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The Open University of Tanzania
P.O. Box 23409,
Dar es Salaam, Tanzania
Fax: +255 22 2668759
http://www.out.ac.tz

The Open University of Tanzania,
Kawawa Road, Kinondoni Municipality,
P. O. Box 23409,
Dar es Salaam, Tanzania

Tel: +255 222 668 835, 222 668 820
Fax: +255 222 668 759
E-mail: huriajournal-editor@out.ac.tz
Website: http://www.out.ac.tz

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CONTENTS

Clusters of Agrocredit Suppliers in Tanzania and their Associated Transaction Costs: A Scholarly Personal Narrative

Deus D. Ngaruko
Email: ngarukoddp@gmail.com
The Open University of Tanzania

ABSTRACT
This paper blends the Scholarly Personal Narrative (SPN) with desk reviews of selected literature on the key concepts and their applications in understanding the key features of agrocredit supply in rural areas. The findings of this exploratory study indicate that the informality of agrocredit supply is associated with low transaction cost, low levels of credit and low levels of repayment rates. It is also noted that the formalised and regulated suppliers are more associated with higher levels of transaction cost with relatively higher levels of repayment. Transaction costs related to searching for potential borrowers, negotiation and enforcement are higher for most regulated suppliers because they involve third parties. Where the transaction involves small volumes of agrocredit, the transaction cost increases due to supplier's compliance to legal formalisation and licensing. In-kind agrocredit supply models are recommended to be the most plausible models for resource poor smallholder farmers due to the fact that in-kind credit is not agile and that it can be used on intended cause. It is also recommended that in order to reduce transaction cost, agrocredit suppliers of in-kind agrocredit should deal with the farmer groups or primary cooperatives which act on behalf of member farmers.

Keywords: *Transaction cost, agrocredit suppliers, agrocredit borrowers, agribusiness, Tanzania*

INTRODUCTION

Agrocredit in this paper refers to a loan either monetary or in kind, to be used for investment in agriculture related businesses. Of all rural financial services (savings, credit and payments), agrocredit is normally the most expensive service not only to access but to produce as well. An agrocredit intermediary has to evaluate the probability of being repaid in the future as a consequence of resources being lent to an individual borrower in the present. *Ex ante*, this is especially expensive when there

is no institutional information about the creditworthiness of a new borrower since not all potential borrowers are credit-worthy. Agrocredit demanded by smallholder farmers may be formal or informal. Formal agrocredit has contracts created and enforced by mechanisms beyond the contracting parties and formal agrocredit organisations may be regulated. In contrast, informal credit contracts are enforced without reference to third parties. In theory, formal credit contracts are enforceable in the courts or possibly by other government mechanisms. Ngaruko and Lyanga (2021) argue that although both formal and informal credits matter to smallholder farmers, the policy normally focuses only on formal credit, ignoring informal credit. There could be two explanations to this: first, informal credit is outside the government's purview. Thus, policy affects formal finance directly but informal finance only indirectly. Second, informal credit is an imperfect substitute for formal credit in the long run. In the short run, however, formal and informal credit may be close substitutes, especially for small, short term uncollateralized loans (Conning & Udry, 2005).

Abay et al. (2022) argue that credit markets are key instruments by which liquidity-constrained smallholder farmers may finance productive investments. However, the documented low demand and uptake of agricultural credit by smallholder farmers in sub-Saharan Africa pose challenges for energizing rural transformation in the region. Assessment of the effective demand for agrocredit by smallholder farmers is a task beset by imprecision and ambiguity. Farmers demand credit if they voluntarily can bear the cost of using the services as stipulated in the credit contract. This type of demand is what is could be referred to, in orthodox economics, as the effective demand. Effective demand excludes the demand by those who, such as delinquent borrowers or bankrupt banks, do not fulfil their contracts (Ngaruko, 2017). These borrowers do not really demand the temporary transfers that are finance; they demand the permanent transfers that are grants. Effective demand for agrocredit can therefore be realised if and only if three conditions are met: first, the user must want the credit i.e. expected benefits to exceed expected costs. Second, the borrower must be able to pay the costs. Third, the borrower must be willing to pay for its cost. Loan default can either be voluntary or involuntary.

