

# Applications of operation research in Zakah administration

Shafiu Ibrahim Abdullahi<sup>a\*</sup>

<sup>a</sup>Department of Economics, Bayero University Kano, Nigeria, [shafiuibrahim@gmail.com](mailto:shafiuibrahim@gmail.com)

\*Corresponding author.

Received: 11 August 2019, revised: 31 August 2019, accepted: 28 September 2019, published: 2 October 2019.

---

## ABSTRACT

*The significance of the Zakah institution to any Islamic economy, it links to financial viability and economic progress has made it a must to modernize the sector to go in line with modern realities. Poor management of Zakah institutions has been described as detrimental to the efforts of these institutions to collect and disburse Zakah effectively. This paper looks at applications of mathematical and quantitative techniques with the view to achieving optimality and efficiency in business of collection and disbursement of Zakah. The mathematical applications tested are the techniques of contribution maximization, programming, and game theory. The potential applications of this field of mathematics to Zakah operations are vast. It calls for concerted efforts and focuses by researchers, policymakers and Islamic scholars on finding the most efficient way of deploying operation research techniques in the management of Zakah institutions.*

**Keywords:** Zakah, operation research, Islamic economics, mathematics, operational efficiency, charitable organization

---

## 1. Introduction

Zakah is a compulsory tax levied by an Islamic state on the Muslim members of the community in order to take the surplus money from the comparatively well to do members of the society and give to the destitute and needy. But, Zakah can also be paid voluntarily by the payer without any use of law enforcement agencies by the constituted authority. In a society where there is no Zakah collection agency, wealthy Muslims paid out their Zakah due on their own, following established Islamic guidelines. Multinational financial institutions such as the IMF have seen the potential of Zakah in fighting poverty. For example, in Sudan IMF has advocated the expansion of Zakah system in the whole of the Sudanese economy. Despite that, modern Muslim governments are reluctant to impose Zakah, notwithstanding, its potentials in eliminating poverty and enhancing harmony in a society. The current management practice of Zakah institutions is full of holes and inefficiencies. Zakah houses have stuck with traditional management practices turning a blind eye to modern management practices. The two main areas of Islamic economics that received a lot of coverage are Islamic banking and Zakah. Despite this, much of the academic contributions on Zakah contains mostly literature reviews and verbal expositions. There is need for serious empirical work on the potentials and operational capacity of Zakah. This is despite the fact that Zakah is an area that deals with quantifiable things, in form of tangible commodities and money. Islamic economics itself has a history of skepticism towards use of mathematics in theory building. The over mathematization of conventional economics has sent a warning signal to Islamic economists making them cautious in adopting mathematics in Islamic economics (Abdullahi, 2018). But, despite that word of caution, quantitative techniques of mathematics have important role to play in the theory and practice of Islamic economics. The significance of Zakah institutions to any Islamic economy, it links with financial viability and economic progress, has made it a must to modernize the sector to go in line with modern realities. There are already proposals to merge Zakah collection and distribution with functions of Islamic microfinance institutions. This it is hoped will help in achieving synergy and getting the best out of the two institutions. Islamic microfinance banks can very well serve the needs of poor Zakah receivers who may need interest free loans to develop their sources of income, thus permanently removing them from Zakah receivers into the league of future Zakah payers (Maulidizen, 2018). Countries such as Malaysia, Indonesia, Pakistan, and Sudan have gone a long way in introducing modern practices into the structural and managerial format of Zakah institutions operations.

<http://dx.doi.org/10.30585/jrems.v1i4.364>

© 2019 the Authors. Production and hosting by Avicenna FZ LLC. on behalf of Dubai Business School, University of Dubai, UAE. This is an open-access article under the CC BY 4.0 license (<https://creativecommons.org/licenses/by/4.0/>).



But, taxation as a system of raising money to finance government services and activities is different from Zakah which is meant to be spent on the eight heads listed in the Holy Qur'an (9:60). Zakah is a social security system that has been in existence in the Muslim world for 14 centuries, the Western world social security system is much more recent, it was first established during the first two decades of the past century (Kahf and Al Yafai, 2015). Zakah is also different from tithes which were church taxes imposed in early Christian times, based on traditions of the Old Testament. Zakah increases productivity, employment, and output, consequently increasing the taxation potential of the governments (Khasandy and Badrudin, 2019). According to Powell (2010), there is some correlation between having a zakah system and both higher wealth and economic equality. Metwally (1983) has given six differences between Zakah and modern taxation that is still relevant. Zakah has a wider base than progressive taxation, it is imposed not only on incomes but idle assets. The proceeds of Zakah go mainly to the poor and needy, thus helping to raise the marginal propensity to consume. Zakah falls on assets that are capable of growing and has stimulating effects on investment. Zakah is a religious tax, collected at all times irrespective of the economic circumstance. The rate of Zakah is fixed and cannot be changed. Finally, the purpose for which the proceeds of Zakah are used can only be those stated in the Holy Qur'an. The following are items covered by Zakah: animal wealth, commercial assets, gold and silver, agricultural products, honey and animal products, mineral wealth and treasures, estates, factories, earning assets and income from employment. Nisab is the minimum level from which wealth is subjected to Zakah; while rate is the percentage/ratio on which Zakah items are taxed. Both the Nisab and rate are fixed in nature and not variable, although there are calls on the need to make them variable. The major beneficiaries of Zakah are listed in Qur'an (9:60). These are the poor, the pauper, the indebted, the wayfarer, the new convert to Islam, liberation of slaves, maintenance of Zakah administration, and in the path of Allah.

