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A system dynamics model on how zakat can reduce poverty in Indonesia

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Abstract

Purpose – This study analyzes the potential of zakat for poverty alleviation using a system dynamics approach. Indonesia has excellent zakat potential as a country with the largest Muslim population. However, the poverty rate in Indonesia is still high at approximately 10.14% of the total population.

Methodology – This study used system dynamics to model how zakat can reduce poverty in Indonesia. The system dynamics method was chosen because of its capability to model the complexity of the system.

Findings – The model indicates that increasing the percentage of productive zakat allocation and decreasing the delay of the conversion program can reduce the poverty alleviation time from 200 to 120 years using the zakat *nisab* standard and from 32 years using the Central Statistics Agency (BPS) poverty standard. However, if Zakat faces limited funds, the focus should be on decreasing the conversion delay.

Implications –This research can encourage people to become *muzakki* (zakat payers) because, as indicated in the simulation models, muzakki growth of *muzakki* has a role in poverty alleviation. In addition, Zakat institutions can use the developed model to simulate the best policy for poverty alleviation before implementing the program.

Originality – Although the system dynamics approach has shown promising findings in modeling poverty, the number of studies utilizing system dynamics to analyze the effect of zakat on poverty reduction is limited. Therefore, this study aims to evaluate the effectiveness of zakat in alleviating poverty by implementing a system-based approach and simulating system dynamics.

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Introduction

According to the Central Statistics Agency (BPS), was recorded at 26.36 million people. This number decreased by 140 thousand from the previous year, but increased by 200 thousand compared to March 2022 (Badan Amil Zakat Nasional, 2022). Through Law No. 23 of 2011, Article 3, the Indonesian government mandated zakat management to realize community welfare and poverty reduction in Indonesia (Badan Amil Zakat Nasional, 2022).

The National Amil Zakat Agency (Badan Amil Zakat Nasional, BAZNAS) noted that the collection of Zakat funds in 2022 experienced a significant increase of 84.16% compared to 2021. By 2022, the collected zakat funds amounted to 22 trillion rupiahs. Growth in zakat collection is also shown by the increase in *muzakki* (zakat payers) and *mustahik* (zakat beneficiaries). By 2022, there were 230,627 corporate *muzakki* and 9,917,706 individual *muzakki*. In addition, the number of poor people recorded as *mustahik* also increased to 25,707,077 in 2022 (Badan Amil Zakat

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Nasional, 2023). This indicates that zakat management in Indonesia continues to improve in terms of zakat collection and allocation. The zakat allocation ratio increased annually. In 2019, 84.9% of collected zakat funds were successfully distributed to zakat beneficiaries.

As of 2022, BAZNAS already has an instrument to distribute zakat for poverty alleviation. This strategy aligns with Law No. 23 of 2011, Article 3, as described above. BAZNAS Indonesia routinely conducts the Zakat Impact Assessment and the National Zakat Index yearly to measure the effectiveness of the poverty alleviation program. BAZNAS divides poverty indicators into three categories: the BPS poverty line, *had kifayah*, and *nisab zakat*. These three indicators have different poverty standards. The BPS sets a poverty standard of IDR 2,324,274 per family per month; the *had kifayah* sets a standard of IDR 3,996,573 per family per month, and the zakat *nisab* sets a standard of IDR 6,607,748 per family per month. In 2022, the BAZNAS measured the success rate of the poverty alleviation program. Based on the BPS poverty line standard, the program alleviated poverty in 46% of recipients (463,154 people). Based on the Had Kifayah and Nisab zakat categories, the program succeeded in alleviating poverty by 34% (342,331 people) and 14% (140,960 people), respectively (Badan Amil Zakat Nasional, 2022).

Zakat management in Indonesia, in terms of collection, distribution, and poverty alleviation, has shown an increasing trend. However, improvement efforts are still needed from the perspective of the potential for collection and poverty alleviation. Indonesia has enormous potential for collecting Zakat funds as it has the largest Muslim population. BAZNAS stated that the potential of zakat in Indonesia is IDR 327 trillion (Badan Amil Zakat Nasional, 2022). Compared to the performance of the zakat collection in 2022, the national zakat collection, which amounted to 22 T, is 7% of the zakat potential. Regarding the effectiveness of poverty alleviation programs, BAZNAS stated that achieving poverty alleviation in 2021 is still below the set target (Badan Amil Zakat Nasional, 2023).

