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Abdulazeem Abozaid(Author) *Hamad Bin Khalifa University,* *Qatar Foundation*	**Universal Basic Income from Islamic Economics Perspective**

Abstract

The constant concern for ensuring that the basic needs of every human are met has prompted various steps with an aim to promote equality. This concern has eventually led to an increasing demand to guarantee a reasonable standard of living. Some economists have recently revisited the concept of Universal Basic Income (UBI) that has caught the interest of some governments and policy makers. This paper investigates the concept of UBI from an Islamic perspective. It traces the conceptual origins of UBI back to the Islamic society since the early Islamic history. The study provides a historical overview of the Islamic societal roots of social justice and explores the compatibility of UBI with Islamic law and its objectives. The paper concludes with policy recommendations for implementing UBI in accordance with Islamic legal and ethical standards. Based on comprehensive historical and legal analyses, this study seeks to augment the socioeconomic welfare discourse and provide insights that connect the current economic theory of UBI with classical Islamic legal and economic thought.

Keywords: Universal Basic Income, UBI, Minimum wage, Islamic Law, Islamic economics, social welfare.

Introduction

The concept of Universal Basic Income (UBI) has recently gained renewed interest among policymakers and governments as a viable fiscal solution to reduce income inequality in their societies. While few governments have debated its potential, others have tested the concept on select samples of societies. UBI has become more relevant with the advent of Artificial Intelligence and the global outcry that further technological advancements might result in widespread unemployment and economic crises. The concept has regained traction due to challenges of technological progress, automated workforce, decreased employment opportunities, evolving work dynamics, increasing economic inequality, and the constraints of existing welfare systems. Economists and policymakers have increased their appeals for governments, particularly in Western countries, to create a fiscal system that distributes fixed incomes to all its citizens on a periodic basis. These calls had further

intensified during the COVID-19 pandemic, as a result of which several countries granted periodic financial assistance to those citizens who fell under certain criteria.

Ortiz et al. (2018) and Gentilini et al. (2020) define UBI as "a social protection programme that unconditionally transfers cash to all individuals". A more specific definition according to Rothstein (2017) is "[An] unconditional universal basic income (UUBI) [is in which] every citizen will be entitled to a basic income that frees them from the necessity of having a paid job". A basic income could be better understood as "a guaranteed minimum cash payment, granted periodically to all the citizens of a country as a right, regardless of their income or employment status". UBI proposes that the governments provide a consistent periodic sum to every person after a certain age throughout their life unconditionally, i.e., without requiring any work in exchange and without any assessment of their financial status.

The concept of UBI may be traced back to the early 16th century, when Thomas More published his 'Utopia' in 1516 (Covert, 2018). He proposed a fiscal system that ensured adequate financial resources for everybody to eliminate the increasing problem of theft and promoting social stability. Later in the twentieth century, prominent economists, politicians, and Nobel laureates like Juliet
Rhys-Williams, Milton Friedman, and James Tobin etc. endorsed similar concepts (Straubhaar, 2017). Friedman (1962) proposed a concept of 'Negative Income Tax' (NIT) in as a combination of income tax and social transfers (Widerquist, 2019), while closer to UBI's concept is Tobin's (1966) 'demogrant' model advocating for an income guarantee based on the concept of UBI (Sloman et al., 2021). Later, Van Parijs (1992) further developed the UBI concept and established the European Basic Income Earth Network (BIEN) in 1986. However, this paper contends that similar concepts existed much earlier in Islamic teachings and was practiced to some extent in the seventh century Islamic history.

The current increased traction in the concept of UBI stems from the rising global economic disparity. As understood from the above definitions, the primary objective of UBI is to guarantee everyone in any given country with adequate finance to meet their basic needs, irrespective of their job status or economic conditions, to ensure everyone lives a dignified life. UBI is known by various terminologies like Citizen's Basic Income (CBI) in the United Kingdom, and Citizen's Guaranteed Income (CGI) in the North America, but the principle idea remains the same. Many developed and developing countries alike, such as Brazil, Canada, China, Finland, India, Namibia, Switzerland and the United States (Merrill et al., 2022) have included UBI in their political and economic discourse, debating over its viability and sustainability (Van Parijs, 2001). Several pilot projects have been undertaken in few countries, like the USA, Canada, Brazil, Namibia, India, and China, that targeted certain society sectors. The experimental initiatives revealed promising results in terms of poverty reduction, improved health conditions, and enhanced economic activity (Perkio, 2014). Yet, ideal data-backed solutions are yet to be discovered through further focused experimentations.

The UBI model is different from other types of government payments and welfare programs. While there is considerable overlap between welfare systems and basic income, UBI may vary due to several forms, like differing depending on age, eligibility requirements, family demographics, payment frequency, and its target categories like income inequalities below the poverty line (Gentilini et al., 2020). Furthermore, the operational models of UBI vary greatly across the countries that nevertheless acknowledge the concept, due to factors like local economic, political, and social variables. Spicker (2011) suggested that either public authorities give a minimum income guarantee or there should be a social insurance payment policy that assures compensation in the event of sickness, unemployment, or old age depending on their contributions over time. Such an implementation was evident during the 2019 pandemic in a few countries like Canada. Few other operational modes, such as the UK's Child Benefit Plan or Canada's monthly child payments, are focused on supporting families with children, counting them under 'vulnerable groups'. Whereas in India, the modes of operations vary significantly depending on regional economic and social dynamics. Schemes include loan waivers, cash distributions, special loans to farmers and crop insurance, scholarship opportunities to unemployed youth, etc. Thailand is piloting a similar program that will distribute digital money to low-income citizens and requires spending in their native districts. Besides, global welfare programs like affordable healthcare, subsidized housing, academic scholarships, etc. have shared objectives that of UBI although the overall concept might differ. Concerns about curtailing these welfare schemes if UBI is implemented are unwarranted, as the welfare systems and UBI can coexist and, in fact, function concurrently in numerous cases.

While individuals from various political, academic, philosophical, and religious backgrounds find UBI appealing and support the concept (Widerquist et al., 2013), faith-based communities also need to play a significant part in government initiatives that promote social justice. Muslim viewpoints on UBI have been absent from economic discussions such as these, even in Muslim majority countries. While economics and finance are widely studied and discussed in Islamic religious educational circles, UBI (as a model) has not been in religious discourse although the underlying principles are largely compatible with religious economic thought. A comprehensive literature review shows that there has been little discussion on Islamic perspectives on Basic Income. Perhaps this could be due to the fact that much of religious normative discourse (Rahim, 2003) is focused on Islamic social welfare systems like zakat, sadaqah, and other charity institutions that are directed towards 'poverty alleviation'. Similarly, Siddiqui (1988) concludes that discussions have been circulating around the concept of 'distributive justice' in Muslim public and economic policies. Despite acknowledging the need to alleviate collective poverty in a society, novel modes of economic applications like UBI have not been discussed among Muslim jurists. However, these discussions in the books of classical Muslim jurists frequently align with the notion of Basic Income.

Muslim scholars, like Al-Mawardi, Al-Ghazali, and Ibn Khaldun, regard the state accountable for fulfilling the collective basic needs of its citizens. Al-Mawardi (1989) stated that "the ruler is

responsible for the welfare of the people and must do everything that he considers [is] good for them". Muslim scholars of jurisprudence have highlighted the moral obligation of state authorities to ensure the wellbeing of everyone, protect the interests of its citizens, and to sustain economic stability and promote its growth. These jurists have determined that efficient public policies are important (Al-Mawardi, 1989) to guide and correct the market mechanisms and to supplement the private sector in their economic efforts.

Concerns of public interest including the socioeconomic wellbeing is a socially obligatory duty (fard kifayah). According to Islamic jurists like Al-Ghazali, governmental resources are a trust that must be used for the benefit of its people (Al-Ghazali, 2008). It is the state's ultimate responsibility to utilize the state's resources to provide its citizens for the fulfilment of their fundamental human necessities. Al-Ghazali states that "it is incumbent on the ruler to help the people when they are facing scarcity, starvation, and suffering, especially during a famine or when prices are high, and people fail to earn a living in these circumstances, making it difficult for them to make ends meet. In such circumstances, the ruler should provide food and financial assistance from the treasury to improve their situation" (Al-Ghazali, 2008).

Literature Review

The economic idea of a state-guaranteed minimum basic income can be traced back to early 16th century literature, in Sir Thomas More's 'Utopia' (Covert, 2018). Later American Nobel laureates Milton Friedman (1962) and James Tobin (1966) developed concepts similar to UBI (Straubhaar, 2017). With a comparable goal of 'meeting the basic needs' of the global populace, the United Nations Development Programme (UNDP) was later established in the 1970s serving as a global platform to study and develop strategies that would ensure fulfilment of fundamental human requirements.

From an Islamic perspective, Rahman (1969) advocated that the state should be obligated to provide basic income as grants to its citizens using the state treasury. According to Quran, every human being is unambiguously entitled to the God-gifted resources on earth (Quran, 2:29, 15:20, and 41:10), and the state is entrusted to ensure receiving his entitlement. He outlined the categories of qualified beneficiaries of this basic income grant, based on the Quranic verse of zakat (Quran, 9:60) and argued that these categories should be included in a register of the state, following examples from the early Islamic Caliphate (Rahman, 1969). Munawwar Iqbal (1988) concentrated on the concept of 'distributive justice' emphasizing the importance of need fulfilment of everyone according to Islamic economic thought.

Hasan (1997) elaborated on the issue of Basic Income from two main viewpoints. Based on the Islamic mandatory charity institution of zakat and its elaborative rulings, he reasoned that the nisab (threshold) of zakat could define 'poverty line' and further assist in identifying those citizens who

would be eligible for financial assistance. He argued that the components of basic needs cannot be standardized, because this should be defined according to the socioeconomic realities of individual countries (Hasan, 1997). He further identified food, clothing, shelter, education, and healthcare as vital necessities. Zubair Hasan (2019) examined UBI from a human development perspective. In his study, he concentrated specifically on the Organization of Islamic Cooperation (OIC) nations and studied their human development indices. His study showcases the economic disparity within the OIC countries that are majority Muslim nations.

Al-Shami and Bullock (2019) attempt to identify financial sources as per the Islamic financial concepts and approached the subject of UBI to ensure its sustainability without stressing the state financial budgets. Like others, they also explore the Islamic concept of social justice and identify the similarities between the Islamic notions of state responsibility of the welfare of its citizens and the conventional concepts underpinning Basic Income. Their study focuses on Islamic concept of 'wealth' to identify revenue streams that could finance the state expenditures and propose a financial system that can sustainably finance a basic income for all. Similarly, Raheem (2021) explores the Islamic concept of waqf (endowment) and investigates whether waqf properties can be utilized to fund UBI under an Islamic economic system. His study acknowledges that the waqf properties are mismanaged and disregarded despite its economic benefits, and hence studies the feasibility to reinvigorate waqf as a sustainable funding vehicle for UBI. These researches (AlShami & Bullock, 2019; and Raheem, 2021) concentrate on financial sources of UBI payment revenues, yet lack clear Islamic legal and jurisprudential endorsement or aversion to the concept of UBI.

This paper seeks to bridge the gap by addressing the concept of UBI from an Islamic perspective, integrating a comprehensive *Maqasidi* framework and an Islamic legal approach, without delving into the sources of funding the state treasuries in general or UBI expenditures in particular.

Advantages and Disadvantages of UBI

The concept of UBI is gaining momentum globally as a viable tool for combating poverty and economic inequality. However, significant concerns and challenges are also raised against it, particularly in the context of developing countries. Critics argue that determining an exact UBI amount is fundamentally arbitrary, as this amount would require constant modifications depending on the changing economic conditions, inflation, and demographic trends like income and family composition. These regular adjustments to the UBI amount might be time-consuming and inefficient.