*"The alms are only for the Fuqara' (the poor), and Al-Masakin (the needy) and those employed to collect (the funds); and to attract the hearts of those who have been inclined (towards Islam); and to free the captives; and for those in debt; and for Allah's Cause, and for the wayfarer (a traveler who is cut off from everything); a duty imposed by Allah. Moreover, Allah is All-Knower, All-Wise." [Al-Quran 9:60]*

According to Faridi (1981), the detail specification of the items on which the Zakah fund can be expended is eminently useful in the context of the experience of much-developing economies in the modern world. Malaysia's zakah system has been given some credit for the amelioration of poverty and has been touted as a model for other Muslim countries (Powell, 2010).

Operation Research (OR) has to do with improving the operational efficiency of systems, an objective which is one of the cornerstones of modern O.R. (Rajgopal, 2004). It is an approach of picking an "operational" system and conducting "research" on how to make it run more efficiently. Operation research is very handy when it comes to strategic planning and resource allocation. The use of computers has made deployment of OR more easy and mundane task, unlike what was involved before the coming of modern computing. Mathematics is widely used in OR, but operation research is not only about mathematics. It is a systematic approach towards solving managerial problems that use mathematics where possible. The steps involved in OR are (1) Orientation, (2) Problem Definition, (3) Data Collection, (4) Model Formulation, (5) Solution, (6) Model Validation and Output Analysis, and (7) Implementation and Monitoring. In order to achieve efficiency level in the administration of Zakah operation, the use of OR shall be emphasized. OR approach is multidimensional where tasks are carried out by team from different backgrounds such as Economics, Accountant, Marketing, Statisticians, Engineers, etc. According to Rajgopal (2004), OR one adapts a procedure that has already been tried and tested, as opposed to developing a completely new one. Though, in exceptional cases a new approach is required. In case of the Zakah operations, OR objectives may be to reduce cost of Zakah administration, increase total Zakah collection, improvement in the effectiveness of Zakah interventions and long term planning. Objectives are juxtaposed against the available resource constraints. Like in OR study, data of previous Zakah operations shall be used in conducting the contemporary operation research study on Zakah. These data include collection, disbursement, Zakah recipients, cost, payers, workforce, etc. Primary data can be collected through questionnaire survey. All Zakah institutions shall have dedicated data specialists who are knowledgeable of modern computing system. The use of statistics in economics and management is viewed as contributing to regularities, measurement, and presentation of economic data. Today, economic researchers and practitioners are leaning towards empirical works rather than building hypothetical theories. This can be seen from the number of empirical works published by conventional economic journals (Abdullahi, 2018).

In terms of scholarly attention received by Islamic finance on one hand and Zakah, on the other hand, Zakah can be said to have received lesser attention (Abdullahi, 2019). It is observed that it would be difficult to evaluate legal zakah regimes for their effectiveness (Powell, 2010). But, this paper will look at how Zakah institutions in the Muslim world shall be managed to achieve desired results. Poor management of Zakah institutions has been described as detrimental to the efforts of these institutions to collect and disburse Zakah effectively (Abdullahi, 2019). The paper started with introduction followed by review of relevant literature related to Zakah,

it then proceeds to discuss the central topic of the work, and finally it provides conclusions and discussions. Under the central section of the paper, it looks at applications of mathematical and quantitative techniques with the view to achieving optimality and efficiency in the business of collection and disbursement of Zakah. A study by Rahmatya and Wicaksono (2018) tries to formulate the process of Zakah collection and distribution through an information system model. The information system model manages data of muzakki (Zakah payer) and mustahiq (Zakah receiver) and provides some reports such as receipt and distribution of zakat funds. The result is a model of receipt and distribution of zakat funds information system model in citizen association level. Some of the mathematical applications in this work include mathematical techniques of contribution maximization, mathematical programming, and game theory. The work emphasizes the relevance of these tools and others in Islamic economics (Zakah). The paper shows the relevance of Zakah in the wider Islamic economy and its connection with Islamic finance. Countries such as Malaysia and Indonesia have included development of effective Zakah collection and distribution systems into their national financial masterplan. Overall, the work is a contribution to Islamic economic analysis with spillover applications (extension) in other areas of Islamic economics such as Islamic finance and investment. The field of OR has grown to be a discipline of its own, thus this work does not attempt to cover the entire field. As a matter of fact, only three models are analyzed here, game theory, goal programming, and contribution maximization. Thus, there is a lot of scope for studying the use of other OR techniques in Zakah administration.