This research aims to address this empirical gap by utilizing dynamic system methodologies to evaluate the impact of zakat on poverty alleviation. Miles (2017) states that this empirical gap is related to previous studies. The empirical gap is characterized by the absence or lack of research on a particular topic. Using the Publish or Perish software, a search was conducted on the "Google Scholar" database with the keywords "system dynamics and zakat." This search yielded one scholarly publication (Mohamad et al., 2022). However, no studies were identified when similar keywords were used to search the Scopus database. A search using the keyword "system dynamics and poverty" in the Scopus database yielded two publications (Vasconcelos et al., 2022; Murtaza & Faridi, 2015). In addition, searching for "system dynamics and poverty" in the Google Scholar database yielded thirteen items. Vasconcelos et al. (2022) examine the relationship between poverty growth and income poverty. On the other hand, Murtaza and Faridi (2015) examined poverty traps with various aspects of social issues such as population distribution, violence, and poverty.

Therefore, there are a limited number of previous studies on the use of system dynamics to examine the impact of zakat on poverty reduction, with only one publication available in the Google Scholar database. The system dynamics approach shows promising results for modeling the complexity of poverty, as evidenced by the identification of 13 papers in the Google Scholar database and two articles in the Scopus database. Conversely, as mentioned, Indonesia, with the highest number of Muslims, has the most significant capacity to collect and distribute zakat to reduce poverty. Hence, this study aims to assess the effectiveness of zakat in reducing poverty by employing a system-approach methodology that utilizes system dynamics simulations. Compared to previous research analyzing poverty using system dynamics, this study used the *zakat* fund as an essential variable in poverty alleviation. System dynamics have been widely used to analyze economic policies with high-complexity characteristics, such as the research by Vasconcelos et al. (2022) and Murtaza and Faridi (2015). The problem of poverty is one with a high level of complexity due to many influencing factors, and each factor also affects or interacts with other factors. Ayuniyyah et al. (2018) stated that it is necessary to increase the study of zakat potential by using quantitative and qualitative methods to prove the role of zakat in the economy. The research findings are expected to address this empirical void by incorporating a system dynamics approach to examine the potential of zakat in alleviating poverty.

Literature Review

Researchers have conducted studies on how zakat influences poverty alleviation. Previous research covers the potential of Indonesia as a country with a majority Muslim population, and the role of zakat in reducing poverty. Ayuniyyah et al. (2017) compared consumptive and productive zakat. The research found that productive zakat improved zakat recipients' material and religious conditions by 300%, while consumptive zakat had only a 20% impact. Ayuniyyah et al. (2018) state that zakat plays a role in alleviating poverty and reducing income inequality. According to the BPS, in 2022, although the poverty rate has decreased, income inequality measured using the Gini ratio has remained the same as in the previous year. However, the Gini ratio in urban areas has increased compared to the previous year, indicating increased income inequality in urban areas (Biro Pusat Statistik, 2022b).

Romdhoni (2018) evaluated the effect of productive zakat on the improvement of community welfare. Romdhoni's research shows that productive zakat, measured by income, consumption, and capital variables, significantly affects the welfare of low-income people. Alim (2015) reviewed productive zakat in Indonesia. Alim found that most productive zakat programs use a loan scheme, although many Islamic scholars (ulama) disagree with this mechanism. Alim (2015) further proposed a saving fund mechanism in which collected zakat funds are managed by amil zakat before being distributed to zakat beneficiaries. Widiastuti et al. (2022) examined the relationship between zakat and the economics of 39 members of the Organization of Islamic Cooperation (OIC) from 2007 to 2020. The research found that zakat has a negative and significant relationship with poverty, which means that zakat can play a role in poverty alleviation among 39 OIC members.

Many previous studies have not yet used system dynamics to model the effect of zakat on poverty alleviation in Indonesia. Masyita (2005, 2007) used system dynamics to model the influence of waqf funds on poverty alleviation in Indonesia. Mohamad et al. (2022) used system dynamics to model the effect of Zakat funds on *asnaf* poverty alleviation in Malaysia. In this study, a system dynamic model of how zakat can alleviate poverty in Indonesia was developed. The developed model can be used as evidence for the impact of zakat on poverty alleviation. Ayuniyyah et al. (2018) state that research on how zakat impacts poverty reduction needs to be communicated to the public in order to increase the number of zakat payers (*muzakki*). On the other hand, Zakat institutions can also use the simulation model to evaluate Zakat management policies before implementing them in the community.