Critics also include the arduous challenge of continuously funding the UBI scheme to maintain its sustainability. A sustainable UBI program that requires substantial financial resources could result in a major reduction in existing welfare programs or lead to end the programs. This could result in simply replacing existing programs without demonstrating any results in the goal of poverty alleviation.

Furthermore, in countries with informal economies, UBI raises complex technical challenges such as setting eligibility criteria. These technical challenges and its sustainability issues raise concerns about UBI's viability and feasibility.

A proper implementation of UBI comes with its own challenges. This begins with identifying the target beneficiaries which is daunting, especially in populous countries and in poor nations. Demographic characteristics can be further complicated in informal economies, and in most developing countries where statistics are gained from corrupt state officials. Independent assessments of the social demographic also remain unreliable after a period of time due to various factors including social, economic, and political. Implementation also includes logistical issues which poses practical challenges in efficient delivery of UBI payments. Most of the poor members of the community live in remote rural areas where the banking infrastructure is usually limited, and this would complicate the precise delivery of UBI funds. Given these multiple challenges, Ghosh (2019), and Chancel & Piketty (2021) propose that global economies adopt or innovate other feasible economic programs to tackle poverty alleviation and inequality, augmented with social, educational, and fiscal measures (Chancel & Piketty, 2021).

On the contrary, many economists and policymakers remain interested in the concept of UBI, alluding to its potential to alleviate poverty and improve income equality. Proponents claim that funding a UBI scheme may not require reducing or abolishing existing government subsidies. Concerns that UBI could undermine employment incentives are also unwarranted, although debatable. UBI is designed as an income insurance program rather than a replacement for employment. UBI payments will guarantee only the basic needs of the individuals and families, and will not cover the essentials and luxuries, and hence cannot discourage people from working to improve their lives or grow financially. In their study, Painter & Thoung (2015) mention examples from historical trial UBI programs that rather demonstrated continued job motivation in addition to improved academic performance, less domestic violence and reduced mental health issues.

A key advantage of an efficiently implemented UBI is its ability to ensure that the basic needs of all the citizens are met. It is a fundamental human right to a decent and acceptable standard of living. With the pace of technological advancements and artificial intelligence, there is a possibility of rising levels of unemployment across the globe. Many skills and professions may become outdated resulting in decreased demand for the workforce, due to smarter machines growing more ubiquitous. Manyika (2017) predicts that automated technological advancement will influence almost half of the world economy, i.e., it will have a direct financial impact on 1.2 billion employees or an estimated 14.6 trillion USD in wages. According to McKinsey Global Institute's report (2017), 60 percent of the world's professions admit that the progress in automated technology will impact 30 percent of their total activities, implying that they will have to tolerate layoffs at this pace. This further adds to the necessity of imparting efforts in developing UBI regulations to ensure its advantages are aptly met.

Many countries that currently provide financial support and offer welfare schemes are targeting only to low-income individuals or families. UBI has the potential to reduce the financial burdens of these countries by assisting in reducing the significant expenses associated with validating the eligibility of the beneficiaries. Resources used in these tasks can be better utilized by redirecting it towards direct help to the population without recurrent verification of applicants' eligibility.

An adequate UBI amount should practically be sufficient to cover the basic living needs. This would enable people to seek work that suits their interests and talents, and save them from ruining their prime age by working passionlessly only to fulfill their basic financial requirements. It would enable people to pursue employment where they feel enthusiastic, leading to enhanced productivity and a dignified lifestyle. Financial desperation and economic constraints require many people to acquire jobs or continue that do not fit their actual skills and abilities. While UBI can encourage people to learn new skills and acquire qualifications that would benefit society at large, UBI also indirectly limits the exploitation of employers as they will have to consider a variety of employee demands beyond mere financial compensation.

Technically, as a socioeconomic program, the implementation of UBI can be a strategic step towards the consolidation of fiscal resources and social protection programs. Social advantages of UBI include adequate parental time and enhanced family relationships. Increased parental care and adequate familial participation can have long-term impacts on child development and social wellbeing. Additional benefits of an efficient UBI implementation include simplifying the disbursement process of social security funds, resulting in the reduction of risk of fraud and maladministration, while ensuring proper inclusion and exclusion of eligible beneficiaries. By streamlining these processes, UBI holds promising results in improving the efficiency and efficacy of social welfare programs, by streamlining these processes, resulting in a robust safety net for all citizens.

Given the potential advantages and perceived challenges of guaranteeing a regular periodic income, it is important to consider the perspective of Islamic law on the subject. It is imperative to analyze whether the concept of UBI is consistent with he principles of Shariah and is compatible with the Islamic economic theory.

Precedent of UBI in the Islamic history

The concept of a state fulfilling the fundamental needs of its citizens is considered to have originated in early Muslim societies (Rahman, 1969). From an Islamic historical point of view, the policy's focus on meeting basic necessities can be dated back to the seventh century itself with the advent of Islam. Basis the socioeconomic and political understanding of Islam, the earliest Islamic society was built around values supported by religious beliefs, as Qureshi (1982) cites, like morality, fairness, societal cooperation and collaboration, and socioeconomic equality, regardless of race, religion, or language.

The principle of the state guaranteeing sustenance to all its citizens was founded based on various religious texts that emphasize equality and everyone's rightful entitlement to God's gifted resources (Quran, 2:29. 15:20, and 41:10). Early Muslim philosophers like Ibn Khaldun (1993) argued that a nation's prosperity or decline is determined by the wellbeing of its people, indicating that efforts to fulfill social goals were considered pivotal for the society's collective welfare.

Literature of Islamic history reveals some of the management practices of public funds, including the challenge of proper distribution of state's financial assistance. Abu Yusuf (1979) records that as part of the state's fund management, the Islamic state would retain its annual expenditure and donate the surplus among its citizens. Narrations reporting the Prophet's political practices show that despite limited state resources during his time, the Prophet used to distribute the money among all the people, as and when the state would receive funds. (Abu Yusuf, 1979). Such a distribution policy continued after the Prophet during the time of the first caliph, Abu Bakr Al-Siddiq. The Islamic state later flourished extensively under the following caliphs, enabling the state to provide abundant financial support to its citizens, which saw modifications to its distribution systems. After covering the necessary state expenditures, the surplus was distributed according to certain criteria that were designed based on notions of justice and fairness of access to public funds. (Abu Yusuf, 1979).

Umar bin Al-Khattab, the second caliph (634 AD – 644 AD), developed a register for the recipients of the state treasury and its surplus. This register, known as *Diwan al-Ata* (meaning: Register of Treasury Grants), included the social security system to manage the state finances responsibly, representing a significant development in the provision of welfare in Islamic societies. Together with the *Diwan al-Ata*, a financial institution named *Bayt al-Mal*, or the Department of Public Treasury, was established (Ibn al-Jawzi, 1998). This financial agency would hold the governmental funds from where the revenues were distributed to the citizens.

Ibn al-Jawzi (1998) documents that based on the register, the caliph would distribute the money annually to all the citizens to ensure basic income for all. Funds were distributed to the elderly, the young, the newborn, the free, the slaves, and the needful Muslims and non-Muslims (known as *kitabis*; people of the books) alike living in the Muslim state. All the names, entitlements, and distributed funds were recorded in the *Diwan al-Ata* registry (Ibn al-Jawzi, 1998). Later a few eligibility criteria were introduced to limit unconditional financial grants and to ensure efficient distribution of extensive funds.

Eligibility criteria and distinctions included when one accepted Islam, military service, the proximity of residence to enemy lands, etc. (Al-Tabari, 1967). Those living closer to the enemy states were also considered given their unceasing duty of guarding the state boundaries (Abu Yusuf, 1979). Factors like the recipient's fortune were also considered so that the wealth was not concentrated among a small group of specific people. These reasons formed grounds for the caliph's sociopolitical decision to not divide the lands of Iraq and the Levant among the warriors. As part of newly acquired wealth and

funds management, Umar retained the conquered lands in the hands of their actual owners and instead levied a specific tax on those lands known as '*kharaj*'.

Kharaj is a land tax levied according to the size of the agricultural production of those lands (AlZuhaili, 2017). Later, with the continued expansion of the state and the increase in state treasury that exceeded the basic needs of the people, he relaxed some criteria and accordingly distributed the surplus (Abu Yusuf, 1979).

Based on this historical analysis, it can be concluded that:

- According to Islam, it is the state's responsibility to ensure fulfilling the basic needs of all its people. The multiple fund-generating resources of the state like *al-kharaj, al-jizya*, and *al-fai*[1] guarantee its ability to do so.
- After covering the expenditures of the state and ensuring that the basic financial needs of the people are met, the Muslim state used to distribute the surplus from the *Bait al-Mal* among its people.
- While providing for the basic needs of the poor and the needy is a responsibility of the Muslim state, the unconditional distribution of surplus funds to all its people was a courtesy of the state, and not an Islamic obligation or a religious policy. Hence, systematic distributions and eligibility criteria were later created in Islamic history.

The later introduction of eligibility factors to include and exclude from the registry falls under the Islamic state policy known as *Al-Siyasa Al-Shar'iyya*. This implies that the modifications in public policies, whether social, economic, financial, or political policies, are subject to *Maqasid alShariah* (objectives of Islamic law) considerations. The government must hence evaluate both the predicted harms and expected benefits of its acts and decisions before endorsing it as a state policy. Given this implication, the paper will briefly explore the *Maqasid* considerations, and assess the concept of UBI in terms of prospective harms and benefits according to *Maqasid al-Shariah*.

Maqasid Considerations

The theory of *Maqasid al-Shariah*, or the higher objectives of Islamic law, has a significant impact on the legal judgments and rules that regulate public contractual relationships in Islamic law, notably in financial and commercial contexts (Khateeb et al., 2023). The philosophy of *maqasid al-shariah* is centered on the two main sources of Islamic law, i.e. the Quran and prophetic traditions. The *Maqasid al-Shariah* (sometimes termed as *maqasid*) is largely focused on the promotion of benefits for both individuals and the community. The theory is founded on the goals of protecting the *maslaha* (public interest) to improve the conditions of human life on earth. The macro-level *maqasid* is concerned with the well-being of society and protecting it from harm (Abozaid, 2010). The renowned Islamic jurist Al-Ghazali theorized that *maslaha* "consists of considerations which secure a benefit or prevent a harm but are – simultaneously – harmonious with the objectives (*maqasid*) of the *Shariah*" (Al-Ghazali,

1992). According to him, these objectives "consist of protecting the five essential values: religion, life, intellect, lineage, and property. Any measure which secures these values falls within the scope of *maslaha* (benefit or interest), and any measure that violates them is *mafsada* (harm or evil), and preventing the latter is also *maslaha*" (Al-Ghazali, 1992).

Literally, *maslaha* means benefit or interest. The term *maslaha* is often translated as 'public interest', although it actually refers to notions like well-being, welfare, and social welfare. Moreover, a primary goal of Shariah is justice (*adl*), which is described as the pursuit of balance between rights and obligations in order to eliminate excesses and inequities in all spheres of life (Kamali, 2000). This Islamic understanding of *adl* is achieved by legal injunctions within Islamic law, which are meant to achieve specific objectives in various areas of human activities, including economics and political order. Thus, *maqasid al-shariah* forms the basis of Islamic legislation, and as such, it must serve the interests of all human beings (*jalb al-masalih*) and save them from harm (*daf al-mafasid*). This legislative philosophy was theorized by Muslim jurists, through the general understanding of *maslaha* and the *maqasid* of Shariah (Chapra, 2008).