## 2. Review of Zakah Literature

Not all Muslim nations implement the Zakah system at the national level. In fact, only very few countries do so. As of 2010, of the forty predominantly Muslim countries, twenty-four do not institutionalize zakah (Powell, 2010). The following countries: Egypt, Jordan, Kuwait, Iran, Bangladesh, Bahrain, Lebanon, Qatar, the UAE, Indonesia, and Oman all have implemented centralized Zakah collection and distribution with varying degrees of governmental oversight and involvement. A growing number of Muslim nations are adopting the practice of deducting Zakah from income tax. Some of the countries that imposed collection of Zakah include Saudi Arabia, Pakistan, Libya, Sudan, Malaysia, and Yemen. According to Khasandy and Badrudin (2019) Zakah payment fosters inclusive economic growth that reduces unemployment, poverty gap, and does not harm the environment. Zakah plays an important role in supporting sustainable economic development and facilitating financial inclusion in Muslim nations. According to study by Abubakar and Abdurashid (2010) on motivations of paying Zakah on income, the study concluded that there is a need for proper education on Zakah in order to help the Ummah to benefit from the noble system of Zakah. In a paper on Sudan Zakah system by Hassanain and Saaid (2016), the authors seek to examine the operational efficiency of the nation's central Zakah body i.e. Sudanese Zakah Chamber (SZC); through assessing the impact of SZC programs on its targeted beneficiaries and determine the extent to which SZC is linked to Sudanese Microfinance services (MFS) sector. Their findings show that despite some operational inefficiencies and other challenges facing SZC there exists a positive and significant relationship between its programs and poverty alleviation in the country. It is possible for SZC to advance funds to the MFIs for the specific purpose of improving standard of living through specific microcredit schemes. SZC works very closely with the Social and Saving Development Bank (SSDB) of Sudan. SZC has partnered with the SSDB and government microfinance portfolio to fund projects that are beneficial to Zakah receivers. In Indonesia, according to study by Kasri (2017), different types of zakah organizations tend to focus on different zakah distribution approaches. The study shows the increasing relevance of productive utilization approach to Zakah distribution as well as importance of enhancing outreach and availability of information on zakah programs (including using online channels) and education of zakah stakeholders.

Zakah is an important fiscal policy tool since the time of the early Islamic caliphate. Although Zakah is not an effective fiscal policy tool in the conventional sense of the concept, it can be used for some specific fiscal policy functions, such as the manipulation of the items of collection i. e. collecting in kind or in money or changing distribution pattern or manipulating the time of distribution. For example, to show the importance of Zakah, as an important fiscal policy tool in Islam, Faridi (1983) observed that Zakah is the most important fiscal and distributive mechanism of an Islamic economy. The most important reason behind the decreeing of Zakah is to narrow the gap between the rich and the poor. Zakah is thus mean to redistribute income between the rich and the poor. Hence, not surprising the millennium-old Islam emphasizes on equity and social justice. Powell (2010) in a study on Zakah in the Muslim world found that the sample pool of forty Muslim majority countries he studied appeared to have relatively good GINI indices compared to most comparable and even some more developed economies. Consumption of goods and services is fulfillment of the natural needs and desires of human beings. As such the Qur'an refers to it as an act of deriving enjoyment and satisfaction from what is in the world which is created to serve mankind (Kahf, 1982). Unlike consumption in a conventional system, consumption in Islam is not without some restrictions on the type of consumption to engage in. One such restriction is the restriction of paying Zakah out of one income before consuming it. The multiplier effect of Zakah increases the total amount of disposable income in the hand of consumers, this increases consumption especially of the poor

recipient of Zakah. But, according to Faridi (1981) the resultant multiplier effect is likely to be low on account of strong probability that such funds would for the part be spent on non-durable consumer goods. According to Metwally (1983) because of Zakah on consumption both average and marginal propensity to consume in an Islamic economy could be higher than non-Islamic economy. He also opined that the investment gap at each level of income would be smaller in an Islamic economy. The overall implication of this is to increase the aggregate demand thus increasing production. In the long run, Zakah increases consumption, investment, demand for labor, and stimulate Zakah recipients to become Zakah payers themselves (Khasandy and Badrudin, 2019).