Another aspect that helps to understand the nature of agrocredit demand by smallholder farmers in Tanzania is the cost to users of the credit

service. The cost of an agrocredit seems to have three major components (Ngaruko, 2008):

a) Price – this is the cash expense paid by the borrower to the supplier, including tax. The price covers at least the provider's costs, legitimate fees and real interest rate.
b) Transformation costs – these are formally observable cash expenses incurred by both the lender and borrower in completing the transaction. Transformation costs refer to costs of producing, consuming, and exchanging goods and services over space (transport costs), time (storage costs), form (processing costs), and expectations (insurance costs).
c) Transaction costs – these are either cash or non-cash costs usually referred to as opportunity costs of borrowing. A borrower incurs opportunity costs even though no one collects them. These include for example cost of time spent in applying for the agrocredit, frustration of wasted time when failing to qualify for the loan, time spent in attending training about loan repayment etc. Other transaction costs are those incurred by credit market agents when searching and screening potential contractual partners, monitoring behaviour of partners to avoid breach of contract, as well as enforcing agrocredit contract in cases of noncompliance with a credit contract.

Studies by Seibel (2001), Ngaruko (2014), Nguvava and Ngaruko (2016), Kashaga and Ngaruko (2019) and recently by Ngaruko and Lyanga (2021) confirm that the contention that rural financial services face high transaction costs associated with imperfect information (search, monitoring and enforcement), increased costs of credit transactions and loweffective demand. The dispersed nature of rural populations increases the transaction costs of servicing rural areas compared to urban areas for many credit providers. Transaction costs relate to increases in transformation costs associated with coordination, information, and strategic behaviour. Coordination costs are the sum of the costs of the time, capital, and personnel invested in negotiating, monitoring, and enforcing agreements among actors. Information costs are the sum of the costs of searching for and organizing information, and the costs of errors resulting from a lack, or an ineffective blend, of knowledge about time and place variables and general scientific principles. Strategic costs are the increased transformation costs produced when individuals use asymmetric distributions of information, power, or other resources to

obtain benefits at the cost of others. The most frequent sources of strategic costs are free riding, rent seeking, and corruption (Ngaruko, 2017; Nguvava & Ngaruko, 2016; Omamo, 2006).

Transaction costs in agrarian economies often swamp cost of credit (interest), thus farmers' sensitivity to the interest rate is strongest when it is the major component of price. A study by Ngaruko (2017) found that in most cases non-price transactions costs are excessive because of rural financial market coordination failures. Weak competition can permit satisfactory suppliers' profits even while ignoring some effective demand. Transaction costs for agrocredit borrowers are excessive when they could be reduced without harming the viability of effective supply. Access is the confluence of effective supply and effective demand. A common phenomenon is the situation where no one is concerned when a lack of access is caused by a simultaneous lack of effective supply and lack of effective demand. There is also tendency for financial market actors, including the government, not to be concerned when a lack of access is caused by lack of effective demand. The FAO's annual report on state of the food globally for 2021 (FAO, 2021) implies that it is important to appreciate that the agrocredit borrowers especially in poor countries face a variety of risks in an agrocredit transaction, which in turn affects sustained developments in world agriculture. Suppliers cannot cover their costs if no one will pay their prices. A concern is lack of access when there is effective demand but there is not effective supply. In this case the borrower farmers would be willing to pay for the cost of credit borrowed if only someone supplied it. Cementing on earlier study by Schreiner (1997), some recent studies (Kashaga & Ngaruko, 2019; Ngaruko, 2017) suggest two reasons for the mismatch between effective demand and effective supply. First, the supply could be too costly to destroy effective demand. The second reason is that supply is costly, but costs could be reduced to levels that would not destroy effective demand if treatable market failures were remedied. This explains the virtual absence of commercial bank branches in rural areas in Tanzania. The major concern by many agricultural development economists has been the second reason. See for example FAO. (2001)'s recommendations on the role of state in the co-ordination of markets in poor rural areas. There is therefore a need for providing specific information that may minimise the persistent mismatches between demand for - and supply of- agrocredit especially in thin agrarian markets like rural Tanzania.

Despite making up over 70% of the smallholder agricultural subsector sector in Tanzania, farmers have little capacity to improve production and increase their revenues, because they cling to low-technology farming techniques. Farming is labour-intensive and dependent on family members working on the land, which can be problematic if someone falls ill or suffers an injury. As a result, farmers are stuck in a vicious cycle where volatile prices, variable outputs and weakening resource conditions, perpetuate current practices and technologies of farming that lower their productivity and increase their sensitivity to unexpected life events (FSDT, 2020).

In Tanzania *rural* usually means *agricultural* and vice versa due to the economic, social and political importance agriculture plays in rural areas (Ngaruko & Lyanga, 2021). Agriculture leads to low population density in rural areas because plants and animals need more space than people. Farmers live near their work to reduce transportation costs and to deter theft. This is in contrast with those who argue that markets and non-agricultural production are cheaper when population density is high due to economies of agglomeration. According to Lwezaura and Ngaruko (2013) squeezing into townships and cities reduces transaction costs through thicker markets which include better information networks, lower search costs and a greater choice of buyers and sellers. Financial intermediaries, as with most other businesses which do not require land for production, locate into cities to take advantage of agglomeration.