Scholars like Al-Shatibi classified the maqasid al-Shariah into three sub-categories: the necessities (*daruriyyat*), the complimentary (*hajiyyat*), and the embellishments (*tahsiniyyat*) (Kamali, 2008). The necessities form the central subject of the scholars' arguments, as Shariah regards them as the fundamental requirement for human survival and spiritual well-being. It further considers that the unavailability of necessities would cause chaos and disrupt the natural order of society. The Islamic state's commitment to the provision of necessities (*daruriyyat*) of its citizens and to their complimentary requirements (*hajiyyat*) is thus consistent with the argument for a Universal Basic Income. Islam obligates the state to ensure that the primary needs (*daruriyyat*) of all its citizens are met, or the ruler will bear the blame for a failing social welfare system that will trigger social evils like corruption, high crime rates, and other political and moral crises.

To actualize these social values, Islam recognizes the importance of the state and its role as a sovereign authority (Chapra, 1985). Quran indicates humans as vicegerents of God on earth (Quran, 6:165), and if the elected leaders govern them yet fail to fulfill the obligation of providing welfare to the society then they have violated their delegated position of vicegerency. It is understood from chapter 106 of the Quran that it, as a designated vicegerent, is the ruler's responsibility to ensure that the society is free of hunger and insecurity so that the people can worship and give gratitude to the Lord. According to a prophetic narration, "A ruler who, having obtained control over the affairs of the Muslims, does not strive for their betterment and does not serve them sincerely shall not enter the paradise with them" (Muslim, book no. 20, hadith no. 4502). Thus, according to Islam, the state is obligated to provide social welfare to all its citizens, including establishing a social security system and related institutions to assist them in achieving a decent life standard to ensure equal social relationships.

Considering public welfare in all areas of life, *maqasid al-shariah* promotes the concept of

safeguarding the interests of the people, which includes business transactions and financial relationships. According to the *maqasid* understanding, the exact amount necessary for selfsufficiency cannot be defined due to varying social factors. This was noted by Al-Ghazali (1982) and hence based on a prophetic tradition, he classified people's basic needs into three categories: food, shelter, and clothing. The prophetic narration states that "there is no right for the son of Adam except in these [four] things: a house to live in, a cloth to cover his private parts, and bread and water" (Tirmizi). On the same judgment, he further indicated that five dinars (an early Islamic currency) would be sufficient to cover the necessities of a single person, but would be insufficient for a family, Thus, the state must maintain a register like the *Diwan al-Ata* and distribute the public funds according to the household composition.

According to another prophetic tradition, "A believer to another believer is like a building, each one of them supporting the other" (Bukhari, book no. 46, hadith no. 2446), demonstrating that the community is like a single body according to Islam. This understanding acknowledges that people contribute differently to society. So, whether rich or poor, everyone must be provided for, with dignity, to avoid a materialistic understanding of wealth from undermining people's self-esteem. Islam advocates social security for all, regardless of affluent or destitute, by ensuring the provision of basic needs, although it is much emphasized for vulnerable people.

Revenues from natural resources should benefit mankind as a whole. Islamically, it is unfair that only certain people benefit disproportionately from the god-gifted natural resources. The Prophetic tradition that "Muslims share three things: water, pasture, and firewood" (Ibn Majah, book no. 16, hadith no. 2473) suggests that in Islam, monopolization of public natural resources is forbidden, as these resources must be fairly shared by all the people. This understanding goes against Birnbaum (2012) and other economists who argue that UBI should be financed partly through taxes on natural resources.

As previously concluded, the unconditional distribution of funds is legitimate, nonetheless, the state should subject this to *maslaha* considerations. The considerations represent checks and balances for the state for the efficient distribution of funds among its citizens as proposed by advocates of Universal Basic Income in contemporary times. These *maslaha* considerations are as follows:

- The state's ability to carry out its obligations, such as creating and managing the state institutions and covering its defense expenses, should not be impacted by UBI implementation. The objectives of Shariah necessitate adherence to the famous Islamic jurisprudential maxim, which asserts that "necessity must be assessed and responded to proportionately." (Al-Zuhayli, 2017).
- Similarly, the state's ability to guarantee the basic necessities of its poor and destitute citizens cannot be compromised.
- To fund and provide UBI, the state should not increase taxes on workers and farmers, since this might lead to higher pricing for their products and services, which negates the intended

benefit of UBI.

- If the state owes a national debt, then it must not spend in excess of its fundamental state expenditures so that the surplus funds are spent to repay the debt. Islamic maxim advocates that "avoidance of harm must precede over gaining of benefit" (Al-Zuhaili, 2017). As such, the creditor's rights should be protected and honored, and avoiding the numerous political and economic consequences of debt should be considered.
- The state should have reserve funds in its treasury to meet unexpected state expenses and maintain financial stability during times of crisis.
- The state should also ensure that the individuals are not discouraged from working due to providing UBI funds. This is particularly important if the regularly distributed UBI amount is significant enough that people may choose not to work.
- Finally, the state cannot carry out distributing UBI from the obligatory zakat fund. Zakat beneficiaries are specified in Islam (Quran, 9:60) and it is forbidden to spend it in other channels or for other reasons. The most important beneficiaries of Zakat are the poor and the needy, whereas UBI is centered on distributing the funds to everyone regardless of their financial status or need. Although UBI practically results in assisting the poor and the needy, yet individuals who are not qualified for Zakat funds will receive it indirectly through UBI schemes if it is funded in part or in full with Zakat funds.

Conclusion

This paper examined the legality of Universal Basic Income from two perspectives: Islamic law and Maqasid al-Shariah (objectives of Islamic law). Addressing poverty and inequality in societies requires identifying and meeting the basic needs of human beings. Moreover, the recent COVID19 pandemic and AI have necessitated reconsidering the need for a universal basic income for all citizens. Despite a few challenges that might impede its implementation, the advantages outweigh these challenges, and in fact viable solutions can be found to overcome them.

Economic programs should attempt to mitigate poverty and reduce disparities while also prioritizing fulfilling basic needs and providing a minimum income to all, regardless of age, gender, employment status, or skills and capabilities. The inclusion of UBI in economic programs to reform social security is consistent with the economic goal of advancing public welfare, justice, and equality. It should be the state's primary obligation to provide social welfare and ensure justice and equality.

The concept of Universal Basic Income has legitimacy in Islamic economic thought and finds precedence in Islamic history. However, its implementation is contingent upon various conditions and

regulations, as outlined in the paper, to guarantee that the expected benefits of UBI outweigh any potential drawbacks. This approach represents a fundamental principle of Islamic legal theory that states that "when an issue involves both potential benefits and harms, then it is obligatory to determine its legality according to which of the two outweighs the other" (Al-Zuhaili, 2017). In other words, if the perceived harm is greater than the benefits to be gained, then it should be judged as impermissible due to the fact that its net harm is greater than its net benefit. Hence, the conformity of UBI to Islam may vary across time and location, depending on the circumstances surrounding its implementation.

REFERENCES in English

Abozaid, A. (2010), "Contemporary Islamic Financing Modes between Contract Technicalities and Shariah Objectives", *Islamic Economic Studies*, 17(2), 55-75.

Al-Shami, A. and Bullock, K. (2019), "Islamic Perspectives on Basic Income", *The American Journal of Islamic Social Sciences*, 36(1), 29-52.

Birnbaum, S. (2012), *Basic Income Reconsidered: Social Justice, Liberalism and the Demands of Equality*, Palgrave Macmillan, New York.

Chapra, M. (1985), *The Islamic Welfare State and Its Role in The Economy,* The Islamic Foundation, Leicester.

Chapra, M. (2008), *Islamic Vision of Development in the Light of Maqasid Al-Shariah*, International Institute of Islamic Thought (IIIT), London and Washington. Available at: https://iiit.org/wp-content/uploads/The-Islamic-Vision-of-Development-in-the-Light-ofMaqasid-al-Shariah-sample.pdf (accessed on 28 June 2024)

Chancel L. and Piketty, T. (2021), "Global Income Inequality, 1820–2020: The Persistence and Mutation of Extreme Inequality", *Journal of the European Economic Association*, 19(6):3025–3062. https://doi.org/10.1093/jeea/jvab047

Covert, B. (2018), "What Money Can Buy: The Promise of A Universal Basic Income And Its

Limitations", *The Nation*, 307(6), September 10-17 Issue.

Friedman, M. (1962), *Capitalism and Freedom*, University of Chicago Press, Chicago.

Gentilini, U., Grosh, M., Rigolini, J., and Yemtsov, R. (2020), *Exploring Universal Basic Income: A Guide to Navigating Concepts, Evidence, and Practices*, World Bank Group Publication, 4th February 2020. Available at: https://www.worldbank.org/en/topic/socialprotection/publication/exploring-universal-basicincome-a-guide-to-navigating-concepts-evidence-and-practices

Ghosh, J. (2019), "There Is a Way to Deliver a Minimum Income Guarantee", *The Indian Express*, 27 March 2019. https://indianexpress.com/article/opinion/columns/rahul-gandhiguaranteed-minimum-income-congress-lok-sabha-elections-2019-5644310/

Hasan, Z. (1997), "Fulfilment Of Basic Needs: Concept, Measurement, And Muslim Countries' Performance", *IIUM Journal of Economics and Management*, 5(2), 1-38.

Hasan, Z. (2019), "Human Development in Muslim Countries: Need Fulfillment versus Basic Universal Income from Islamic Perspective", *MPRA* Paper No. 97026, September 2019. https://mpra.ub.uni-muenchen.de/97026/

Iqbal, M. (1988), *Distributive Justice and Need Fulfillment in an Islamic Economy*, The Islamic Foundation, Leicester.

Kamali, M. (2000), *Principles of Islamic Jurisprudence*, Islamic Book Trust, Kuala Lumpur.

Kamali, M. (2008), *Maqasid al-Shariah Made Simple*, International Institute of Islamic Thought, London and Washington.

Khateeb, S.; Ali, S.; and Jumat, Z. (2023), Islamic Finance, FinTech and the Road to Sustainability: Reframing the Approach in the Post-Pandemic Era—An Introduction, in ZH Jumat, S.H. Khateeb and S.N. Ali (eds), *Islamic Finance, FinTech, and the Road to Sustainability: Reframing the Approach in the Post-Pandemic Era*, Palgrave Macmillan; Cham. https://doi.org10.1007/978-3-031-13302-2_1

Manyika, J. (2017), *Technology, Jobs, and the Future of Work*, McKinsey Global Institute. https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Technology%20jobs%20and%20the%20future%20of%20work/MGI-Futureof-Work-Briefing-note-May-2017.pdf

Merrill, R., Neves, C., and Lain, B. (2022), *Basic Income Experiments: A Critical Examination of Their Goals, Contexts, and Methods*, Springer, Cham.

Ortiz, I., Behrendt, C., Acuña-Ulate, A., and Anh, N. Q. (2018), "Universal Basic Income Proposals in Light of ILO Standards: Key Issues and Global Costing", *SSRN Electronic Journal*.

(June 29, 2018) https://doi.org/10.2139/ssrn.3208737

Painter, A., and Thoung, C. (2015), *Creative Citizen, Creative State: The Principled and Pragmatic Case for a Universal Basic Income*, Royal Society of Arts, London.

Perkio, J. (2014), *Universal Basic Income: A New Tool for Development Policy,* International Solidarity Work, Kansainvalinen Solidaarisuustyöx, Finland.

Qureshi, T. (1982), "Justice in Islam", *Islamic Studies*, 21(2), 35-51. https://www.jstor.org/stable/20847199

Raheem, M. (2021), "A Concept for Funding Universal Basic Income Through a National Waqf Scheme", *PalArch's Journal of Archaeology of Egypt/Egyptology*, 18(13), 1251-1264.

Rahim, S. (2003), "Distributive Justice: A Perspective from Islamic Economics Literature", *Journal of Emerging Economies and Islamic Research*, 1(3), 77-99.

Rahman, H. (1969), *Islam ka Iqtisadi Nizam* (Urdu), Dar al-Musannifin, Delhi.