According to some Islamic economists, in true Islamic economy inflation should be a strange and temporary phenomenon. Wherever it occurs, it is seen as a signal that things are not going properly. The elimination of interest and speculation, the emphasis on moderation and cooperation would combine to work against inflation in an Islamic economy in the opinion of certain scholars, the collection of Zakah from the rich and disbursement to the poor who have a higher marginal propensity to consume shall cause inflation (Khan, 1982). Different suggestions were offered on how to deal with the problem of inflation, especially one that resulted from disbursement of Zakah. Khan (1982), Metwally (1983), Kahf (1982b) and Faridi (1981) have suggested changes in the composition (in kind or money) at the end of collection or disbursement as well as manipulations in the time of distribution of the Zakah, in such a way that inflation will be control. In the opinion of Siddique (1982), subjecting hoarded money to the tax of Zakah of 2.5% would discourage hoarding and make money available for circulation, thus, introducing stability in the value of money. Another angle from which Zakah is seen, as acting as anti-inflation, is as a tax on money. Zakah levies, even though not directly connected with current income, will in effect constitute charge on it. With fixed rates, Zakah levies will constitute an inbuilt fiscal stabilizer (Faridi, 1983). The perception among those who are skeptical about Islamic economics is that Zakah would reduce savings (by transferring money from the rich who have high MPS to the poor who have high MPC and therefore investment. This is totally wrong as Fahim Khan (1984) has convincingly argued in his well-known paper. Instead of discouraging investment Zakah increases it, with the imposition of 2.5% Zakah on hoarding of wealth. Therefore, the only alternative is either people increase their savings by at least the amount of Zakah so that the collection of Zakah does not reduce their wealth below the desired level before collection of Zakah or they attempt to invest their accumulated wealth in profitable projects (Kahf, 1982). Thus, Zakah increases savings as well as investment. Using mathematics, Metwally (1983) was able to show that 'because of Zakah, the demand for investment for a given expected rate of profit would always be higher in an Islamic economy than in a non-Islamic free economy'. He demonstrated that investment in an Islamic economy could take place even if the expected rate of profit was zero. Only when the expected rate of profit drops to a negative value given by  $r = E/(e-1)$  where E is rate of Zakah on idle assets and e the rate of Zakah on net returns from investment, would investment cease to take place (Metwally, 1983). Iqbal (2000) advanced the argument in favor of government collection of Zakah in a paper title 'Economic rationale for the state collection of zakah'. He has done this by elucidating the public good character of the rationale for redistribution.

An erroneous idea hypothesized that Zakah reduces employment by shifting money that is supposed to be saved into consumption and by being a disincentive. This is totally wrong, Zakah can only increase savings (investment) through direct and indirect channels, but not reduce it. The increase in consumption as a result of Zakah is good, as it 'would stimulate consumption expenditure and contribute towards closing the gap between income and consumption (Metwally, 1983). Thus, it pushes expected rate of profit upward and this stimulates private investment. Overall, this increase employment generation in the economy. Zakah has also a positive impact on willingness to work. According to Faridi (1981), 'the natural desire to protect one's net saving in the absence of the effortless accretion to it through interest would strength the desire of individual to work harder or to enables others to work harder with the help of his resources. In this way idleness would be discouraged and work rewarded'. The way Zakah is distributed is found to have important implications on the level of employment. At the time of depression and unemployment, according to Kahf (1982) Zakah may be collected and distributed in the form of consumer goods, thus forcing zero saving on the part of Zakah receivers and emptying the shelves of Zakah payers. This increased distribution in the form of capital goods may offer greater employment and better income to the poor, instead of immediate satisfaction (Kahf, 1982, Maulidizen, 2018). Choudhury (1986) mathematically formulate how Zakah can affect labor supply. Achieving economic growth and development is no doubt the prime objective of any economy the world over. The realization of economic growth cannot be possible without the desired level of saving since economic growth depends on the rate of savings. According to Metwally (1983), 'fiscal policy should aim at achieving the maximum mobilization of saving in these economies'. This is where Zakah comes in, Zakah penalization of idle wealth increase saving and investment and from there economic growth. Economic equilibrium is one of the objectives of the Islamic state. General equilibrium is achieved when there is equilibrium in money market as well as goods market. Among the tools suggested to achieve and maintain general equilibrium, two of them are related to Zakah: a general equilibrium tax and the management of the degree of monetization of Zakah. Metwally (1983) has

suggested a variable rate of Zakah where variation is done by the state for equilibrium purposes. Later, he suggested the substitution of the variation of the rate of Zakah by Zakah with a constant rate plus a variable rate general equilibrium tax, because variable rate of Zakah was considered a violation of Shariah by many Muslim scholars. Kahf (1983) on the other hand has proposed the variation in the degree of monetization of Zakah, as leverage in equilibrating the economic activities. In the goods market, the levying of Zakah on waiting assets, in the words of Kahf (1982) 'eliminate an important source of instability in the Islamic markets. This means that demand and prices tend to be more stable in the Islamic markets than in the capitalist market. Zakah, therefore, tends to narrow the gap between income and investment and Zakah is observed to lead to a stable budget.

### 3. Applications of quantitative techniques in the management of Zakah

In line with the aim of this paper of using operation research methods in the management of Zakah, some simple mathematical techniques are used here to show how to optimally manage Zakah functions, taking into consideration the challenges available. The opportunities provided by the use of OR is vast, this paper only analyzed the applications of three OR models.

#### 3.1. Goal programming

Goal programming is used in analyzing wide arrays of goals; institutional entities such as governments and corporate institutions set for themselves a lot of goals to be achieved annually. Goal programming deals with the issue of achievement of desired goals in face of constraints. Just like other nonprofit organizations, Zakah institutions are faced with daunting challenges that have crippled their operations over the years. Some of these challenges have been mentioned in the introduction and literature review sections of this paper. The aim of goal programming is to help overcome these challenges.