There are many reasons as to why only a few or none of the major formal suppliers of credit are not extending their services to majority rural poor. Kashaga and Ngaruko (2019) argue that the cost of rural lending depends on the cost of determining if potential borrowers are willing and able to repay. Rural remoteness increases the cost of evaluating creditworthiness and thus decreases access to credit. The cost of public infrastructure per person also increases as population density decreases. As a result, rural roads are few and often rough and impassable especially during rainy season. Most households do not have electricity or telephones, if any these utilities can only be affordable at high running costs. This implies that communication and transportation are more expensive in rural than in urban areas. Thus, the traded goods and services tend to be more expensive in rural areas than in urban areas. One of the advantages of low population density in rural areas is the potential for strong social networks (Fafchamps & Minten, 2001). Friendships are stronger when people are

scarce, thus rural people may cling to social networks out of loneliness (Ngaruko, 2012). In addition, most agrocredit borrowers often run hereditary agroenterprises. This lengthens the horizon over which relationships are valued both within and between borrowers with a locality. Strong social networks reduce asymmetric information and thus decrease the costs of informal financial services. Formal intermediaries are not allies to these networks hence they are likely to incur high transaction cost to market entry as well as their business operations. These costs are assumed to be too high to inhibit participation of such organisations in lending to smallholder farmers.

Kingu (2019) contents that Tanzania's smallholder farmers are the most underfinanced group in the country, but improved agricultural and financial sector policies, enhancement of capacity of financial service providers to appraise agri-related loans and raising awareness of farming technology could improve the amount of credit they receive and help them increase their production, says a recent report. Despite the country's steady economic growth, farmers still struggle to obtain sufficient credit because the agricultural sector is considered high risk by lenders. According to the recent Credit Diagnostic report by the Financial Sector Deepening Trust (Kingu (2019) it is noted that improved policies and raising farmers' awareness of farming practices and irrigation technologies could improve productivity; henceforth, providing farmers a more credit-worthy reputation and open increased access to credit from lenders.

The agriculture sector contributes 28.7% of the GDP as well as 65.5% of direct labour force and 10% indirect labour force (FSDT, 2020). However, FSDT report unveils that out of 24 surveyed banks, only 13 banks were found to have any agriculture lending products. Many banks concentrate their activities in urban and semi-urban areas, with limited presence of branches in the rural areas where smallholder farmers are often located. Limited presence in rural areas leaves most banks out of touch and incapable of understanding the specific needs of farmers. As a result, they view smallholder farmers as unreliable borrowers because of unstable income, lack of savings, and volatile productivity which is dependent on rainfall. Therefore, FSDT recommends that banks need to reconsider their rural penetration strategies and develop business models that improve delivery of credit products to smallholder farmers.

It is from this background that this paper presents a framework for understanding the importance of Transaction Cost Economics theory in classifying players in the supply chain of agrocredit to smallholder farmers in Tanzania. This paper, which is conceptual in nature, covers features of agrocredit borrowers which in turn may increase transaction of agrocredit delivery. Further, the paper characterises clusters of agrocredit suppliers based on their transaction cost mitigating behaviours. The paper adds value to the existing literature on the application of Transaction Cost Economics theory in understanding the causes for the mismatching supply and demand for agrocredit in Tanzania. Findings from this study are expected to prompt a country-wide study to further cement applicability of Transaction Cost Economics in the provision of financial intermediation that supports agribusiness development in Tanzania and related economies

METHODOLOGY

This paper blends the exploratory research approach and Scholarly Personal Narrative (SPN) in understanding the economics of agrocredit supply in thin markets more closely comparable to Tanzania. The desk review of the relevant published and unpublished reports was complemented with a review of publications by the author of this paper on topics related to agrocredit and transaction cost. SPN enabled the author to logically draw critical issues from a variety of academic and non-academic references and findings. Using SPN allows the writer to communicate to both academic and non-academic audiences with realistic reflections of the complexities of daily life and personal identity. Scholarly personal narrative is a constructivist research methodology that recognizes the researcher's personal experience as a valid object of study. For a logical synthesis of exploratory information, findings are presented in thematic descriptions of agrocredit, agrocredit suppliers and transaction costs.

FINDINGS AND DISCUSSIONS

As stated earlier, this paper presents findings from the selected literature with much insights from the personal knowledge of the author. There are three main areas of findings: first is the characterisation of agrocredit; second part of findings is the profile of agrocredit suppliers; and the third section provides theoretical insights on the key forms of agrocredit transaction costs. The paper concludes by suggesting recommendations

for a workable agrocredit supply model that blends both formal and informal agrocredit suppliers to absorb the agrocredit transaction costs.