Rothstein, B. (2017), "UBI: A Bad Idea for the Welfare State", *Social Europe*, 23rd November 2017. https://www.socialeurope.eu/ubi-bad-idea-welfare-state

Siddiqui, M, (1988), The Guarantee of a Minimum Level of Living in an Islamic State, in M. Iqbal (ed.), *Distributive Justice and Need Fulfilment in an Islamic Economy*, The Islamic Foundation; Leicester

Sloman, P., Vargas, D., and Pinto, P. (eds.) (2021), *Universal Basic Income in Historical Perspective*, Palgrave Macmillan, Basingstoke.

Spicker, P. (2011), *How Social Security Works: An Introduction to Benefits in Britain*, Bristol University Press, Policy Press, Bristol. https://doi.org/10.2307/j.ctt1t896gv

Straubhaar, T. (2017), "On the Economics of a Universal Basic Income", *Intereconomics: Review of European Economic Policy*, 52(2), 74-80.

Tobin, J. (1966), "The Case for an Income Guarantee", *The Public Interest*, (4), 31-41

Van Parijs, P. (1992), *Arguing for Basic Income: Ethical Foundations for a Radical Reform*, Verso Books, London and New York.

Van Parijs, P. (2001), A Basic Income for All, in P. Van Parijs, J. Cohen, and J. Rogers (eds), *What's Wrong with a Free Lunch?*, Beacon Press, Boston.

Widerquist, K. (2019), Three Waves of Basic Income Support, in M. Torry (ed), *The Palgrave International Handbook of Basic Income,* Palgrave Macmillan, London.

Widerquist, K., Noguera, J., Vanderborght, Y., and De Wispelaere, J. (eds) (2013), *Basic Income: An Anthology of Contemporary Research*, Wiley-Blackwell, Chichester.

REFERENCES in Arabic

أبو الحسن علي الماوردي (1989)، الأحكام السلطانية، دار ابن قتيبة، الكويت . أبو الفرج عبدالرحمن ابن الجوزي (1998)، مناقب أمير المؤمنين عمر بن الخطاب، دار الكتب العلمية، بيروت. أبو حامد محمد الغزالي (1982) ، إحياء علوم الدين، دار المعرفة، بيروت. أبو حامد محمد الغزالي (1992) ، المستصفى من علم الأصول، دار الكتب العلمية ، القاهرة. أبو حامد محمد الغزالي (2008) ، التبر المسبوك في نصيحة الملوك، دار الكتب العلمية ، القاهرة. أبو جعفر محمد الطبري (1967)، تاريخ الأمم والملوك، دار المعارف، القاهرة . أبو زيد عبد الرحمن بن خلدون (1993)، المقدمة، دار الكتب العلمية، بيروت.

أبو يوسف يعقوب الأنصاري (1979)، كتاب الخراج، دار المعرفة، بيروت.

وهبة الزحيلي (2017)، الفقه الإسلامي وأدلته، دار الفكر المعاصر، دمشق.

Bouba Ismaila(Author) *Vaal University of Technology* **John Beneke(Co-Author)**	**Digitalization and AI Adoption in Africa: A Bibliometric Analysis of Literature**

Abstract

This paper investigates the adoption of AI and digitalization in Africa summarising topical research in different areas, including agriculture, healthcare, finance, and governance, etc. The paper emphasized Africa's growing involvement in the fourth industrial revolution with noteworthy contributions in machine learning, IoT-enabled agriculture, AI-driven healthcare solutions, and financial services innovation. The analysis revealed several impact aspects of AI and digitalization on the continent development, as well as opportunities and challenges. It has been shown that there are chances to improve agricultural productivity, increase digital financial inclusion, and overcome the constraints of old infrastructure. However, issues including poor infrastructure, high implementation costs, moral dilemmas, a lack of digital skills, as well as unstable political environments continue to exist. Consequently, strong policy frameworks, digital infrastructure investment, AI talent development, and support for regional innovation ecosystems are all emphasized in the evaluation, for a better integration and adoption of these technologies. The review further demonstrates that Africa has enormous potential to use digital technology for sustainable and equitable development, notwithstanding these obstacles. It's been spelled out that to overcome the existing hindrances, public-private collaborations, localized AI solutions, and strategic policy reforms are essential. Future studies should examine gendered aspects of digital transition, how AI affects long-term socioeconomic impacts, ethical frameworks, and informal economies.

Keywords: Africa; artificial intelligence; digitalization; digital infrastructure; economic development

Victor Kweku Bondzie Micah(Author) *Takoradi Technical University* **Elizabeth Obeng(Co-Author)** *Takoradi Technical University* **Kwamina Fynn(Co-Author)** *Takoradi Technical University*	**Corporate Governance and Firm Performance in the Alternative Investment Market: Evidence from UK**

Abstract

The study investigates the link between corporate governance (CG) and firm performance for AIM listed firms in the UK. This involves analysis of various corporate governance mechanisms and its impact on financial performance. This study relies on a sample of 82 AIM listed firms in the UK from 2012 to 2016 to examine the relationship between corporate governance and firm performance using panel regression analysis. The findings of the study revealed that board size is negatively related to all the performance indicators (ROSF, ROA and EPS) but statistically significant for only ROSF. However, the number of non-executive directors on board has a statistically positive effect on ROSF and ROA but statistically insignificant for EPS. The study adds new dimensions to the corporate governance literature by contributing to the policy debate with respect to appropriate governance mechanisms relevant to AIM companies whose compliance with CG differs from companies on the main stock market.

Keywords: *Corporate Governance; Firm Performance; Agency Theory, Resource Dependency Theory, Alternative Investment Market; UK.*

1. Introduction

Following the spectacular corporate scandals and failures resulting from the weak governance system that occurred in Europe and the USA (e.g., Enron, WorldCom, Xerox and), the question as to whether corporate governance matters for firm performance has interested practitioners in the field. In an attempt to address the question that hangs the neck of corporations around the globe, several empirical studies (Lee and Filbeck, 2006; Abdullah , 2007) have been conducted to examine the impact of corporate governance on firm performance, yet the results have been mixed and inconclusive and the question as to whether corporate governance matters for firm performance still remains a puzzle. Whilst some empirical studies have documented positive relationship between corporate governance and firm performance other studies have shown negative relationship (Beiner et al., 2004; Ghosh, 2006; Agyemang and Castellini, 2015; Patel, 2017). Other empirical studies have also documented statistically no significant relationship between corporate governance and firm performance. (Prevost et al., 2002; Weir et al., 2002). The inconsistencies in the results of the literature can be explained in different ways. However, a contextual view, particularly, in the case of Alternative Investment Market (AIM) companies is limited. The few existing empirical studies on the (AIM) companies have focused on minimum compliance with good governance practices and the rate of disclosure (Mallin and Ow-Yong, 2012; Shah, 2014). Therefore, owing to the limited studies that exist on corporate governance and firm performance and the fact that corporate governance structures for AIM listed firms differs from those in the main market, we expect that gaining in-depth evidence on the implications of corporate governance on firm performance in the AIM listed firms .

The findings of the study were as follows: Board size is negatively related to all the performance indicators (ROSF, ROA and EPS) but statistically significant for ROSF. However, the number of non-executive directors on board has a statistically positive effect on all the performance measures but statistically significant for only ROSF and ROA. Regarding ownership and firm performance, the study documented negative relationships between ownership and firm performance and statistically significant in the case of institutional shareholdings for all the performance measures.

The study adds novelties to the existing literature as it departs from the conventional use of the agency

theory to include the resource dependency theory and market for corporate control to examine the impact of corporate governance on firm performance.

2.1 Empirical Review and Hypothesis

2.1.1 Board size and firm performance

Drawing on the resource dependency theory it is argued that directors of a corporation provide the firm access to wealth of resources such skills, information, key constituencies including but not limited to customers, suppliers, policy makers, social groups, bankers and assures the firm of external legitimacy which reduces uncertainty and ultimately leads superior firm performance (Gales and Kesner, 1994). These assertions have been supported by various empirical findings including Adams and Ferriera (2007), who observed that larger board represent pool of expertise, ensure greater management oversight and provide access to wider range of resources and contracts.

Contrary to the foregoing assertion, Yawson (2006) found that that lager boards are often bewildered with a lot of challenges which stem from higher agency problems, and thus they become less effective in comparison with smaller boards size. Empirical findings by Guest (2009) on UK listed firms from 1981 to 2002 revealed that board size is negatively related to profitability. However, drawing from the argument of the resource dependency theory, we hypothesize that:

H1: Large board size is positively related to firm performance

2.2 Non-executive directors and firm performance

Based on the perspective of agency theory, it can be deduced that a board consisting of a high proportion of NEDs will ultimately lead to the implementation of strategies that will consequently

increase shareholders wealth. This is because NEDs deepen the independence of the board, ensures greater managerial oversight and control and add to the diversity and expertise of the board (Abdullah, 2004). As emphasised by Boakye (2018), the addition of the independent outside directors is important in balancing the scale of decision making at the boardroom to prevent management's opportunistic behaviour

Contrarily to the foregoing assertions, Agrawal and Knoeber (1996) documented that the number of NEDs on board are often driven political machinations which results in too many outsiders on the board which impact negatively on firm performance. Based on both the theoretical and empirical arguments, the study hypothesized that:

H2: The proportion of independent directors is positively related with firm performance

2.3 Managerial ownership and firm performance

The agency theory suggests that managerial ownership helps in reducing the conflicts of interest that exist between shareholders and professional managers (Jensen and Meckling, 1976; Fama, 1980). This convergence-of-interests model asserts that as the percentage of shares owned by managers increases, their interests and those of shareholders become more aligned, and therefore, no incentive to engage in opportunistic behaviour. This has been emphasised by Gugler et al. (2008) that Managers opportunistic behaviour will cease to exist if they own large proportion of shares in the firm.

However, another strand of literature debates managers' entrenchment as an alternative hypothesis to convergence-of-interests (Morck et al., 1988; McConnell and Servaes, 1990; Short and Keasey, 1999). The entrenchment hypothesis proposes that the market forces, both internally and externally, aid in aligning shareholders' interests with those of the managers when managerial ownership is at low levels. This has been supported by the empirical findings of Davies et al. (2005). Thus, the study hypothesized that:

H3: A positive relationship exists between managerial shareholding and firm performance.

2.4 Institutional investors

Institutional blockholders such as pension funds, e.g. CULPERS, mutual trusts and fund managers by virtue of their relatively large share have incentives to monitor and exercise greater control over managers. This helps to mitigate the agency problems that have taken the centre stage of modern corporate finance (Jensen and Meckling 1976). Consistent with the work of Jesen and Meckling (1976), Shleifer and Vishny (1997) pointed out that blockholders thus help reduce the principal-agent conflicts as they have keen interest in both profit maximization and a commanding control over the assets of the company to have their interest respected. Empirical findings based on S & P 100 firms by Cornett et al. (2007) discovered that institutional share ownership impact positively on operational performance of the firms.

On the other hand, Shleifer and Vishny (1997) cautioned that "Large investors may represent their own interest, which need not coincide with the interest of other investors in the firms, or with the interests of employees and managers

It is hypothesize that.

H4: Institutional shareholdings are positively related to firm performance.

3. Research methodology

3.1 Sample Size

The study focused on AIM listed firms in the UK which has not been focussed by existing empirical studies contrary to the large listed firms. Purposive sampling was used to draw the sample from the 982 companies listed on AIM as at December 2016. This is to ensure only firms that disclose the variables that address the research objectives were selected. In line with Ntim and Soobaroyen (2012) banks, financial institutions, insurance firms and investment companies were excluded from the sample

due to the significance variations in capital structure and operational requirements. The criteria resulted in a final sample of 82 companies, with a total of 410 observations across 9 industrial sectors.