A Zakah agency may have the following three goals:

- 1- Higher collection of Zakah ( $X_1$ )
- 2- Reaching the poorest of the poor ( $X_2$ )
- 3- Operational cost efficiency ( $X_3$ )

Each goal can be met individually, however trying to meet all the three at once may at times be very difficult to achieve. It is assumed here that any failure to meet a goal carries a severe consequence (in form of undesirable effects), proportional to the amount by which the goal is not met. The followings are the constraints against meeting the goals:

- 1- Cost constraints ( $x_1$ )
- 2- Technology/information constraints ( $x_2$ )
- 3- Regulatory constraints ( $x_3$ )

Thus, the combined goal is to maximize the Zakah organization's stated goals while avoiding negative consequences and being mindful of the constraints present. This leads to the following mathematical analysis. The general form of the mathematical solution for this problem is as below (see also appendix 1):

$$\text{Maximize } y = f(X_1, X_2, X_3) \quad (1)$$

$$\text{Subject to } g(x_1, x_2, x_3) \quad (2)$$

$$L = f(X_1, X_2, X_3) + \lambda g(x_1, x_2, x_3) \quad (3)$$

After taking the necessary mathematical steps for maximization of a Lagrangean function, we arrive at the equation set that satisfies the above conditions at which our target goals can be optimized subject to our constraining peculiarities. Another very useful alternative method of treating this problem is linear programming by means of simplex method.

#### 3.2. Application of game theory in strategic planning

In a paper on the use of strategic planning in enhancing the performance of Zakah institutions in Indonesia by Kasri and Putri (2018), the authors affirmed the importance of strategic planning in increasing Zakah organization's performance. The study also observed that corporate zakah agencies have the highest collection capacity. For decades now strategy planners in governmental organizations, corporate firms, and nonprofit organizations have applied game theory in their strategic planning. In most of these cases planners developed models to explain the options available to their institutions taking into consideration the options available to

their rivals. Game theory has been used to analyze world geopolitics, corporate rivalry between firms competing in a particular market, sporting games, etc. In this particular game model, it is calculated the options available to a Zakah institution, assuming that its major rival in collecting tax from the public is the conventional government tax authority that collects tax on behalf of the government. This assumption is based on the fact that in most Muslim nations government collects tax *visa vi* Zakah which is collected either by government-supervised agency or independent religious council. Thus, Zakah institutions have to take into consideration the fact that most of the rich Muslim population, while it is compulsory on them to pay Zakah as a religious duty, they must also pay government taxes depending on their source of income, spending and business interests. In a highly religious society the work of Zakah institution in terms of collection of Zakah is lesser, requiring less amount of time, energy and monetary cost. But, such an ideal Islamic society is much difficult to find today, wealthy Muslim Zakah payers must be motivated through education and law enforcement. Thus, assuming both Zakah management and government tax collection agency have two tools for collection of Zakah or conventional tax at their disposal: education/enlightenment and enforcement. The illustration below shows how Zakah management shall utilize their options in face of competition from government tax agency (see also appendix 2 for mathematical treatment).

**Table 1.** Game plan

		Tax agency	
		Education/enlightenment	Enforcement
Zakah Agency	Education/enlightenment	Z, t	Z, T
	Enforcement	z, t	z, T

Source: Author analysis

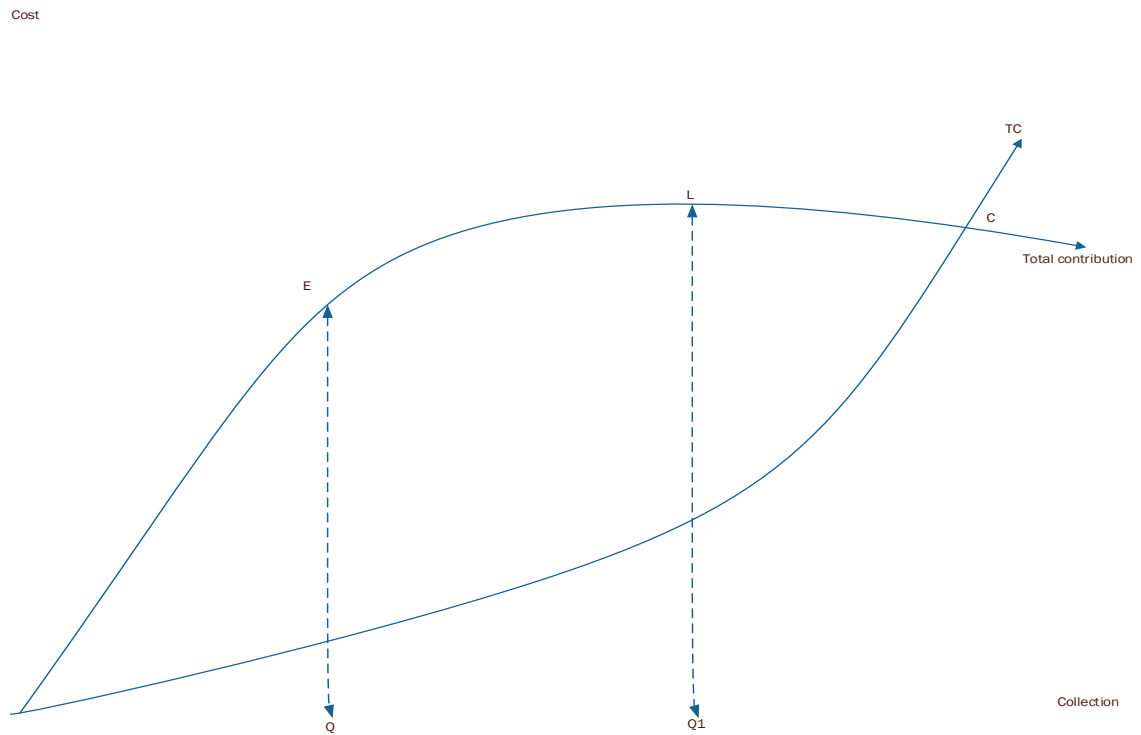
For the Zakah agency (looking at their present status in most Muslim nations, as a bit powerless) the use of education/enlightenment is their most important source of strength. While for government control tax agency (looking at the non-cooperative nature of developing countries citizens when it comes to paying tax) enforcement by means of law enforcement power available to tax authorities is the most important source of power. But, in certain circumstances a source of strength can turn out to be the weakest option. Thus, in the above game equilibrium is reached where Zakah agency adopts education/enlightenment while the tax agency adopts enforcement.