Prior research has been conducted to formulate the dynamic hypotheses. This study utilizes Sterman's dynamic system development flow as a framework for model development. Sterman asserted that dynamic hypothesis formation is the second stage in the five-stage dynamic system modeling (Sterman, 2000). The Results and Discussion section presents an explanation of the hypothesis formulation phase and formulation of the dynamic hypothesis subchapter.

Research Methods

This study aimed to evaluate the effect of zakat on poverty alleviation using a dynamic system model. The model aims to understand the complexity of zakat management and poverty alleviation. Ayuniyyah et al. (2018) stated that it is necessary to increase the study of zakat potential by using quantitative and qualitative methods to prove the role of zakat in the economy. Zakat managers can use this model to evaluate the productive zakat portion of a scenario. However, regarding research on zakat and poverty, this model can strengthen previous research findings by providing illustrations through simulations of how zakat can reduce poverty.

System dynamics modeling consists of five steps: (1) problem articulation, (2) formulation of dynamic hypotheses, (3) formulation of the simulation model, (4) testing, and (5) policy design and evaluation (Sterman, 2000). Problem articulation was conducted by identifying reference and time horizons. In this paper, the researcher discussed the problem with Basnas and gathered historical data from BAZNAS annual reports and relevant previous research to thoroughly understand the problem. Discussions with BAZNAS involved the Head of Zakat Collection and

the Head of Distribution and Empowerment. The historical data collected were the 2019 National Zakat Statistics Report (Badan Amil Zakat Nasional, 2019), *Zakat* and Poverty Alleviation Report (Badan Amil Zakat Nasional, 2022), and National Zakat Outlook 2023 (Badan Amil Zakat Nasional, 2023), while previous research related to the dynamic system used was conducted by Mohamad et al. Mohamad et al. (2022) and Masyita (2005, 2007). Through data collection, this study comprehensively considered both primary data from expert judgments and secondary data from reports and previous research.

The reference mode was evaluated by observing the behavioral patterns of the problem. A dynamic hypothesis was then developed based on the reference and time horizons. This is called a hypothesis because it is provisional, can be revised, and can be abandoned after modeling (Sterman, 2000). This study uses a causal loop diagram (CLD) to illustrate how the variables are connected. The simulation model was then formulated by developing a stock-and-flow model based on the causal loop model developed in the previous phase.

The testing phase consisted of model verification and validation. Verification ensures that the computer model can be run without errors, whereas validation ensures that the model represents the actual system (Sterman, 2000). The validity test was conducted using face and statistical validity. Face validity was assessed through interviews and discussions with BAZNAS, while statistical validity was evaluated using Theil's Inequality Coefficient (U), *r* (correlation), and Root Mean Square Percentage Error (RSMPE). Yudi et al. (2016) used Theil's Inequality Coefficient (U) to evaluate the model's validity. Sterman (2000) stated that Theil's Inequality Coefficient (U) divides the Mean Square Error (MSE) into three components: bias, unequal variation, and unequal covariation. Ahlburg (1984) provides a formula to calculate the three components of Theil's Inequality Coefficient (U), as shown in Equations 1, 2, 3, and 4. A is the actual value, and P is the prediction value. The sum of *UM*, *UR*, and *UD* was 1. The model is valid when *UM* is close to zero, *UR* is small, and *UD* is large.

$$MSE = (\bar{P} - \bar{A})^2 + (S_P - rS_A)^2 + (1 - r^2)S_A^2 \quad (1)$$

(i) The bias proportion (*UM*)

$$UM = (\bar{P} - \bar{A})^2 / MSE \quad (2)$$

(ii) The regression proportion (UR)

$$UR = (S_P - rS_A)^2 / MSE \quad (3)$$

(iii) The disturbance proportion (UD)

$$UD = (1 - r^2)S_A^2 / MSE \quad (4)$$

In addition to the above indicators, Sterman (2000) used the correlation (r) value and RSMPE to measure validity. The model is valid when the *r* value is 0.9 - 1.0 and the RSMPE is less than 0.2. The formulas for calculating *r* and *RSMPE* are as follows:

$$r = \frac{n\sum_{i=1}^{n} A_i P_i - \sum_{i=1}^{n} A_i \sum_{i=1}^{n} P_i}{\sqrt{\left[n\sum_{i=1}^{n} {A_i}^2 - \left(\sum_{i=1}^{n} A_i\right)^2\right] n\sum_{i=1}^{n} {P_i}^2 - \left(\sum_{i=1}^{n} P_i\right)^2}} \quad (5)$$

$$RSME = \sqrt{\frac{\sum_{i=i}^{n} \left(\frac{E_i}{A_i}\right)^2}{n}} \quad (6)$$