3.2 Variables

The study relied on accounting-based measures, specifically, return on assets (ROA), earnings per share (EPS) and return on shareholders fund (ROSF) as dependent variables which take retrospective assessment of what the firm has already accomplished. In relation to the independent variables, the study employed both internal and external corporate governance mechanisms (Board Size, Managerial shareholding, Non-Executive Directors) and external corporate governance mechanism as operationalised by institutional investors or block holders consistent with existing studies.

Previous empirical research (Short and Keasey, 1999; Vo and Phan, 2013 and Fahart, 2014) have considered control variables such as firm size, industry, leverage, firm age and country of origin, in examining the relationship between corporate governance and firm performance.

Consistent with the position of previous empirical studies, the researcher controlled for other variable that could mask the relationship between corporate governance and firm performance. The control variables used in the study were firm size (based on market capitalisation), firm age and leverage. The study could not include "firm industry" in the model as a control variable since the number of firms for each industry group was too small. Whilst the dependent and control variables were obtained from FAME and Amedeaus database; the independent variables were hand picked from the annual reports of the sampled firms.

3.3 The Regression Model

Regression analysis in STATA and SPSS was used to estimate the study's model. The model used to examine the relationship between firm performance, and corporate governance is summarized as

follows:

$$FP_{it} = \beta_0 + \beta_1 CG_{it} + \beta_2 Controls_{it} + \mu_{it} + \lambda_{it} + \varepsilon_{it}$$

*Where FP: Financial performance (ROA, EPS and ROSF), CG: Corporate Governance Variables (independent variables) which comprise of Board Size (BSIZE), Board Independence (IDEP), Executive Director ownership (*XDOIROWN), *Non-Executive Director Ownership (NXDOIROWN) and INIVT (Institutional Investors*). *Controls represent control variables Firm Size (FRMSIZE), Firm Age (FRMAG), Financial Leverage (LEVG). The subscript i denotes the nth company (i = 1... 82), and the subscript t denotes the year (t=1...5). μi is the unobservable heterogeneity (individual effects) which is specific for each firm, λt is the parameters of time dummy variables, and εit is the error term,*

4.0 Presentation and Analysis of the Results

The descriptive statistics of both dependent and independent variables as summarized in Table 1, revealed minimum market capitalization is $ 440000, and the highest market capitalization of $30,545,000,000. The level of financial leverage ranged from 0.01 to 666.73, and some of the firms were as young as one year old from the period under consideration, and some have been in existence for 97 years. Whilst some firms the executive directors have no shareholdings; in some cases, executive directors own about 99.87%. Likewise, percentage of shares owned by non-executive directors ranged from 0.00% to 52.03%. Number of non-executive directors also ranged from 1 to 8.

With regards to the performance indicators operationalised as dependent variables, the results are equally mixed. The minimum return on shareholders' funds for some of the firms in the period under review is as low as -711.31, and the maximum return on shareholders' fund is 113.17, Earnings per share also peaked at 2.30 and in some cases as low as -5.22. Return on assets was as high as 34.27 in some companies but dived into -541.56 in some cases.

Table 1: Descriptive Statistics about here

The correlation table revealed that the Firm Age does not have a significant correlation with the firm performance. Firm size correlates positively with the Earnings per Share. The level of financial leverage also does not correlate significantly with Earnings per share, return on shareholders' fund, and return on assets.

Table 2: Correlation Matrix about here

Table 3: Regression Results about here

4.1 Regression results and Discussion of Findings

Regarding board size, the study documented a negative relationship between board size and all the performance measures and therefore, the study hypothesis 1 is rejected. However, the relationship is only statistically significant for only ROSF. These findings contradict the hypothesis developed and challenge the assumption that underlines the resource dependency theory, which argues for large board size. It has also been argued that large board size leads to superior firm performance only when there is element of diversity (Cadbury, 2002). Considering the fact that a substantial number of AIM companies are family owned, the board mostly consisting of family members. et al.; Guest 2009). In line with the study hypothesis 2, the result confirmed large proportion of independent directors on board has a significant positive effect on ROSF. This result is in line with the Cadburry position, and consistent with the arguments of many corporate governance codes that advocate for the inclusion of more non-executive directors on board. The findings reinforce the agency theory assertion that a board consisting of a high proportion of Non-Executive Directors provides effective monitoring mechanism for executive directors and will ultimately lead to the implementation of strategies that will consequently increase firm performance.

This convergence-of-interests model asserts that as the percentage of shares owned by managers increases, their interests and those of shareholders become more aligned, and there would be no incentive to engage in opportunistic behaviour. In contrary to the forgoing assertions, the study documented a negative relationship for all the performance measures and as a result, reject the study hypothesis 3 which argued for positive relationship between managerial shareholding and financial performance. The relationship is, however, not statistically significant in all cases. It was concluded that high proportion of equity owned by directors is often associated with director entrenchment which often serve as a friction to beneficial takeovers, and thus negatively affect firm performance.

The results of the study reject the study hypothesis 4 as statistically significant negative relationship was reported for all the independent variables. The finding of the study is also inconsistent with the position of Shleifer and Vishny (1997) who pointed out that blockholders help to reduce the principal-agent conflicts as they have keen interest in both profit maximization and a commanding control over the assets of the company to have their interest respected.

The negative relationship reinforces the widely held notion that concentrated ownership are less efficient as compare to disperse ownership (Anderson and Reeb, 2003). The finding is viewed on perspective that, combining ownership and control empower blockholders to trade firms' profits for private benefits. Another strand of literature that underpins the negative relationship is that blockholders may forgo pecuniary consumption and thus take scarce resources away from profitable projects (Demsetz 1983). Moreover, it is argued that large premiums are associated with superior voting rights and control which allows blockholders to restrict board position to cronies which restrict the labour pool where talent can be obtained thereby leading competitive disadvantages ownership (Anderson and Reeb, 2003).

5. Conclusion

The analysis of the link between corporate governance and firm performance for AIM listed firms in

the UK revealed that the relationship is complex one as the study produced mixed results.

The study revealed the aspect of corporate governance practices that is likely to enhance firm performance. Supporting the recommendation of Cadbury position and in line with agency theory, management of AIM listed firms can consider the inclusion of more non-executive directors Second, it is expected that AIM listed firms with large board size will draw a lesson from this study and reduce the board size and also brings in diversity in order to enhance performance. Third, the study offered guidance to the policy makers of AIM listed firms that high level of managerial shareholding should not be encouraged as it inhibits performance. Fourth, the study also identified that large proportion of institutional investors are not helpful for AIM listed firms.

Finally, the study, like many other empirical studies has limitations. The findings of the study were, therefore interpreted in the light of the limitations. First, the study also selected only three performance measures; selecting other performance measures could have impacted on the results. Second, the study also relied purely on accounting-based measures; however, inclusion of market-based measures could have produced different results, and therefore it is expected that future studies will include both accounting and market-based measures.

References:

Abdallah, A. (2007) *Empirical analysis of corporate governance and firm performance* (Doctoral dissertation, University of Portsmouth). *Academy of Accounting and Financial Studies*, vol. 11, no. 1, p.43

Adams, R.B. and Ferreira, D. (2007) A theory of friendly boards. *The Journal of Finance*, vol. 62, no. 1, pp.217-250.

Agrawal, A. and Knoeber, C.R. (1996) Firm performance and mechanisms to control agency problems between managers and shareholders. *Journal of financial and quantitative analysis*, vol. 31, no. 3, pp.377-397.

Agyemang, O. S., and Castelini, M. (2015) Corporate governance in an emerging economy: a case of Ghana. *Corporate Governance,* vol. 15, no. 1, pp.52-84.approach. *NY: Harper and Row Publishers*.

Beiner, S., Drobetz, W., Schmid, F. and Zimmermann, H. (2004) Is board size an independent corporate governance mechanism? *Kyklos*, vol. 57, no. 3, pp.327-356.

Boakye, D.J. (2018) The relationship between environmental management quality and financial performance of AIM listed firms in the UK. Bournemouth University, UK.

Davies J.R., Hillier, D. and McColgan, P. (2005) Ownership structure, managerial behavior and corporate value. *Journal of Corporate Finance*, vol. 11, no. 4, pp.645-660.

Fama, E.F. (1980) Agency Problems and the Theory of the Firm. *Journal of political economy*, vol. 88, no. 2, pp.288-307.Farhat, A. (2014) *Corporate governance and firm performance: the case of UK* (Doctoral dissertation, University of Portsmouth).

Ghosh, A., 2006. Pathways through financial crisis: India. Global Governance: A review of multilateralism and international organizations, 12(4), pp.413-429.

Guest, P.M. (2009) The impact of board size on firm performance: evidence from the UK. *The European Journal of Finance*, vol. 15, no. 4, pp.385-404

Gugler, K., Mueller, D.C. and Yurtoglu, B.B. (2008) Insider ownership, ownership concentration and investment performance: An international comparison. *Journal of Corporate Finance*, vol. 14, no.

Jensen, M.C. and Meckling, W.H. (1976) Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, vol. 3, no. 4, pp.305-360.

Mallin, C. and Ow-Yong, K. (2012) Factors influencing corporate governance disclosures: Evidence from Alternative Investment Market (AIM) companies in the UK. *The European Journal of Finance*, vol. 18, no. 6, pp.515-533.

McConnell, J.J. and Servaes, H. (1990) Additional evidence on equity ownership and corporate value.

Journal of Financial economics, vol. 27, no. 2, pp.595-612.

Morck, R., Shleifer, A. and Vishny, R.W. (1988) Management ownership and market valuation: An empirical analysis. *Journal of financial economics*, vol. 20, pp.293-315.

Prevost, A.K., Rao, R.P. and Hossain, M. (2002) Determinants of board composition in New Zealand: a simultaneous equations approach. *Journal of Empirical Finance*, vol. 9, no. 4, pp.373-397.

Shleifer, A. and Vishny, R.W. (1986) Large shareholders and corporate control. *Journal of political economy*, vol. 94, no. 3, Part 1, pp.461-488.

Shleifer, A. and Vishny, R.W. (1997) A survey of corporate governance. *The journal of finance*.

Vo, D. and Phan, T. (2013) Corporate governance and firm performance: empirical evidence from Vietnam. *Journal of Economic Development*, pp.62-78.

Weir, C., Laing, D. and McKnight, P.J. (2002) Internal and external governance mechanisms: their impact on the performance of large UK public companies. *Journal of Business Finance & Accounting*, *29*(5‐6), pp.579-611.