### 3.3. Analysis in contribution maximization

Like a mainstream firm, Zakah collection management has aspiration levels. For example, they may want to collect the maximum Zakah possible at the minimum cost possible. As a religious assignment, Zakah collection may continue up to the point where marginal contribution equals zero. The point L (on the curve below) explains the reason why Zakah agencies shall manage the costs involved in Zakah collection and distribution; because it does not make sense to allow the cost of managing Zakah operations to continue to rise up to (and beyond) the point C where the total cost of Zakah collection and distribution is more than (or equal to) the total amount of Zakah collected. Thus, at point L, the Zakah administrators must find the necessary ways of reducing the costs associated with Zakah administration. In other words, point L means that the cost of administering Zakah is rising at increasing rate while the total Zakah collection is rising at decreasing rate. Thus, it did not make economic and managerial sense to continue managing Zakah in this way. Though due to the religious significance of Zakah there will not be a stop to collection and distribution of Zakah, management must find ways to cut the total cost involved to the level corresponding with L. This is shown in the following figure.

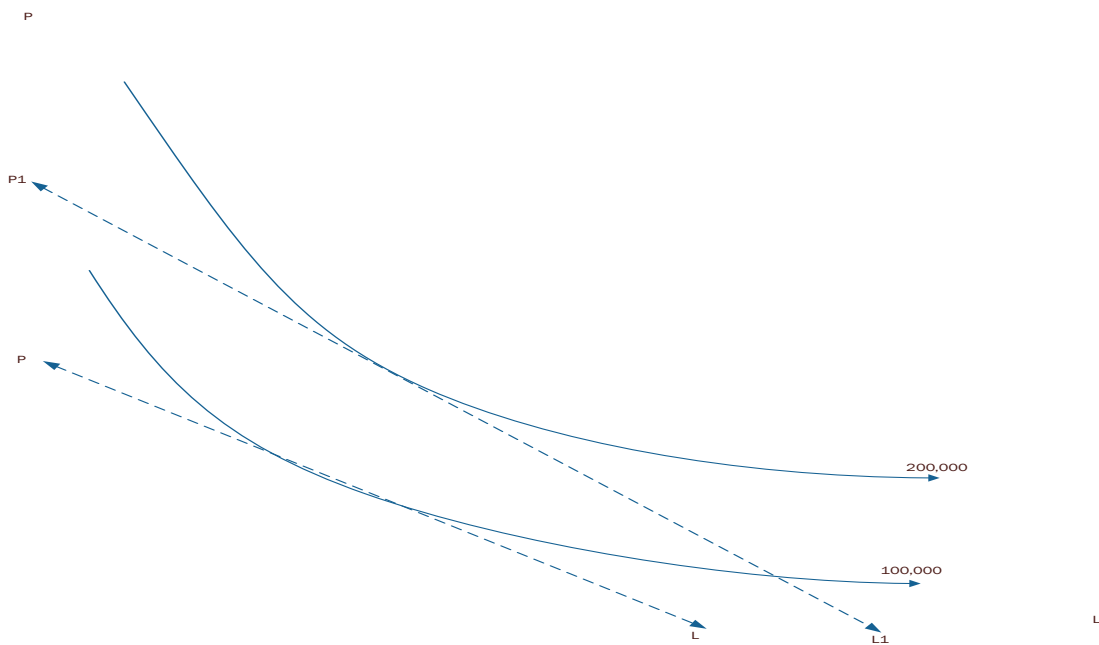
At point L on the total contribution curve, the total collection is Q this is greater than Q to be collected at point E and marginal contribution at this point (i.e. L) is zero. It is also clear that it is only at point C that total contribution equal total cost. Allah in the Holy Qur'an has described man as niggardly, love evil and love wealth; to invite people into paying Zakah require not only sending Zakah collectors but education and enlightenment by means of preaching and modern media campaigns. This is the analysis that means putting more emphasis on enlightenment and publicity. Thus, to move from one contribution curve to a higher one, the relative increase in labor and publicity in this example have to favor publicity/enlightenment.