Results and Discussion

Problem Formulation

The problem to be modeled in this research is how zakat can play a role in poverty alleviation in Indonesia. A literature review was conducted using the 2019 National Zakat Statistics Report (Badan Amil Zakat Nasional, 2019), the Zakat and Poverty Alleviation Report (Badan Amil Zakat Nasional, 2022), the National Zakat Outlook 2023 (Badan Amil Zakat Nasional, 2023), research

on zakat and poverty alleviation (Ayuniyyah et al., 2017, 2018), and research on system dynamics (Mohamad et al., 2022; Masyita, 2005, 2007).

BAZNAS has a poverty alleviation program mandated by Law No. 23 of 2011 (Article 3). The effectiveness of the poverty program is measured annually using three poverty indicators: the BPS poverty line, *had kifayah*, and *nisab zakat*. This study used *nisab zakat* as a measure of poverty. The measure of success of the poverty alleviation program is the conversion rate from *mustahik* to *muzakki*. BAZNAS determines two categories of *zakat* allocation, consumptive zakat and productive zakat, where the productive zakat is allocated for poverty alleviation programs. Based on this description, the critical variables identified in the system are *mustahik*, *mustahik out*, *muzakki*, *poor population*, *zakat collection*, and *productive zakat allocation*. The official reports from the National Zakat Statistics Report (Badan Amil Zakat Nasional, 2019), Zakat and Poverty Alleviation Report (Badan Amil Zakat Nasional, 2022), and National Zakat Outlook 2023 (Badan Amil Zakat Nasional, 2023)) were used as sources of historical data to determine the value of each variable.

The problem was articulated by identifying the reference mode and the time horizon. The results of the literature review revealed that the expected pattern is that the number of *mustahik* decreases, while the number of *muzakki* increases to a certain equilibrium point. On the other hand, the time horizon in this simulation is determined in years. The total number of years of simulation is 200 because, according to the BAZNAS report, the conversion without zakat from *mustahik* to *muzakki* requires 36 years.

Formulation of Dynamic Hypothesis

In its annual report, BAZNAS states that the productive zakat allocated can contribute to poverty alleviation in Indonesia. However, there was a delay when a *mustahik* received zakat to become *muzakki*. The number of zakat funds collected depends on the number of *muzakki*, while the number of funds allocated depends on the number of *mustahik*. Figure 1 shows the causal loop diagram (CLD) of Zakat's role in poverty reduction. To develop the CLD, the author conducted interviews and brainstorming with experts at BAZNAS, especially the Head of the Zakat Collection and Distribution Division. A positive sign (+) in CLD indicates that the relationship between the two variables is directly proportional. In contrast, a negative sign (-) indicates that the relationship between the two variables is inversely proportional. CLD validation was conducted through face validity with BAZNAS Yogyakarta Province, consisting of the Head of Zakat Collection and the Head of Distribution and Empowerment.