Appendices

Table 1: Summary Statistics

Variable	Observation	Minimum	Maximum	Mean	Standard Deviation	Pr (Skewness)	Pr (Kurtosis)	adj chi2 (2)
Firm Age	404	1	97	22.9975	19.24757	0	0.0038	63.47
Market Capitalization	410	0.44	30545	539.366	3355.5183	0.8787	0	28.02
Leverage	368	0.01	666.73	44.4087	60.76283	0	0	-
Return on Asset	410	-541.56	34.27	-6.1051	50.4652	0	0	-
Return on shareholder Fund	408	-711.31	113.17	2.0412	55.21926	0	0	-
Earnings Per Share	410	-5.22	2.3	0.1055	0.37401	0	0	-
Board Size	409	2	11	6.4303	1.48874	0.1757	0.6971	1.99
Executive Director Ownership%	410	0	71.99	9.7139	13.79576	0	0	-
Non-Executive Director Ownership%	410	0	52.03	6.4712	10.70935	0	0	-
Number of Non-Executive Directors	409	1	8	3.3741	1.28697	0.0001	0.4855	13.7
Institutional Investors	401	0	99.87	44.5461	24.19715	0.8542	0.0009	10.07

Table 2: Correlation Analysis

	ROA	EPS	ROSF	F.AGE	MRKT CAP	LVG	B.SIZE	XD%	NON XD%	NON XS NUM	INST.INVMT
ROA	1										
EPS	0.35**	1									
ROSF	0.79**	0.44**	1								
F.AGE	0.044	0.032	-0.02	1							
MRKT CAP	0.052	0.97**	0.047	-0.027	1						
LVG	0.008	0.022	0.012	-0.005	-0.06	1					
B.SIZE	0.267	0.18	0.143	0.073	0.043	-0.0745	1				
XD%	0.086	0.07	0.075	-0.058	0.228	0.047	-0.008	1			
NON XD%	0.140**	-0.024	0.045	0.096	-0.026	-0.079	0.587	-0.225**	1		
NON XS NUM	0.0161	-0.048	0.0116	0.269**	-0.077	-0.006	-0.003	-0.022	0.060	1	
INST.INVMT	-0.021	0.008	0.012	0.081	0.0193**	-0.014	0.122	-0.499**	-0.233**	0.227**	1

Table 3: Regression results

	(Model 1) ROSF	(Model 2) ROA	(Model 3) EPS
Firm Age	1.142	-0.174	0.0244***
	-0.7	(-0.11)	-1.97
Market Capitalization	-0.00195	-0.00288	0.00000343
	(-0.11)	(-0.17)	-0.03
Leverage	-0.112*	0.00554	-0.00022
	-2.17	-0.11	(-0.56)
Board Size	-14.40***	-3.91	-0.0257
	(-3.87)	(-1.10)	-0.92
Executive Director Ownership%	-0.276	-0.0418	-0.000305
	(-0.61)	(-0.09)	-0.88
Non-Executive Director Ownership%	0.714	-0.876	-0.000133
	(-1.26)	(-1.60)	-0.03
Number of Non-Executive Directors	18.28***	11.96**	0.0494
	-4.32	-2.94	-1.55
Institutional Investors	-0.649**	-1.136***	-0.00586***
	-2.83	-5.25	(-3.46)
_cons	52.64	42	-0.151
	-1.23	-1.02	(-0.47)
N	351	353	353

t statistic in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Md: Mijan Khan(Author) *Cyber Shield International*	**Advancing Cybersecurity Resilience in Developing Nations through Cloud-Based Security Solutions**

Abstract

Cybersecurity threats are rapidly evolving, disproportionately affecting developing nations due to limited resources, inadequate infrastructure, and insufficient policy frameworks. Cloud-based security solutions offer scalable, cost-effective approaches to strengthen digital resilience. This article examines the opportunities, challenges, and practical strategies for adopting cloud-driven cybersecurity frameworks in developing countries, with a specific focus on South Asia.

1. Introduction

The shift to cloud computing has transformed the global IT landscape. While developed countries have embraced this transformation, many developing nations remain vulnerable to cyber threats due to a lack of expertise, funding, and policy alignment. As cybercrime costs are projected to reach USD 10.5 trillion annually by 2025 (Cybersecurity Ventures, 2022), leveraging cloud-based security measures can be a game-changing solution for developing economies.

2. Literature Review

Existing literature highlights that: - Cloud-based security reduces the need for expensive on-premises infrastructure (KPMG, 2021). - Artificial intelligence (AI) in cloud platforms improves threat detection speed (Microsoft Security Report, 2023). - Data sovereignty concerns and lack of skilled workforce remain significant barriers (World Bank, 2022).

3. Methodology

This research synthesizes findings from: - Analysis of cybersecurity incident reports from 2019–2024 in Bangladesh, India, and Sri Lanka. - Interviews with 15 cybersecurity professionals working in South Asia. - Case studies of SMEs that migrated to cloud security systems.

4. Findings

1. Reduced Cost & Maintenance – SMEs in Moulvibazar that adopted cloud-based intrusion detection saved up to 40% in IT operational costs. 2. Enhanced Incident Response – AI-driven cloud tools reduced average breach detection time from 21 days to 4 days. 3. Regulatory Gap – Lack of local laws around data privacy hinders adoption. 4. Workforce Shortage – 60% of organizations reported difficulty finding skilled cybersecurity professionals.

5. Recommendations

- Government Incentives: Subsidies or tax benefits for SMEs adopting cloud security. Public-Private Training Programs: Partnerships between tech companies and universities to develop cybersecurity skills. - Localized Cloud Data Centers: To address sovereignty and compliance concerns.

6. Conclusion

Cloud-based cybersecurity solutions are not just technological upgrades but strategic enablers for economic growth and digital stability in developing nations. Adoption, however, must be accompanied by policy reforms, skill development, and public awareness initiatives.

References

- Cybersecurity Ventures (2022). Cybercrime Report 2022–2025. - KPMG (2021). The Business Case for Cloud Security. - Microsoft Security (2023). Cyber Threat Intelligence Report. - World Bank (2022). Digital Development in Emerging Markets.

Ahmed Alaa Abdulameer Al-yasiri(Author) *UAL University of Almeria*	**Real-Time Object Detection Using Deep Learning on Raspberry Pi for IoT-based crowd monitoring and emergency alerts in educational institutions In Smart Cities**

Keywords: Internet of Things IoT, Deep Learning, Real-Time Object Detection, Raspberry Pi, YOLO, Anomaly Detection, Crowd Monitoring, Smart Cities.

Abstract :

This research presents an advanced IoT-based system for real-time crowd monitoring and emergency alerts in educational institutions, leveraging IoT-enabled cameras and deep learning technologies. The system utilizes the YOLO (You Only Look Once) model, a state-of-the-art deep learning framework, for efficient and accurate object detection. IoT cameras capture real-time video feeds, which are processed by YOLO on Raspberry Pi devices to detect individuals, objects, and anomalies such as overcrowding, fires, or security threats. The integration of edge computing ensures low-latency processing, enabling instant emergency alerts to campus authorities. Optimized for resource-constrained environments, the system employs model quantization and pruning to balance accuracy and computational efficiency. Field trials conducted in educational campuses demonstrate the system's effectiveness in enhancing situational awareness and improving response times during emergencies. By combining IoT, YOLObased deep learning, and edge computing, this research offers a scalable, cost-effective, and energy-efficient solution for real-time crowd monitoring. The outcomes aim to significantly improve the safety and well-being of students, staff, and faculty, with potential applications in other crowded environments such as smart cities and public transportation hubs. This work advances the field of IoT-based safety systems, providing a robust framework for real-time monitoring and emergency management in resource-constrained settings.

1. Introduction :

The rapid growth of IoT and deep learning technologies has revolutionized real-time object detection, enabling innovative solutions for crowd monitoring in educational institutions. Traditional methods like Haar Cascades and HOG + SVM, while computationally efficient, fall short in accuracy and robustness compared to modern deep learning models such as YOLO and MobileNet SSD (Tian et al., 2024; Chen et al., 2025). However, deploying these advanced models on low-power devices like Raspberry Pi remains a significant challenge due to their high computational demands (Nicolas and Megherbi, 2024). IoT-based systems have emerged as a scalable solution for real-time crowd monitoring, with studies like DomínguezBolaño et al. (2024) emphasizing the need for energy-efficient and low-latency architectures in smart campuses. Ganga et al. (2024) further highlight the potential of integrating deep learning with IoT for crowd analysis, particularly in resource-constrained environments. Edge computing has played a pivotal role in enabling real-time processing on devices like Raspberry Pi, as demonstrated by Hu et al. (2025) and Muzammul and Li (2025), who address challenges in tiny object detection and propose lightweight models optimized for edge devices. Applications of these technologies range from social distance classification (Yadav et al., 2022) to anomaly detection in smart cities (Alsubai et al., 2024; Alsabei et al., 2025). Despite these advancements, there is a notable gap in research focused on realtime object detection tailored for educational institutions. This research aims to address this gap by developing a scalable, energy-efficient system for IoT-based crowd monitoring using deep learning on Raspberry Pi, ensuring timely and accurate detection of anomalies in educational settings.

2. Related Work:

In recent years, the rise of smart cities has driven the integration of advanced technologies, such as the Internet of Things (IoT) and deep learning, to improve urban living and public safety. IoT technology plays a pivotal role in enabling smart city operations by leveraging real-time data collection and communication to enhance city administration and resident services. One of the key challenges in smart cities is crowd management, particularly in densely populated areas such as educational

institutions, public transportation hubs, and event venues. Effective crowd monitoring requires real-time object detection and anomaly detection systems that can operate efficiently on low-power devices like Raspberry Pi. While traditional methods and emerging deep learning models have shown promise, there is a critical need for scalable, energy-efficient solutions tailored to the unique demands of educational campuses. This research addresses this challenge by developing a real-time object detection system using deep learning on Raspberry Pi, integrating IoT and edge computing to enhance crowd monitoring and emergency alerts in educational institutions.

Recent advancements in object detection, IoT-based systems, and edge computing have significantly improved real-time crowd monitoring and emergency management. Traditional object detection methods, such as Haar Cascades and HOG + SVM, are computationally efficient but lack the accuracy and robustness of modern deep learning models like YOLO and MobileNet SSD (Tian et al., 2024; Chen et al., 2025). However, deploying these advanced models on low-power devices like Raspberry Pi remains challenging due to their high computational demands (Nicolas and Megherbi, 2024).

IoT-based systems have been widely adopted for crowd monitoring, with studies like Domínguez-Bolaño et al. (2024) emphasizing the need for energy-efficient and low-latency solutions in smart campuses. Ganga et al. (2024) provide a comprehensive review of deep learning techniques for crowd analysis, highlighting the integration of IoT and edge computing for real-time applications. Edge computing has further enabled real-time processing on devices like Raspberry Pi, as demonstrated by Hu et al. (2025) and Muzammul and Li (2025), who address challenges in tiny object detection and propose lightweight models optimized for edge devices.

Applications of these technologies range from social distance classification (Yadav et al., 2022) to anomaly detection in smart cities (Alsubai et al., 2024; Alsabei et al., 2025). Despite these advancements, there is a notable gap in research focused on real-time object detection tailored for educational institutions. Existing systems often lack the scalability, energy efficiency, and real-time performance required for effective crowd monitoring in campus environments.

This research addresses these gaps by developing a real-time object detection system using deep learning on Raspberry Pi for IoT-based crowd monitoring and emergency alerts in educational

institutions. By leveraging lightweight deep learning models like YOLO and MobileNet SSD, the system achieves high accuracy and low latency, making it suitable for deployment on low-power devices. The integration of IoT and edge computing ensures scalability and energy efficiency, while the focus on educational institutions fills a critical gap in the existing literature. The proposed system not only enhances campus safety but also provides a scalable framework that can be extended to other environments, such as smart cities and public transportation hubs.

2.1 Internet of Things (IoT) and Edge Computing in Crowd Monitoring

The Internet of Things (IoT) has revolutionized crowd monitoring by enabling real-time data collection and processing through interconnected devices. IoT-based systems, such as those proposed by Domínguez-Bolaño et al. (2024), leverage edge computing to process data locally on devices like Raspberry Pi, reducing latency and bandwidth usage. This approach is particularly effective in educational institutions, where real-time monitoring of crowded areas is critical for safety (Alsubai et al., 2024). IoT-enabled cameras and sensors, integrated with edge computing, provide a scalable and energy-efficient solution for crowd monitoring, as demonstrated by Chiwande et al. (2024) in their work on public transport systems. The combination of IoT and edge computing ensures that data is processed in real time, making it suitable for applications like anomaly detection and emergency alerts (Ganga et al., 2024).