Feature of typical agrocredit

The features of agrocredit shape the way borrowers in their smallness, remoteness and ruralness interact when they participate in the agrocredit market. The demand for agricultural credit is characterised by three main features: required investments and the lags both between investment and production and between production and investment or consumption; the marketing intermediaries; and the risks. A summary of agrocredit features in Tanzania can be conceptualised in terms of investment lags, market intermediaries, unusual risks, agrocredit agility and flexibility.

Investment and lags

Agricultural production requires investment. Cash inflows from production lag behind the cash outflows yet investment requires finance. Most agricultural investment expenditures have both lumpy and continuous characteristics. Lumpy investments usually require a single expenditure. Other agricultural inputs are consumed over the course of a single production cycle and often require several smaller expenditures. Before harvest there are very many cash outflows for inputs such as pesticides, fertilisers, tilling, harvesting, weeding, wage labour, fuel etc. These inputs must be financed either by savings or credit. Many small cash outflows followed by a single larger cash inflow imply demand for small, short financing. Agricultural production lags behind investments so cash outflows and cash inflows are mismatched not only in one season but also over many seasons. Storage links the lags between production and use of the products. However not all products are equally storable. Unlike continually harvested produce like milk, single-harvest products such as grains and livestock are often storable.

Marketing intermediaries

Marketing can be defined as the process of finding partners for exchange. All farm output not consumed or reinvested requires marketing. Marketing is especially costly for rural enterprises because of the cost of communication and transportation over rural distances. The unusually heavy and bulky goods relative to their value also exaggerate marketing costs. Marketing margins decrease with distance from markets. This is because transportation costs increase with the distance to the farm even though the sale price in the market does not change. Produce not

consumed by the household itself (e.g. cotton, coffee, cashew, tea, tobacco, sugar cane, livestock etc) usually must be cleaned and processed before being marketed. To take advantages of economies of scale, processing plants are large and thus cannot be close to many farms. Due to this, farmers usually sell unclean and unprocessed produce to marketing intermediaries. In many cases, these intermediaries also supply credit to farmers through various linkages. This is possible because the marketing intermediaries already know the farmers and their creditworthiness. The credits are not regulated; therefore, even tax evaders have access to credit. In addition, the intermediaries can deduct loan repayments from payments for the farmer's produce. Schreiner (1997) observes that although marketing enterprises provide access to credit, they often command monopsony power, and they may offer loans with very unfavourable terms.

Unusual risks

Agriculture is unusually risky. Weather can destroy crops regardless of the efforts of the producer. Some weather risks, such as hail are idiosyncratic; others like drought are systemic. Prices fluctuate beyond the control of the farmer. The prices of spices, fruits and vegetables are particularly volatile. As in most developing countries, Tanzanian smallholder farm enterprises are completely uninsured (Mutayoba & Ngaruko, 2015). Due to these risks, agricultural loans have been perceived unusually risky. Agricultural loan delinquency has also resulted from the politicised lending. Other factors that explain weak loan repayment include poor farmers' debt to equity ratio as well as the historical use by the state, of agrocredit as a way to subsidise agriculture and as a substitute for insurance. From the supply side, production risk and price increase the uncertainty of repayment. Historical non-repayment also increases the perceived risk, thereby increasing the cost of credit and decrease in its supply. Risk tends to increase as size and length of loan increases. From the demand side, risk increases the desire for credit because without perfect guarantees, the fixed nature of the repayment obligation allows the borrower farmer to shift some risk to the lender. However, increased desire stimulated by risk does not increase effective demand. Risk decreases the effective demand for large, longer loans because such loans usually require traditional collateral such as titled land, buildings etc. Likewise, risk increases the demand for short, small loans because such loans help smooth consumption in bad seasons.

Agrocredit agility and flexibility

Agrocredit borrowers, like any other users of financial services, would prefer the best products at the lowest prices possible, thus they will never be completely satisfied. Thus, a desirable credit should impose low transaction costs on the users. As noted before, transaction costs are important because they often swamp prices. In addition, remoteness makes transaction costs in rural areas high. Credit agility and flexibility decrease transaction costs of borrowing. A credit is agile if it is fungible across different uses and it is flexible if it can be matched with the number, size, and timing of the cash flows of borrowers. Unlinked cash loans are more agile than linked loans. Decoupling tax compliance from access to regulated intermediaries opens access to many unbanked smallholder farmers (Ngaruko, 2008). Rural informal lenders, market intermediaries, and finance organisations who are currently supplying credit to smallholder farmers are precisely those intermediaries who do not link access to tax compliance. Nguvava and Ngaruko (2016) content that Linking tax compliance to access to regulated intermediaries hurts the poor because they demand credit even though they do not pay taxes. However, the poor will not stop evading taxes simply to gain access to financial services.