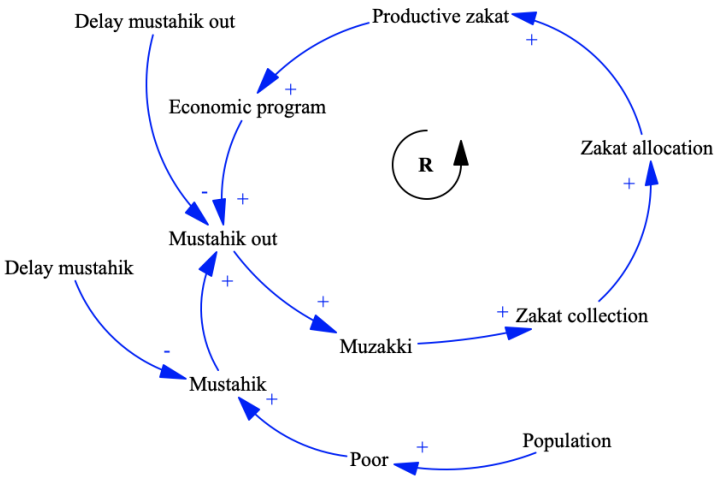


Figure 1. Causal Loop Diagram

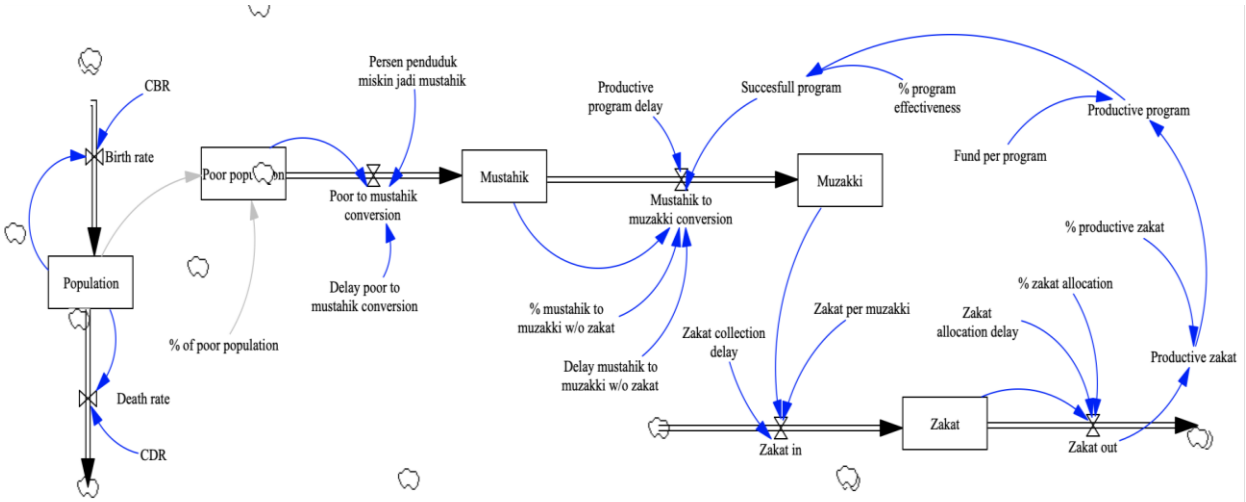
In this research, the CLD of the system dynamics zakat was developed based on research by Khairullah (2022) and Mohamad et al. (2022). Khairullah (2022) researched system dynamics in zakat using the Yogyakarta Province as a case study. The causal loop developed in Khairullah's research incorporates zakat allocations for economic purposes. However, Khairullah's research did not model

this loop in a causal loop diagram. On the other hand, Mohamad et al. (2022) researched the system dynamics of zakat in Malaysia by proposing a causal loop diagram with one reinforcing loop consisting of *zakat prayers* → *zakat collection* → *development program* → *asnaf out* → *zakat prayers*.

In this study, CLD consists of one reinforcing loop: *muzakki - zakat collection - zakat allocation - productive zakat - economic program - mustahik out - muzakki*. This reinforcing loop is by the reference mode in problem articulation, where *mustahik* is expected to decrease and *muzakki* is anticipated to increase. Several delays accommodated in CLD are delays in converting poor people into *mustahik* and delays in the poverty alleviation program.

Formulation of Simulation Model

Stock flow diagrams were developed based on CLD. The 11 critical variables in the CLD were then identified, and categorized as stock, flow, or auxiliary. The 11 variables were also elaborated in the stock flow diagram by adding the relevant constants. Figure 2 shows the stock and flow diagrams. The stock and flow diagrams were verified by ensuring that all units were appropriate and that there were no errors when running the model.



Source: Data processing

Figure 2. Stock and Flow Diagram

The parameters for each variable were obtained from the secondary data of the 2019 National Zakat Statistics Report (Badan Amil Zakat Nasional, 2019), the Zakat and Poverty Alleviation Report (Badan Amil Zakat Nasional, 2022), and the National Zakat Outlook 2023 (Badan Amil Zakat Nasional, 2023). Table 1 shows the values or estimations of each variable in the stock and flow diagrams.