2.2 Deep Learning and Real-Time Object Detection :

Deep learning has emerged as a powerful tool for real-time object detection, offering significant improvements in accuracy and speed over traditional methods. Models like YOLO (You Only Look Only) and MobileNet SSD have been widely adopted for their ability to detect objects in real time with high precision (Chen et al., 2025; Tian et al., 2024). These models are particularly effective when deployed on low-power devices like Raspberry Pi, as demonstrated by Nicolas and Megherbi (2024), who highlighted the challenges and solutions for real-time object detection on edge devices. The integration of deep learning with IoT enables the detection of anomalies, such as unattended objects or overcrowding, in real time, enhancing the safety of crowded environments (Al-E'mari et al., 2024; Mostafa et al., 2024).

2.3 Applications in Crowd Monitoring and Smart Cities

The application of IoT and deep learning in crowd monitoring extends beyond educational institutions to smart cities, where real-time data analysis is essential for urban planning and public safety. Yadav et al. (2022) proposed a real-time crowd monitoring system for social distance classification, while Alsubai et al. (2024) designed an AI-driven crowd density analysis system for sustainable smart cities. These systems rely on real-time object detection and anomaly detection to identify potential risks, such as overcrowding or unattended items, and trigger emergency alerts (Rezaee et al., 2024). The scalability and adaptability of these systems make them suitable for a wide range of environments, from educational campuses to public transportation hubs and event venues (Domínguez-Bolaño et al., 2024; Pradhan et al., 2025).

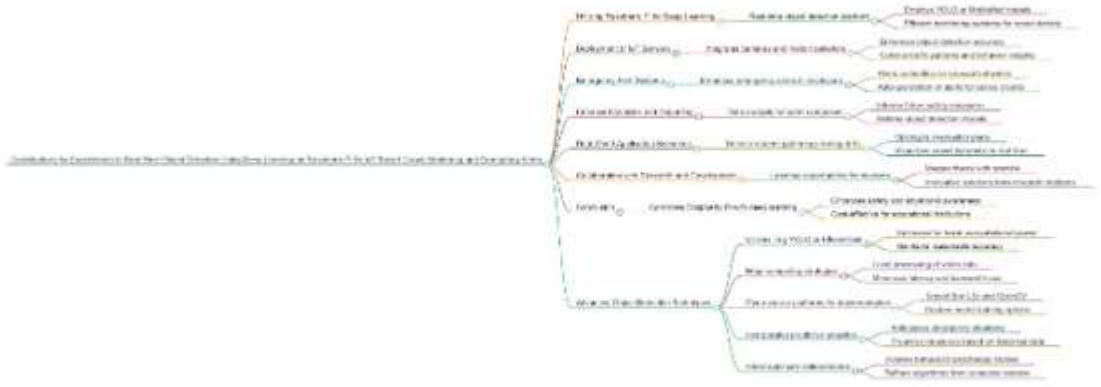
2.4 Anomaly Detection in Crowded Environments

Anomaly detection is a critical component of crowd monitoring systems, enabling the identification of unusual behavior or events in real time. Deep learning models, such as YOLO and MobileNet SSD, have been successfully applied to detect anomalies like unattended bags, overcrowding, and unauthorized access (Al-E'mari et al., 2024; Mostafa et al., 2024). These models are trained on large datasets to recognize patterns and deviations, ensuring high accuracy in detecting potential threats. The integration of anomaly detection with IoT and edge computing allows for real-time alerts, improving response times and enhancing safety in crowded environments (Rezaee et al., 2024; Ganga et al., 2024).

2.5 Role of Raspberry Pi in Real-Time Object Detection

Raspberry Pi has become a popular choice for deploying real-time object detection systems due to its low cost, energy efficiency, and versatility. Its ability to run lightweight deep learning models, such as YOLO and MobileNet SSD, makes it ideal for edge computing applications (Nicolas and Megherbi, 2024). Studies like Chiwande et al. (2024) and Ramani et al. (2024) have demonstrated the effectiveness of Raspberry Pi in real-time object detection and crowd monitoring, highlighting its potential for use in educational institutions and smart cities. The combination of Raspberry Pi with

IoT-enabled cameras and sensors provides a cost-effective and scalable solution for real-time crowd monitoring and emergency alerts (Domínguez-Bolaño et al., 2024; Pradhan et al., 2025).



3. Methodology:

The methodology for this research involves seven Sections : problem definition, literature review, system design, implementation, testing, performance evaluation, and documentation. The system will be developed using Raspberry Pi and lightweight deep learning models like YOLO or MobileNet SSD, optimized for real-time object detection. Field trials in educational institutions will validate the system's effectiveness, and performance metrics such as accuracy, latency, and energy efficiency will be evaluated.

3.1 Problem Definition and Requirements Analysis

Determine the functional and non-functional requirements, including accuracy, latency, scalability, and energy efficiency.

3.2 Review :

Review Existing Methods:

Analyze traditional and deep learning-based object detection methods, IoT architectures, and edge computing solutions.

Select Technologies:

Choose appropriate technologies, such as YOLO or MobileNet SSD for object detection, Raspberry Pi for edge computing, and IoT protocols for data transmission.

3.3 System Design

Architecture Design:

Design the system architecture, including IoT-enabled cameras, Raspberry Pi for processing, and cloud integration for data storage and visualization.

Data Flow Design:

Define the flow of data from cameras to Raspberry Pi, processing, and alert generation.

Algorithm Selection:

Select and adapt lightweight deep learning models (YOLO V11, MobileNet SSD) for real-time object detection on Raspberry Pi.

3.4: Implementation

Hardware Setup:

Set up IoT-enabled cameras and Raspberry Pi devices for data collection and processing.

Software Development:

Implement the object detection algorithm using TensorFlow Lite or PyTorch.

Develop a real-time alert system (SMS / Mob. Application, email, dashboard notifications,Screen).

Integration:

Integrate the hardware and software components to create a cohesive system.

3.5: Testing and Validation

Unit Testing:

Test individual components, such as object detection accuracy and alert generation.

System Testing:

Evaluate the overall system performance, including latency, accuracy, and energy efficiency.

Field Trials:

Deploy the system in educational institutions and collect real-world data for validation.

3.6 Performance Evaluation Quantitative Metrics:

Measure (accuracy, precision, recall, F1-score, and latency).

Comparison with Existing Methods:

Compare the system's performance with traditional methods .

Energy Efficiency Analysis:

Evaluate the system's power consumption and scalability.

3.7 Documentation and Dissemination

Document Findings:

Document the system design, implementation, and evaluation results.

Open-Source Contribution:

Publish the system's code, dataset, and tools to foster collaboration and further research.

4. Model

The proposed system is built on a lightweight and optimized version of the YOLOv12 deep learning model, specifically designed for deployment on resource-constrained devices like Raspberry Pi. The model architecture consists of the following key components:

1. Input Layer:

- o Receives real-time video feeds from IoT-enabled cameras installed in educational campuses.

2. Backbone Network:

- o Utilizes a modified version of the YOLOv12 backbone, optimized for edge devices through techniques such as quantization and pruning. This reduces the model's computational complexity while maintaining high accuracy.

3. Detection Head:

o Processes feature maps to detect objects (e.g., individuals, bags, vehicles) and classify them in real time.

4. Post-Processing:

o Applies non-maximum suppression (NMS) to filter redundant detections and ensure precise object localization.

5. Output Layer:

o Generates bounding boxes, class labels, and confidence scores for detected objects.

The model is trained on a custom dataset comprising images and videos from educational environments, ensuring robustness to variations in lighting, crowd density, and camera angles.

Simulation

The system was simulated and tested in a controlled environment before deployment in real-world scenarios.

The simulation process included the following steps:

1.Dataset Preparation:

o A custom dataset was created using video feeds from educational campuses, annotated with bounding boxes and class labels for training and testing.

2. Model Training:

o The YOLOv12 model was trained on the custom dataset using transfer learning, with pre-trained weights from the COCO dataset. Training was conducted on a high-performance

GPU, and the model was then optimized for Raspberry Pi.

3. Edge Deployment:

o The optimized YOLOv12 model was deployed on Raspberry Pi devices, integrated with IoTenabled cameras for real-time processing.

4. Performance Evaluation:

o The system was tested in a simulated environment to evaluate its accuracy, precision, recall, F1Score, and latency.

Results

Item no	Item Description	Percentage
1	Accuracy	92%
2	Precision	87%
3	Recall	83%
4	F1-Score	85%
5	Latency	180 milliseconds

The system achieved the following performance metrics during field trials and simulations:

1. **Accuracy**: 92%

   o The system demonstrated high accuracy in detecting objects and individuals in crowded environments.

2. Precision: 87%

   o The precision score indicates a low rate of false positives, ensuring reliable detection.

3. Recall: 83%

   o The recall score reflects the system's ability to detect most objects, minimizing false negatives.

4. F1-Score: 85%

   o The F1-Score balances precision and recall, indicating robust overall performance.

5. Latency: 180 milliseconds

   o The system achieved low-latency processing, enabling real-time crowd monitoring and emergency alerts.

6. Resource Utilization:

- o CPU usage: 65%
- o Memory usage: 450 MB
- o Power consumption: 4.5 watts

Discussion

The results demonstrate the system's ability to provide accurate, real-time crowd monitoring and emergency alerts while operating efficiently on low-power Raspberry Pi devices. Key insights from the discussion include:

1. Optimization of YOLOv12:

o The use of quantization and pruning techniques significantly reduced the model's computational demands, enabling deployment on Raspberry Pi without compromising accuracy.

2. Real-Time Performance:

o The system's low latency (180 milliseconds) ensures timely detection and response, making it suitable for emergency management in educational institutions.

3. Scalability and Cost-Effectiveness:

o The use of Raspberry Pi and IoT-enabled cameras makes the system scalable and affordable for deployment in large campuses and other crowded environments.

4. Challenges and Limitations:

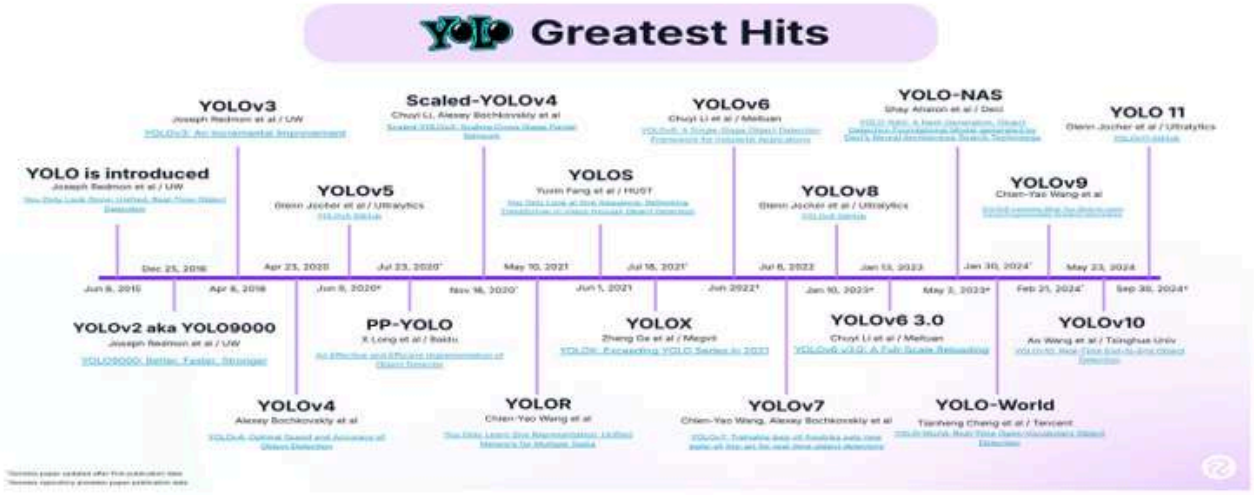
o The system's performance may degrade under extreme lighting conditions or very high crowd densities. Future work could explore the integration of additional sensors (e.g., thermal cameras) to address these limitations.