Kashaga and Ngaruko (2019) shows that although borrowers prefer disbursement in cash, they sometimes prefer repayments in kind. This helps to avoid costs of marketing. For some specific types of farm products, marketing intermediaries also sometimes prefer in kind repayment because it helps them utilise installed capacity. Other than individuals, in some cases only farmer groups are creditworthy. Thus lenders evaluate the creditworthiness of the groups because bands of smallholder farmers may substitute for large, single-owner farm such as the Group Lending Schemes adopted by many microfinance organisations.

In conclusion, agrocredit linked to specific purchases are useful, but they cannot be used for all expenditures. Cash loans, especially flexible cash loans, which allow the borrower to choose the timing and size of disbursements and repayments, are especially valuable for continuous production and consumption expenditures. Payment by cash is the most common and essential. However, as cash has a physical existence, it has to be transported, and kept safe, but it can also be stolen or lost. The cost of transportation and risk of loss are especially important in rural areas.

This implies that credit supply through cash payment mechanisms will attract higher transaction cost than linked (in kind) credit.

Features of agrocredit suppliers in Tanzania

Several features were considered to classify the various suppliers of agrocredit as shown in Table 1 and Table 2. Both formal and informal suppliers were observed in the study area where formal suppliers were either regulated whereas others were unregulated. The agrocredit suppliers were either privately or publicly owned. The form of agrocredit could slither be cash mainly for regulated banks but the form could either be inkind or cash for most of the unregulated supplier. Different types of suppliers and/or form of credit faced different levels of competition and risks due to lack of sufficient information on borrower characteristics. Table 1 summarises the typological framework of suppliers of agrocredit to smallholder farmers in Tanzania based on formality, regulation, ownership and competition. Based on the type of agrocredit, suppliers can be broadly categorised into four main groups: informal credit suppliers, unregulated formal private credit suppliers, unregulated formal public credit, and regulated credit suppliers.

Table 1: Suppliers of agrocredit by formality and regulatory related features

Supplier	*Formality*	*Regulation*	*Ownership*	*Competition*
Family/friends	Informal	No	Private	Medium/High
Inkind credit supplier	Informal	No	Private	Low/Medium
Commodity buyer	Formal	No	Private	Low/Medium
Agricultural cooperatives	Formal	No	Cooperative	Low
SACCOS/ROSCAs	Formal	No	Cooperative	Low
NGOs/CBOs	Formal	No	Non-profit	Low
Public credit schemes	Formal	No	Public	Low
Community banks	Formal	Yes	Public/Private	Low
Commercial banks	Formal	Yes	Public/Private	None/Low

Source: Modified from Ngaruko, 2014

Informal agrocredit suppliers: Informal agrocredit refers to credit that is not based on any rules or regulations and hence it is purely not regulated, and it can be supplied as cash or in-kind. The credit's main repayment enforcement mechanism is through threats posed on loss of family relationships and values as well loss of friendship as a result of the failure to repay them credit. Table 1 lists two main informal agrocredit

suppliers for smallholder farmers: family members and/or friends and input creditors.

Family and friends

Smallholder farmers access informal cash credit from friends and relatives. These suppliers may be employees in non-farm activities, wage earning farmers' family members residing locally or in urban areas or from other farmers. While this type of credit seems to be widespread, agile and flexible, its size is limited by the surplus of the lender. Therefore, informal credit usually finances non-durable purchases by households or farm activities. Terms are adjustable and prices and transaction costs are low, but the opportunity cost of indebtedness to relatives and friends can be high. Flexible repayment terms mean that risk of default is low. Borrower's character is usually the only form of guarantee.

In-kind credit suppliers

Some smallholder farmers receive informal credit in kind from employers, input suppliers, local consumer shops, or from other farmers. In kind credit is a sort of barter trade with non-simultaneous exchange. Examples include trading groceries for delivery of certain farm produce of certain quality after harvest. For example, a bag of seeds at planting for 2 to 3 bags of grain at harvest, one future harvest for a bicycle, beef cattle for milk cows, 2 bags of harvested grain for the piece of land rent etc. Closely related to the persistent situation in rural Tanzania, Schreiner (1997) found out that in extraordinarily isolated rural areas in Argentina, inkind credit from mobile retailers with trucks of consumer merchandise are the only external credit available, and that the retailers often set up a 50% mark-up. The mark-up reflects of transportation costs, credit risks, the time value of resources as well as monopoly power.