Table 1. Value or Equation of the Stock and Flow Variables

No	Variable	Value or Equation	Unit	Source
1	Population	INTEG (Birth rate – Death rate) *Initial value*: 259091970	People	(World Bank, 2023)
2	Crude death rate (CDR)	7,46	1/year	(World Bank, 2023)
3	Crude birth rate (CBR)	18,448	1/year	(World Bank, 2023)
4	Birth rate	Population*CDR /1000	People/year	-
5	Death rate	Population*CBR /1000	People/year	-
6	% of the poor population	11,22	1/year	(Biro Pusat Statistik, 2022a)

No	Variable	Value or Equation	Unit	Source
7	Poor population	INTEG (-Poor to *mustahik* conversion) *Initial value:* % of poor population *Population/100	People	-
8	Poor to *mustahik* conversion	Poor population *% of poor become *mustahik* /100/ Delay poor to *mustahik* conversion.	People/year	-
9	% of poor become *mustahik*	12 + STEP(70,2)	1/year	(Badan Amil Zakat Nasional, 2022)
10	Delay poor to *mustahik* conversion	2	Year	(Badan Amil Zakat Nasional, 2022)
11	*Mustahik*	INTEG (Delay poor to *mustahik* conversion - Mustahik to *muzakki* conversion) *Initial value:* 5.100.000	People	(Badan Amil Zakat Nasional, 2019)
13	% *mustahik* to *muzakki* w/o zakat	2	1/year	(Badan Amil Zakat Nasional, 2022)
12	Delay *mustahik* to *muzakki* w/o zakat	36	Year	(Badan Amil Zakat Nasional, 2022)
13	Muzakki	8.200.000	People	(Badan Amil Zakat Nasional, 2019)
15	Zakat per *muzakki*	1.200.000	IDR/people	(Badan Amil Zakat Nasional, 2023)
16	Zakat collection delay	3	Year	(Badan Amil Zakat Nasional, 2023)
17	Zakat in	Zakat per *muzakki* * *Muzakki*/zakat collection delay	IDR/year	-
17	Zakat	INTEG (zakat in - zakat out) *Initial value:* 3.650.400.000.000	IDR	(Badan Amil Zakat Nasional, 2023)
18	% zakat allocation	80	1/year	(Badan Amil Zakat Nasional, 2019)
19	Zakat allocation delay	3	Year	(Badan Amil Zakat Nasional, 2023)
20	Zakat out	((% zakat allocation*Zakat)/100)/ Zakat allocation delay	IDR/year	-
21	% productive zakat	20	1/year	(Badan Amil Zakat Nasional,, 2022)
22	Productive zakat	Zakat allocation*% productive zakat	IDR/year	-
23	Fund per program	2000000	IDR	(Badan Amil Zakat Nasional,, 2022)
24	Productive program	Zakat productive/fund per program	People	-

No	Variable	Value or Equation	Unit	Source
25	% program effectiveness	70	1/year	(Badan Amil Zakat Nasional„ 2022)
26	Successful programs	Productive program * % program effectiveness	People/year	-
27	Productive programs delay	26	1/year	-
18	*Mustahik* to *muzakki* conversion	Successful programs / Productive programs delay + % *mustahik* to muzakki w/o zakat *Mustahik*/100/ Delay *mustahik* to *muzakki* w/o zakat	People/year	-

Testing

Verification ensures that there are no errors in the stock and flow models and that there is a unit fit for the entire model. In contrast, validation ensures that the model represents the actual system. This study used content and statistical validity.

Face validity

Face validity is the subjective assessment of an expert. The test involved interviewing an expert from BAZNAS Yogyakarta and showing them the causal loop, stock, and flow diagram. From the interviews and discussions, it was found that the model was relevant to the actual system.

Statistic validity

Statistical validity was measured using *r* (correlation), the RSMPE, and Theil's Inequality Coefficient (*U*). The statistical validity test was conducted on *Mustahik* and *Muzakki* data using historical and simulation data from 2015 to 2021, as shown in Table 2 (Badan Amil Zakat Nasional, 2019). This year's range was selected because complete zakat data have been available only since 2015. Statistical tests on the *muzakki* data cannot be performed because the national *muzakki* data were not available for 2015-2019. However, because *muzakki* was the response variable in the model, the test was still conducted through face validity. Using Equations 2, 3, 4, 5, and 6, the statistical validity test results are presented in Table 3.