**Figure 1.** Contribution curve



Source: Author

**Figure 2.** Collection curve



Source: Author

In the above diagram it can be seen that to move from a collection of 100,000 to 200,000, the increase in expenditure on enlightenment/publicity from P1 to P2 is greater than the increase in labor from L to L1.

**4. Conclusions**

Most of the empirical pieces of evidence on Zakah gathered so far have indicated that the full potential of Zakah can go as high as 4.3 percent of GDP. This is clear evidence of the effectiveness of Zakah as economic policy

tool in Muslim nations. But, the question is how the present Muslim nations could achieve such level of Zakah collection today. Previous studies on this matter are not very optimistic looking at the present state of Islamic nations around the world. This called for seriousness on the part of Muslims nations' governments. It also called for development of the institution of Zakah at both macro and micro levels. But, as discussed in this paper, Zakah problem is not restricted to collection alone but the overall inefficiency of management of Zakah institutions. This most change, efficiency shall be the watchword. This work tries to explain the use of operation research techniques to improve the efficiency of Zakah institutions around the Muslim world. There has been outcry about the increasing cost of running a Zakah program which calls for the need to find means of reducing cost. The amount of Zakah collection spend on administrative functions of the Zakah agencies in the Muslim world is not consistent. It changes from 10% in Libya to 14.5% in Sudan, thus, any managerial procedure that will help minimize the cost of collection and distribution of Zakah shall be welcomed. The potential application of this field of research to Zakah operations is very vast. It calls for concerted efforts and focuses by researchers, policymakers and Islamic scholars on finding the most efficient way of deploying operation research techniques in the management of Zakah institutions in the Muslim world. Overall, Muslim nations shall develop their national economies because economic growth and development have positive relationship with the amount of Zakah collection in an Islamic economy. A country with relatively rich citizens will have more Zakah payers than a country with poor citizens. Islam has always put emphasis on trade and lawful earning right from the time of prophet who himself engaged in trading activities. Thus, Islamic nations shall emphasis developing opportunities for their people to become independent and wealth creators so as to be able to become Zakah payers, not receivers. While Muslim nations shall not make the mistake of giving priority to growth over equality, but growth too shall not be neglected entirely. Islamic economics is about economic growth with equity. The use of microfinance institutions (MFI) will greatly reduce the cost of running Zakah operations since MFIs have their own staff who will disburse Zakah fund to target beneficiaries. Countries shall borrow from the example of Pakistan where commercial banks were used in collection of Zakah. This too will go a long way in increasing the operational efficiency of the system.

#### 4.1 Areas for further research

Looking at the voluminous literature on operation research that developed over the past decades, there is a lot of opportunities for application of the same techniques in Zakah management. Muslim mathematicians, statisticians, and economists shall develop specific quantitative techniques to take care of the peculiar needs of Zakah institutions around the Muslim world. OR techniques developed for use by conventional tax agencies can also be co-opted to serve the needs of Zakah management. The intersection between ethics, management and OR shall be the focus of future works in this area. More research shall be undertaken to find out ways to develop synergies between Zakah institutions and Islamic microfinance institutions.

#### ACKNOWLEDGEMENT

The author will like to acknowledge the valuable comments by the journal editor and two anonymous reviewers.

#### REFERENCES

- Abdullahi, S. I. (2004). *Role of mathematics in Zakah assessment and collection*. (Unpublished Thesis) Department of economics, Usman Danfodio University Sokoto, Nigeria.
- Abdullahi, S. I. (2018). Contribution of mathematical models to Islamic economic theory: a survey. *International Journal of Ethics and Systems*, 34(2), 200-212.
- Abdullahi, S. I. (2019). Zakah as tool for social cause marketing and corporate charity: A conceptual study. *Journal of Islamic Marketing*, 10(1), 191-207.
- Abubakar, N. B. and Abdurashid, H. M. (2010). Motivations of paying Zakat on Income: Evidence from Malaysia. *International Journal of Economics and Finance*, 2(3), 76-84.
- Choudhury, M. A. (1986). Role of Zakah, the Islamic quasi wealth tax. in M. A. Choudhury (Eds) *Contribution to Islamic economic theory: A study in social economics*. London, Macmillan.
- Faridi, F. R. (1981). Zakah and fiscal policy. In K. Ahmed (Eds), *studies in Islamic Economics*. Jeddah, International Centre for research in Islamic economics.
- Faridi, F. R. (1983). A theory of fiscal policy in an Islamic state. In Z. Ahmed (Eds), *Policy and resources allocation in Islam*. Jeddah, International Centre for research in Islamic economics.
- Hassanain, K. and Saaid, A. E. (2016). Zakah for Poverty Alleviation: Evidence from Sudan. *International Research Journal of Finance and Economics*, 154, 83-104.
- Iqbal, Z. (2000). Economic rationale for the state collection of zakah. *International Journal of Islamic Financial Services*, 2(1), 11-37.