In general, inkind agrocredit has low transaction costs and risks, especially if the borrower and the lender already have a relationship. By avoiding cash, inkind credit is protected against hyperinflation, and it naturally subsidises cash loans for rural economy whose degree of monetisation is narrow. Inkind credit avoids marketing costs as well as taxes. However, inkind credit is neither agile nor is it flexible, terms are fixed by the production cycles and opportunity costs are high because production and delivery obligations are fixed. Lenders are often monopsonist buyers of farm produce, controlling market power and fixing

exploitative loan terms. However, NIE theory argues that provided there is no alternative, the prevailing service supply mechanisms suffice what farmers could not have had access to. Therefore they are regarded as ex ante, efficient institutional arrangements (Ngaruko, 2012).

Table 2: Suppliers of agrocredit by selected features of agrocredit

Supplier	***Guarantee***	***Agility***	***Term***	***Flexibility***		
				Number	***Size***	***Time***
Family/friends	Character	Cash	Any	Any	Small	Any
Inkind credit suppliers	Character	Linked	Production cycle	One	Large	Fixed
Contract farming	Harvest delivery	Linked	Production cycle	One	Medium	Fixed
Agricultural cooperatives	Harvest delivery	Linked	Production cycle	One	Medium	Fixed
SACCOS/ROSCAs	None	Cash	Few months	Few	Small/med	Fixed
NGOs/CBOs	None/Group	Cash	Few months	Few	Small	Fixed
Public credit schemes	Cooperatives	Linked	Production cycle	Varies	Varies	Any
Community banks	Character/license	Cash	≥6 months	Many	Varies	Any
Commercial banks	Collateral/license	Cash	Up to 2 years	Many	Varies	Any

Source: Modified from Ngaruko, 2014

Unregulated formal private agrocredit suppliers: Some farmers receive agrocredit from unregulated formal credit suppliers such as input suppliers, agricultural cooperatives, and NGOs and CBOs. They are briefly discussed in the subsequent sections.

Credit from agricultural input suppliers

Many farmers access agrocredit from retailers of agricultural inputs. Retailers who do not also market agricultural produce usually collect cash after the harvest. Retailers who also market produce usually deduct debt repayments from payments for the delivery of produce after harvest. Sometimes even retailers who do not market produce can have their repayments deducted automatically by marketing intermediaries (See for example Dorward et al. (2003), Atieno (2001), Ngaruko and Lyanga (2021)). Repayment by deductions from committed deliveries not only reduces transaction costs but also acts as a guarantee that reduces transaction risks. However, this repayment mechanism increases

opportunity costs because farmers must sell at harvest when prices are the lowest to specific intermediaries who may try to fix prices. The input supplier credit often does not carry explicit interest rate but it is insinuated in the purchase price of the farm price. Sometimes credit from input suppliers is driven by competition for certain commodities. For instance, input suppliers who also process agricultural products (e.g. coffee marketing firms) may be motivated to supply credit in order to guarantee better utilisation of their installed capacity (e.g. Specific asset investment in coffee processing plants). Credit from input suppliers has limited agility and flexibility. The size of credit is tied to the input purchase, and the term is tied to the production cycle. Supplier credit is only relevant to farmers who buy inputs and/or who sell to marketing intermediaries. With this type of credit, formal written contracts, tax compliance and formal collateral are not necessary.

Agricultural financing through contract farming

Contract farming between farmers and private companies offering credits for agricultural inputs, capital and ensuring the availability of markets, are among the strategies used in production of agricultural products in some parts of the country. This input supply system is common in outgrower schemes in sugar and tea plantations, in export horticultural farms as well as in tobacco sub sector. For example Wangwe and Lwakatare (2004) observed that Dimon (T) Ltd, which is a tobacco leaf processing company located in Morogoro region, is a supplier of tobacco to the Tanzania Cigarette Company (TCC) and deals directly with tobacco farmers through the already existing primary cooperative societies. Dimon has learnt lessons from the collapse of vast number of private companies that have failed in tobacco market due to outstanding debts. Thus instead of dealing with individual farmers, the company deals with the primary cooperative society leaders who distribute the money paid in advance to farmers as a means for buying farm inputs such as fertilizer, seed, pesticides and other essential items. It is up to the leaders to keep within budget allocated to them. As an addition to funds for agricultural inputs, the company also supplies each borrower farmer with the bag of maize seeds to encourage them to grow other crops for food as well as for additional crop sales income. A bag of maize is provided for every four bags of tobacco seeds bought by the farmer. Repayment on the loans is done at various points: the delivery of the agreed quantity of produce in the first and second phase is for the debt recovery. The farmer is only paid on the third delivered allotment.