Table 2. Real and simulation data – *Mustahik*

Year	Real	Simulation
2015	5,100,000	5,100,000
2016	6,800,000	6,838,750
2017	8,700,000	8,468,280
2018	22,200,000	18,986,100
2019	23,500,000	25,178,300

Source: Badan Amil Zakat Nasional, 2019

Table 3. Statistic Validity Test

Validation criteria	Value	Valid criteria
r (correlation)	0.98	0.9 – 1.0
RSMPE	0.07	<0.2
UM	0.0365	Close to zero
UR	0.0008	Small
UD	0.9625	Big

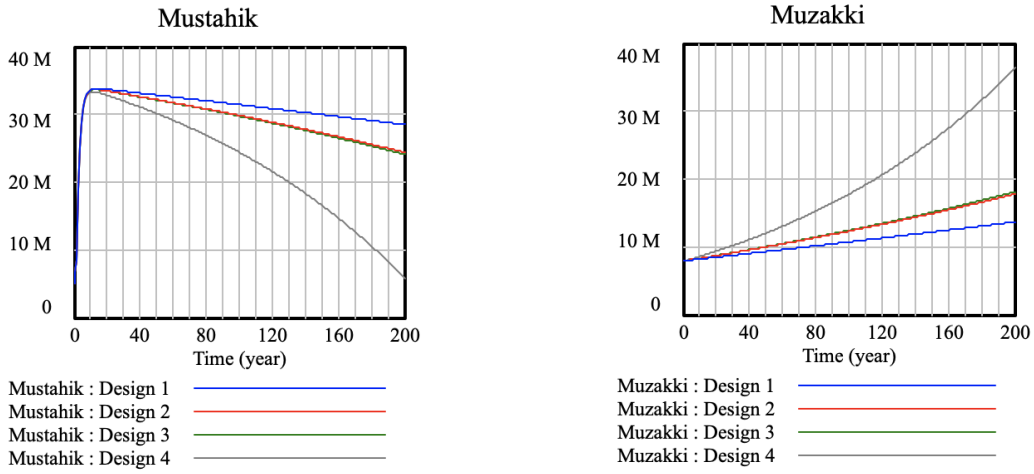
Policy Design and Evaluation

Determining the variables that become factors and responses is the first step in developing scenarios. These factors are the input parameters that are controllable or uncontrollable. The stock and flow diagram factors are *% productive zakat* and *delay program*. In contrast, the response variables are the output parameters. In the model above, the response variables are the number of *mustahik* and *muzakki*. Because two factors are identified, using a full 2^k, there are four experimental designs. For each factor, a comparison was made between the initial conditions and improvements. The details of the experiments conducted on the model are listed in Table 4.

Table 4. Design of scenarios

Design no	% productive zakat	Delay program
1	20%	26
2	50%	26
3	20%	10
4	50%	10

The four experimental designs were evaluated using the model and compared to obtain the best scenario. Figure 3 shows the performance comparison of the response variables, number of *mustahik* and number of *muzakki* for the four scenarios. *Design 4* is the best scenario, which combines increasing the percentage of productive zakat allocation and decreasing program delay. *Design 3* exhibited a slightly better performance than *Design 2*. This means that if the zakat institution has limited funds, it should focus on monitoring the program, which can have an impact on reducing the delay of *mustahik* to *muzakki* conversion.



