology (ICT)
2 <sup>nd</sup>	Trust
3 <sup>rd</sup>	Credibility
4 <sup>th</sup>	Transparency
5 <sup>th</sup>	Accountability



**Fig. 2.** Design *Zakat* management based on ICT

(ZA1 to ZA4), and three *Zakat* payers (ZAP1 to ZAP3). Questions include what technology can increase *Zakat* collecting through increasing trust, credibility, transparency, and accountability as if these variables can be deals then the *Zakat* payer will satisfy in terms of trust. *Zakat* management will be efficient, transparency, and accountable it does mean everyone can monitor in terms of data openness. Finally, the *Zakat* volume will increase as the target as in Indonesia the volume of *Zakat* is still poor. The respondents were asked to evaluate and choice which ICT technology which urgent in the current time to be implemented in Indonesia in boosting the *Zakat* management, the ICT Technologies offered are: Fintech, Blockchain, Internet of Things (IoT), and Artificial Intelligent (AI) the respondents can choice at least one. The respondents mapping displayed in the Table 4.

From Table 2, it can be concluded that all respondents agree that Blockchain technology can improve *Zakat* management, then Fintech can also increase efficiency and be backed-up by IoT and artificially intelligent. Among respondent’s opinions, the highest selected technology is Blockchain (100%), Fintech (70%), IoT (50%), and Artificial

**Table 4.** Respondents opinion related the appropriate ict technology to deal with the *Zakat* management issues.

No	Respondents	What ICT technology can deal with the issues of trust, transparency, accountability, credibility, and efficiency in terms of <i>Zakat</i> management			
		Blockchain	Fintech	IOT	AI
1	Academicians (AC1 to AC10)	10	5	4	2
2	ICT Practitioners (ICT1 to ICT3)	3	3	3	3
3	<i>Zakat</i> Institutions (ZA1 to ZA4)	4	3	2	1
4	<i>Zakat</i> Payers (ZAP1 to ZAP3)	3	3	1	3
		20 (100%)	14 (70%)	10 (50%)	9 (45%)

Intelligent (AI) equal to 45%. Hence it can be concluded that Blockchain is the appropriate technology to deal with the increasing *Zakat* collecting in Indonesia as this technology has some features such as trust, transparency, accountability, credibility also efficiency.

#### 4.4 The Model of *Zakat* Based Blockchain Technology

The current collection strategy these days has utilized information technology that it can increase *Zakat* donations, and help introduce *Zakat* institutions to the wider community. The technology, however, has not been equipped with responsibility publications for the management of *Zakat* funds and assets. Therefore, this study develops a more comprehensive *Zakat* management strategy, particularly in terms of collecting and reporting *Zakat* fund management. This strategy can be realized by using the blockchain system (worldwide *Zakat* blockchain). This integrated system can be referred to as worldwide *Zakat* management through blockchain. The Indonesian government also provides support for the use of blockchain technology to improve company performance [29].

Blockchain creates globally and permanently documented records (distributed ledger) [29] The transaction authorization and verification process is faster. Movement of *Zakat* funds and transactions can be traced so easily that transparency increases. The auditing process will be easier to do. Furthermore, a database of the transaction frequency can be processed by the *Zakat* manager to analyze people's behavior towards *Zakat* [30]. There have been many studies on the application of blockchain technology in the field of Islamic Banking products yet blockchain as a comprehensive *Zakat* management system has not been implemented.

Thus, the next research needs to elaborate a *Zakat* management model based on blockchain in detail. This is because the blockchain can deal with such issues as trust, credibility, transparency, and accountability. In addition, blockchain has advantages in security from cybercrime, fraud, and manipulation, and in increasing efficiency. With the implementation of blockchain, *Zakat* management is expected to be optimal. Some of the remarkable advantages of a business when using this technology include the wider access to finance, and the way of running businesses can be executed more efficiently, cheaply and safely [31].

## 5 Conclusion

From the discussion explained earlier, it can be concluded that to ensure effective zakat management, a design that is supported by ICT is needed. Based on several previous study there are five important variables that can ensure the success of technology-based zakat management. They include trust, accountability, credibility, transparency, and information technology management (ICT).

By using descriptive statistic founded the dominant factors in determining the success of effective zakat management produce five rank sequences; ICT as the first and then followed by Trust, Credibility, Transparency, and at last accountability. Moreover, the ICT-based *Zakat* management is needed to accommodate the variables of trust, credibility, transparency, and accountability where all stakeholders such as *Muzakki*, *Mustahiq* and society can watch the *zakat* management real time by using mobile phone.

Blockchain is the appropriate technology to be implemented to boosting *Zakat* volume because Blockchain has some features which meet with the *Zakat* requirement such as trust, transparency, accountability, and efficiency. The second rank technology is financial technology (Fintech), IOT and AI. It is therefore, the next research in detail is needed to design a *Zakat* model based on Blockchain technology due to its capability of providing security from the cybercrime, fraud and manipulation. In addition, the blockchain is able to facilitate the access of finance more widely, efficiently and cheaply.

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