- Kahf, M. (1982). Saving and Investment functions in a two sector Islamic economy. In M. Ariff (Eds), *Monetary and fiscal economics of Islam*. Jeddah, International Centre for research in Islamic economics.
- Kahf, M. (1982b). Fiscal and monetary policies in an Islamic economy. In M. Ariff (Eds), *Monetary and fiscal economics of Islam*. Jeddah, International Centre for research in Islamic economics.
- Kahf, M. (1983). Taxation policy in an Islamic economy. In Z. Ahmed (Eds), *Fiscal policy and resources allocation in Islam*. Jeddah, International Centre for research in Islamic economics.
- Kahf, M. and Al Yafai, S. (2015). Social security and Zakah in theory and practice. *International Journal of Economics, Management and Accounting*, 23(2),189-215.
- Kasri, R. A. (2017). Management of Zakah Distribution: Empirical Evidence from Indonesia. *AFEFI Islamic Finance and Economic Review (AIFER)*, 2(2),1-15.
- Kasri, R. A. and Putri, N. I. (2018). Does Strategic Planning Matter in Enhancing Performance of Zakah Organization? Some Insights from Zakah Management in Indonesia. *International Journal of Zakat*, 3(1),1-21.
- Khan, M. A. (1982). Inflation and the Islamic economy: a closed economy model. In M. Ariff (Eds) *Monetary and fiscal economics of Islam*. Jeddah, International Centre for research in Islamic economics.
- Khan, M.F. (1984). Macro consumption function in an Islamic framework. *Journal of Research in Islamic Economics*, 1(2), 3-25.
- Khasandy, E. A. and Badrudin, R. (2019). The influence of Zakat on economic growth welfare society in Indonesia. *Integrated Journal of Business and Economics*, 2,125-140.
- Maulidizen, A. (2018). Zakah as instrument Islamic microfinancing mechanism to productive Zakah recipients in Malaysia. *International of Nusantara Islam*, 6(2),115-124.
- Metwally, M. M. (1983). Fiscal policy in an Islamic economy. In M. Ahmed (Eds), *Policy and resources allocation in Islam*. Jeddah, International Centre for research in Islamic economics.
- Powell, R. (2010). Zakat: Drawing insights for legal theory and economic policy from Islamic jurisprudence. *7 Pitt. Tax Rev.* 43,12-31.
- Rahmatya, M. D. and Wicaksono, M. F. (2018). Model of receipt and distribution of zakat funds information system. *IOP Conf. Series: Materials Science and Engineering*. 407, 012071, doi:10.1088/1757-899X/407/1/012071.
- Rajgopal, J. (2004). Principles and applications of operations research. *Maynard's Industrial Engineering Handbook*, 5th Edition, (11.27-11.44). New York, McGraw-Hill.
- Siddiqi, M. N. (1982). Islamic approaches to money, banking and monetary policy: A review. In M. Ariff (Eds), *Monetary and fiscal economics of Islam*. Jeddah, International Centre for research in Islamic economics.

## APPENDIX 1. Goal Programming Problem

Notational presentation of Goal programming problem

$$\begin{aligned} \text{Maximize: } & \quad \emptyset = \sum_{j=1}^n c_j x_j \\ \text{Subject to: } & \quad \sum_{j=1}^n a_{ij} x_j \leq r_i \quad (i = 1,2,3) \\ \text{And,} & \quad x_j \geq 0 \quad (j = 1,2,3) \end{aligned}$$

## APPENDIX 2. APPLICATION OF GAME THEORY IN STRATEGIC PLANNING

For a Zakah agency the strategy options are:

Let  $\mathbf{p}_z, \mathbf{p}_t$ , be the probabilities with which Zakah agency select its strategy; z = education/enlightenment and t = enforcement

As usual,  $0 \leq \mathbf{p}_i \leq 1$  is probabilities of Zakah agency selecting its strategies ( $\mathbf{i} = \mathbf{z}, \mathbf{t}$ )

$$\text{Thus, } \sum_{i=z} \mathbf{p}_z = \mathbf{z} \text{ or } \sum_{i=t} \mathbf{p}_t = \mathbf{t} \quad \dots (1)$$

For the conventional taxation agency:

Let  $\mathbf{k}_t, \mathbf{k}_z$ , be probabilities of conventional taxation agency selection of strategy

As usual,  $0 \leq \mathbf{k}_j \leq 1$  is the probabilities of conventional taxation agency selecting its strategies ( $\mathbf{j} = \mathbf{t}, \mathbf{z}$ )

$$\text{Thus, } \sum_{j=z} \mathbf{k}_z = \mathbf{z} \text{ or } \sum_{j=t} \mathbf{k}_t = \mathbf{t} \quad \dots (2)$$

Both agencies attain an optimal level where:

$$\sum_{i=z} \mathbf{a}_{zt} \mathbf{p}_z \geq \mathbf{U} \quad \mathbf{i} = \mathbf{t}, \mathbf{z} \quad \dots (3)$$

$$\sum_{j=t} \mathbf{a}_{zt} \mathbf{k}_t \leq \mathbf{U} \quad \mathbf{j} = \mathbf{t}, \mathbf{z} \quad \dots (4)$$

U here is defined as the value of the game; in equation (3) Zakah agency expected gain from using education/enlightenment is at least as large as U when conventional taxation agency employs its best strategy which here is enforcement. While at equation (4), lost to be incurred by conventional taxation agency is not higher than U. Thus U is the outcome expected at the equilibrium.