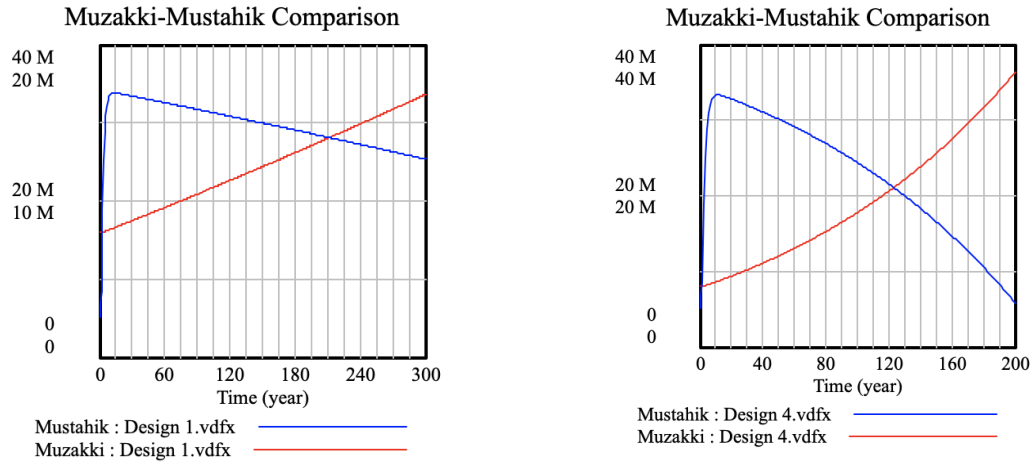
Source: Data processing

Figure 3. Scenario comparison (a) Number of *Mustahik*, (b) Number of *Muzaki*

A more detailed analysis of *Design 4* and *Design 1* (existing conditions) is shown in Figure 4. As previously described, *Design 4* can reduce the number of *mustahik* (zakat beneficiaries) and increase the number of *muzakki* (zakat payers) exponentially. In *Design 4*, the number of *muzakki* exceeds the number of *mustahik* in year 120, whereas in *Design 1* (existing condition), the number of *muzakki* exceeds the number of *mustahik* in year 200. This means that a combined strategy of increasing the allocation of productive zakat and decreasing the delay time can accelerate the poverty alleviation program in Indonesia 40% faster than the current scenario.

In the previous section, it was explained that this research used the *zakat nisab* poverty standard. Compared with the other two poverty indicators, *nisab zakat* used the highest standard. According to BAZNAS reports, the poverty standards for BPS, *had kifayah*, and *nisab zakat* are IDR 2,324,274/family/month, IDR 3,996,573/family/month, and IDR 6,607,748/family/month,

respectively (Badan Amil Zakat Nasional, 2022). Therefore, the *nisab zakat* standard is 2.8 times higher than the BPS poverty standard. This means that if this research used the BPS poverty standard, poverty alleviation would be 3.7 times faster (Badan Amil Zakat Nasional, 2022). Therefore, using the scenario in *Design 4* and the BPS poverty standard, poverty alleviation in Indonesia could be achieved in year 32.



(a) (b)

Source: Data processing

Figure 4. Scenario comparison (a) *Design 1* (Existing), (b) *Design 4*

This study used system dynamics to model the behavior of the observed system on how zakat can reduce poverty. In the policy design and evaluation phase, two response variables, the number of *muzakki* (zakat payers) and *mustahik* (zakat recipients), were compared for the four scenarios. The test results of all scenarios showed that zakat reduces poverty, whereas in this study, poverty alleviation was represented by a decrease in the number of *mustahik* (zakat beneficiaries) to *muzakki* (zakat payers). Further discussion comparing the performance of the four scenarios indicated that *Design 4*, a combination of increasing productive zakat funds and monitoring zakat programs, was the best scenario. Regarding managerial implications, the zakat manager can create a policy to increase the proportion of productive zakat funds and monitor the productive zakat allocation program for zakat recipients.

On the other hand, if the *zakat* manager is faced with limited fund availability, the policy should increase the monitoring function. In addition, in terms of theoretical implications, this study fills the gap in the need for more research on zakat or other social funds for poverty alleviation from the perspective of system dynamics. The results of this study indicate that system dynamics can be used to model the complexity of poverty alleviation and add to the repertoire of research on system dynamics and poverty alleviation.

Conclusion

This study examined the role of zakat in poverty alleviation in Indonesia. System dynamics was selected because of its capability to model the complexity of the observed system. The system dynamics model indicates that increasing the proportion of productive zakat allocation and decreasing the conversion delay from *mustahik* (zakat beneficiaries) to *muzakki* (zakat payers) can reduce the time required for poverty alleviation from 200 to 120 years. However, if zakat institutions face limited funds, the focus should be on decreasing the conversion delay. This study used the poverty indicator of *nisab zakat*, which is 2.8 times greater than the BPS standard. If the model were run with the BPS standard, poverty alleviation could occur 3.7 times faster or be achieved in year 32.

Regarding managerial implications, zakat managers can implement policies to increase the proportion of productive zakat money. Additionally, they can closely monitor the allocation

program of productive zakat to ensure that it reaches the intended recipients. This study has the potential to address the absence of research on zakat or other social funds for poverty alleviation from a system dynamics perspective, which has important theoretical implications. This study is limited in that it only investigates variables. Further investigation can be conducted by providing a more detailed analysis of the variables and loops of the model. In this study, productive zakat was treated as a single variable. Therefore, the variable productive zakat can be further elaborated by categorizing each form of productive program for the *mustahik*.

Author Contributions

Conceptualization: Danang Setiawan
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