The problem related to interlocked market contractual arrangement is evidenced by Tanzania Breweries Ltd (TBL) which has for some years been contracting barley farmers by providing them with farm inputs. The company made heavy loss from dishonest farmers of up to TShs 1.2 billion in a year (Wangwe & Lwakatare, 2004). Farmers obtained input seeds such as seeds from the company on agreement of supplying the produce to the company after harvest. However, some farmers sold the seed to other big farmers for cash and thus could not supply the required quantity and quality barley to the company. The company claims that it could be costlier to legally enforce the contracts because the defaulting farmers were too many and too poor (costly) to open court files. From this experience the company has changed terms and conditions of new agreement by carefully selecting few large farmers to contract directly and the others through their cooperative societies. Thus, instead of dealing with all individual farmers, TBL deals with two forms of contracting partners: the carefully screened farmers and the farmer cooperative societies which act on behalf of farmers who do not qualify for direct contract with the company. Other than providing agrocredit to barley farmers, TBL also provides agricultural extension services to farmers and operates the Corporate Social Responsibility Funding Scheme which provides funds for rural development initiatives in areas of their intervention. The funding scheme provides some forms of a complementary investment like education, health and transport necessary to reduce transaction failures in input credit supply and barley procurement.

Credit from agricultural cooperatives

Agricultural cooperatives supply inputs and market produce. In general, corruption and bad management has reduced the importance and scope of agricultural cooperatives. However, some regional cooperatives which have survived shocks of the structural reforms (e.g. KNCU of Kilimanjaro region), still handle a substantial share of credit supply to their members although, to a lesser extent than in the pre-reform era (Maghimbi, 2010). Cooperatives lend for inputs against the promise of delivery of harvest. None of the cooperatives lend cash for unlinked expenditures or for purchases outside of the cooperatives. Loans through universal accounts with cooperatives carry low transactions costs because application procedures are simple, disbursement is quick, disposition of assets is not required and tax evasion is ignored. However, loans through

universal accounts carry fairly high prices and high opportunity costs due to obligations to deliver produce to the cooperative at a given time. In addition, competition is low because most farmers in a given region are associated with only one cooperative. As with other linked credit forms, default risk depends on ability and/or willingness to repay or willingness to deliver farm product to the cooperative. (Kashaga & Ngaruko, 2019) observes that there is a high probability of default where there are many marketing intermediaries to which farmers can have access to linked credit. Related to agricultural cooperatives are Savings and Credit Cooperative Societies (SACCOS) and Rotating Savings and Credit Associations (ROSCA). SACCOS and ROSCA are financed by savings and member shares. Their transformation as well as transaction costs are generally low.

Credit from NGOs and CBOs

Credit from microfinance NGOs and CBOs are unregulated, tax-exempt, and often funded by donations and hence keeping their lending and borrowing transformation costs relatively low. Most NGOs/CBOs are flexible organisations which can adapt to local conditions and to grassroots demands. They also have experience with organising groups, and group based financial technologies, which tend to reduce transaction costs of supplying finance in rural areas. Normally NGOs do not reject tax evaders nor do they insist on traditional guarantees. Therefore, NGOs can make agile, flexible loans based on appropriate creditworthiness. Schreiner (1997), Stoian et al. (2016) and Sharma and Bansal (2017) point out that the best financial NGOs do not distinguish between household and the enterprise. However, lack of collateral compels NGOs to supply small, short loans. In addition, the lending technologies used by many NGOs impose excessive transactions costs on users and some of them offer loans at interest rates higher than the official interest rate in order to cover operational costs. For instance, some microfinance NGOs in Tanzania charge up to 50% interest rate whereas the official lending interest rate charged by commercial banks is on average 24%. Other highly subsidised NGOs charge interest rate less than the commercial rate.

Unregulated, formal public agrocredit suppliers: There are some special agrocredit programmes either administered purely by the government or jointly by the government and private stakeholders.

Seasonal Input Credit Scheme

In the early 1990s, the Seasonal Input Credit Scheme (SICS) was set by the government to supply input for traditional export commodities as well as for food grain production. SICS was supplying majority of fertiliser distribution as well as majority of agrochemicals to the agriculture sector as a whole. However, following the reforms that took place in the mid-1990s, especially privatisation of the Cooperatives and Rural Development Bank (CRDB) in 1996 which was responsible for running SICS, this scheme collapsed. In response to these, hybrids of public credit programmes tailored to the needs of smallholder farmers have emerged. Whereas some are run by the crop boards e.g. the Cotton Development Fund or the passbooks for cotton, others are jointly run by the state, crop boards and the private stakeholders e.g. the National Input Voucher Scheme(NIVS)(Kinuthia, 2020).