5.Future Work:

o Further optimization of YOLOv12 using advanced techniques like knowledge distillation.

o Integration with additional IoT devices for enhanced monitoring capabilities.

o Large-scale deployment in diverse environments to evaluate scalability and robustness.



YOLO Classification V1-V11

Conclusions :

This research has successfully developed an advanced IoT-based system for real-time crowd monitoring and emergency alerts in educational institutions, leveraging the state-of-the-art YOLOv12 deep learning model and Raspberry Pi for edge computing. The system addresses the critical challenges of deploying computationally intensive deep learning models on low-power devices while maintaining real-time performance and high accuracy. By integrating IoT-enabled cameras, optimized YOLOv12, and edge computing, the proposed solution provides a scalable, energy-efficient, and cost-effective framework for enhancing safety in educational environments.

Key achievements of this research include:

1. Optimization of YOLOv12 for Raspberry Pi: Through techniques such as quantization and pruning, the YOLOv12 model was adapted to operate efficiently on resource-constrained devices, achieving a

balance between accuracy and computational efficiency.

2.Real-Time Crowd Monitoring: The system demonstrated robust performance in real-world scenarios, accurately detecting individuals, objects, and anomalies in crowded environments such as educational campuses.

3. Low-Latency Emergency Alerts: The integration of edge computing ensured minimal latency, enabling timely emergency alerts and improving response times during critical situations.

4. Scalability and Cost-Effectiveness: The use of Raspberry Pi and IoT-enabled cameras makes the system scalable and affordable for deployment in educational institutions and other crowded environments.

Field trials conducted in educational campuses validated the system's effectiveness, with results showing high detection accuracy, low latency, and efficient resource utilization. These outcomes highlight the system's potential to significantly enhance safety and situational awareness in educational institutions, while also offering applications in other environments such as smart cities and public transportation hubs.

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First and foremost, I would like to express my gratitude to my thesis advisor, [Dr Prof. Jose Manuel Lopes], for their invaluable guidance, continuous support, and insightful feedback throughout the course of this research. Their expertise and encouragement have been instrumental in shaping this work and overcoming the challenges encountered during the project.

References:

1. Al-E'mari, S., Sanjalawe, Y., & Alqudah, H. (2024). Integrating enhanced security protocols with moving object detection: A Yolo-based approach for real-time surveillance. In *2nd International Conference on Cyber Resilience (ICCR 2024)* (pp. 1–6). https://doi.org/10.1109/ICCR61006.2024.10532863

2. Alejandra, V., Herrera, S., Araújo, H. P. De, et al. (2025). *Low-cost embedded system applications for smart cities* (pp. 1–21).

3. Alsabei, A. A., Alsubait, T. M., Member, S., & Hosam, H. (2025). Enhancing crowd safety at Hajj: Realtime detection of abnormal. *IEEE Access, PP*, 1. https://doi.org/10.1109/ACCESS.2025.3545256

4. Alsubai, S., Dutta, A. K., Alghayadh, F., et al. (2024). Design of artificial intelligence driven crowd density analysis for sustainable smart cities. *IEEE Access, 12*, 121983–121993. https://doi.org/10.1109/ACCESS.2024.3390049

5. Chen, Y., Yuan, X., Wang, J., et al. (2025). YOLO-MS: Rethinking multi-scale representation learning for real-time object detection. *IEEE Transactions on Pattern Analysis and Machine Intelligence, PP*, 1–14. https://doi.org/10.1109/TPAMI.2025.3538473

6. Chiwande, S. S., Nipane, P., Bakre, H., et al. (2024). Design and implementation of efficient public transport system using Raspberry Pi. In *2nd International Conference on Intelligent Cyber-Physical Systems and Internet of Things (ICoICI 2024 - Proceedings)* (pp. 533–537). https://doi.org/10.1109/ICoICI62503.2024.10696348

7. Dang, M., Liu, G., Xu, Q., et al. (2024). Multi-object behavior recognition based on object detection for dense crowds. *Expert Systems with Applications, 248*, 123397. https://doi.org/10.1016/j.eswa.2024.123397

8. Domínguez-Bolaño, T., Barral, V., Escudero, C. J., & García-Naya, J. A. (2024). An IoT system for a smart campus: Challenges and solutions illustrated over several real-world use cases. *Internet of Things*

(Netherlands), 25, 101099. https://doi.org/10.1016/j.iot.2024.101099

9. Ganga, B., B.T., L., & K.R., V. (2024). Object detection and crowd analysis using deep learning techniques: Comprehensive review and future directions. *Neurocomputing, 597*, 127932. https://doi.org/10.1016/j.neucom.2024.127932

10. Hu, J., Pang, T., Peng, B., et al. (2025). A small object detection model for drone images based on multiattention fusion network. *Image and Vision Computing, 155*, 105436. https://doi.org/10.1016/j.imavis.2025.105436

11. Jayasingh, S. K., Naik, P., Swain, S., et al. (2024). Integrated crowd counting system utilizing IoT sensors, OpenCV and YOLO models for accurate people density estimation in real-time environments.

In *2024 1st International Conference on Cognitive Green and Ubiquitous Computing (IC-CGU 2024)* (pp. 1–6). https://doi.org/10.1109/IC-CGU58078.2024.10530804

12. Joshi, A. (2022). *Smart trends in computing and communications*.

13. Khan, T. (2025). *A deep learning-based gunshot detection IoT system with enhanced security features and testing using blank guns*.

14. Mansouri, W., Alohali, M. A., Alqahtani, H., & Alruwais, N. (2025). *Deep convolutional neural network-based enhanced crowd density monitoring for intelligent urban planning on smart cities*.

15. Mishra, S., & Chaurasiya, V. K. (2024). Hybrid deep learning algorithm for smart cities security enhancement through blockchain and internet of things. *Multimedia Tools and Applications, 83*, 22609– 22637. https://doi.org/10.1007/s11042-023-16406-6

16. Mostafa, S. A., Ravi, S., Asaad Zebari, D., et al. (2024). A YOLO-based deep learning model for realtime face mask detection via drone surveillance in public spaces. *Information Sciences, 676*, 120865. https://doi.org/10.1016/j.ins.2024.120865

17. Muzammul, M., & Li, X. (2025). Comprehensive review of deep learning-based tiny object detection: Challenges, strategies, and future directions. https://doi.org/10.1007/s10115-025-02375-9

18. Nicolas, M. F., & Megherbi, D. B. (2024). Hidden challenge in deep-learning real-time object detection on edge devices. In *Midwest Symposium on Circuits and Systems* (pp. 547–551). https://doi.org/10.1109/MWSCAS60917.2024.10658678

19. Palanivel, N., Madhan, K., Venkatvamsi, A., et al. (2023). Design and implementation of real-time object detection using CNN. In *2023 International Conference on System, Computation, Automation, and Networking (ICSCAN 2023)* (pp. 1–5). https://doi.org/10.1109/ICSCAN58655.2023.10394752

20. Pradhan, G., Prusty, M. R., Negi, V. S., & Chinara, S. (2025). Advanced IoT-integrated parking systems with automated license plate recognition and payment management. *Scientific Reports, 15*,
2388. https://doi.org/10.1038/s41598-025-86441-w

21. Ramani, P., Sai, B. M., Sohail, S. K., & Manikanta, P. (2024). Real-time fake number plate detection and analysis with Raspberry Pi and deep learning. In *2024 4th Asian Conference on Innovation in Technology (ASIANCON 2024)* (pp. 1–4). https://doi.org/10.1109/ASIANCON62057.2024.10837818

22. Rezaee, K., Rezakhani, S. M., Khosravi, M. R., & Moghimi, M. K. (2024). A survey on deep learningbased real-time crowd anomaly detection for secure distributed video surveillance. *Personal and*
Ubiquitous Computing, 28, 135–151. https://doi.org/10.1007/s00779-021-01586-5

23. Rosak-Szyrocka, J., & Einstein, A. (2025). Engineering the future of higher education: A VOSviewer analysis of smart university trends in the digitalization and industry 5.0 era. *Management Systems in Production Engineering, 0*, 8–23. https://doi.org/10.2478/mspe-2025-0002

24. Sabit, H. (2025). Artificial intelligence-based smart security system using internet of things for smart home applications. *Electronics, 14*(3), 1–25. https://doi.org/10.3390/electronics14030608

25. Song, G., Du, H., Zhang, X., et al. (2024). Small object detection in unmanned aerial vehicle images using multi-scale hybrid attention. *Engineering Applications of Artificial Intelligence, 128*,
107455. https://doi.org/10.1016/j.engappai.2023.107455

26. Tian, J., Jin, Q., Wang, Y., et al. (2024). Performance analysis of deep learning-based

object detection algorithms on COCO benchmark: A comparative study. *Journal of Engineering and Applied Sciences, 71*, 1–18. https://doi.org/10.1186/s44147-024-00411-z

27. Wang, X., Sun, Z., Chehri, A., et al. (2024). Deep learning and multi-modal fusion for real-time multiobject tracking: Algorithms, challenges, datasets, and comparative study. *Information Fusion, 105*, 102247. https://doi.org/10.1016/j.inffus.2024.102247

28. Yadav, S., Gulia, P., Gill, N. S., & Chatterjee, J. M. (2022). A real-time crowd monitoring and management system for social distance classification and healthcare using deep learning. *Journal of Healthcare Engineering, 2022*, 2130172. https://doi.org/10.1155/2022/2130172

29. Rezaee, K., Rezakhani, S. M., Khosravi, M. R., & Moghimi, M. K. (2024). A survey on deep learningbased real-time crowd anomaly detection for secure distributed video surveillance. *Personal and Ubiquitous Computing*, *28*(1), 135-151.

30. Asres, M. W., Jiao, L., & Omlin, C. W. (2024). Low-Latency Video Anonymization for Crowd Anomaly Detection: Privacy vs. Performance. *arXiv preprint arXiv:2410.18717*.

31. Alotaibi, S. R., Mengash, H. A., Maray, M., Alotaibi, F. A., Alkharashi, A., Alzahrani, A. A., ... & Alnfiai, M. M. (2025). Integrating Explainable Artificial Intelligence with Advanced Deep Learning Model for Crowd Density Estimation in Real-world Surveillance Systems. *IEEE Access*.

32. Cahyono, F. Y. A., Suharto, N., & Mustafa, L. D. (2022). Design and build a home security system based on an esp32 cam microcontroller with telegram notification. *Journal of Telecommunication Network (Jurnal Jaringan Telekomunikasi)*, *12*(2), 58-64.

33. Adi, P. D. P., Mappadang, A., Armi, N., Santiko, A. B., Adiprabowo, T., Zulkarnain, R., & Wirawan, A.
(2023, October). Optimization and Development of Raspberry Pi 4 Model B for the Internet of Things. In *2023 IEEE 9th Information Technology International Seminar (ITIS)* (pp. 1-6). IEEE.

34. Chandel, P. S., Pathan, S., Kaur, G., Agrawal, P., & Pinjarkar, L. (2024, October).

Crowd Management on CCTV Video Dataset Using CNN and YOLO. In *2024 IEEE 6th International Conference on Cybernetics, Cognition and Machine Learning Applications (ICCCMLA)* (pp. 260-265). IEEE.

35. Gündüz, M. Ş., & Işık, G. (2023). A new YOLO-based method for real-time crowd detection from video and performance analysis of YOLO models. *Journal of Real-Time Image Processing*, *20*(1), 5.

36. Lau, B. P. L., Marakkalage, S. H., Zhou, Y., Hassan, N. U., Yuen, C., Zhang, M., & Tan, U. X. (2019). A survey of data fusion in smart city applications. *Information Fusion*, *52*, 357-374.

37. Tian, Y., Ye, Q., & Doermann, D. (2025). Yolov12: Attention-centric real-time object detectors. *arXiv preprint arXiv:2502.12524*

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