National Input Voucher Scheme, (NIVS)

NIVS is a product of mutual interest in a functional production and marketing system. A comprehensive account on NIVS is well covered in Knowles (2015). NIVS operates a special input fund whereby licensed parchment buyers issue a specified portion of farmer's coffee payments in the form of input vouchers. Vouchers channel part of each farmers' income from coffee payments in the following season. Traders purchase input vouchers proportional to the amount of parchments of coffee they expect to buy from farmers. These vouchers are then distributed to farmers at the coffee buying posts. For monitoring purposes, NIVS registers input distributors who apply to participate in the scheme. The vouchers collected by registered input suppliers are submitted to NIVS office for cash payment. In the 1996/97 season, vouchers accounted for 20% of the value of inputs required by coffee farmers in country. NIVS is another form of credit in kind; it is thus not agile although some farmers who need cash may trade the vouchers with the supplier in exchange for cash. Although it appears sustainable, NIVS does not encourage self-finance. Its operational costs are high implying high price and transaction costs running the scheme.

Agricultural Input Trust Fund

The widening agrocredit supply gap triggered the government to intervene by providing an alternative way of financing in order to ensure sustainable supplies of inputs to farmers. This led to the establishment of Agricultural Input Trust Fund (AGITF) Act in 1994 and reviewed in 2002

in order to bridge the gap left out by the importers and the co-operative system by ensuring that, agricultural inputs are readily available and can be accessed by the smallholder farmers. The objective of this among others was that the fund is to encourage the use of agricultural inputs, machinery and equipment in order to increase production and productivity of the sector (Munuo, 2014). Since then AGITF has undergone transformation and streamline its activities of providing soft loans to stockists, farmers and other beneficiaries in its efforts to enhance recovery of issued loans so that the Fund revolves and sustains itself. Credits through AGITF have been offered mainly for purchase, repair and maintenance of tractors.

The fund is channelled either directly to the farmers or indirectly by financing distributors of agricultural inputs. In any case the applications are sent through local authorities at the district level where screening is done before the forms are sent to the fund headquarter in Dar es Salaam for decision making. The applicant must have formal collateral preferably an immovable asset and the loan has to be repaid in 5 years period. The allocation of funds to this fund has been unstable and below requirements. The fund is meant to be revolving and growing but it faces very low loan recovery rate. This implies that it is unlikely that smallholder farmers can access credits offered through AGITF. Irrespective of its good intentions, AGITF does not form a reliable solution to agrocredit supply to geographically isolated poor small farmers especially those from income poor regions in the country.

Export Credit Guarantee Scheme

Export Credit Guarantee Scheme (ECGS) is another public source of agrocredit in Tanzania supported by the government and donor community. The funds of the scheme are channelled through a private bank, CRDB Bank (1996) Ltd. The ECGS has enabled a few well-established cooperative unions to secure credits for buying large quantities of crops and procure necessary inputs. By 2005 the scheme had supplied credit to only seven such cooperatives i.e. Nyanza Cooperative Union, Shinyanga Cooperative Union, Karagwe Cooperative Union, Biharamulo Cooperative Union, Arusha Cooperative Union, Kilimanjaro Native Cooperative Union, ISAYULA co-operative Union and Mbozi Cooperative Union. For example, in 2004, Shinyanga Cooperative Union secured Tshs. 3.3 billion for buying cotton; and Karagwe District

Cooperative Union secured Tshs. 2.2 billion and bought member coffee on credit guarantee scheme[1].

Small Enterprises Loan Fund

Other special credit programmes lend to organisations that on-lend to final borrowers. For instance, a state-run fund, Small Enterprises Loan Fund (SELF) lends to several SACCOS and microfinance NGOs/CBOs which then on lend to their members. However, very few smallholder farmers have access to such credit due to inherent bias of credit suppliers against farm enterprises.

Regulated agrocredit suppliers: Public and private banks provide regulated agrocredit. The central bank requires that all regulated financial intermediaries to check their customers to ensure they are in good standing with the tax and licensing authorities before borrowing or opening any type of account. This blocks small farmers from access to formal credit form banks. Virtually, no small farmers have access to bank loans. Tanzania Agricultural Development Bank Limited (TADB) is a state-owned development finance institution established under the Companies Act no. 2 of 2002. The key role of the bank is to be a catalyst for delivery of short, medium and long- term credit facilities for the development of agriculture in Tanzania. The establishment of TADB is meant to be a major step towards increasing the flow of credit to rural farmers who account for over 80% of farmers. However, the smallholder farmers are yet to realise the existence of this bank. This is due to the fact that just like any other regulated commercial banks, it follows the formalized system of agrocredit delivery which fails to cater for the intended groups of majority small borrowers of agrocredit. Being a public bank, TADB is yet to capitalise on its potential in reduction agrocredit delivery at low levels of transaction costs associated with smallness of borrowers.

Currently only two banks in Tanzania (NMB and CRDB) are offering loans to farmers indirectly through intermediaries who act as guarantors to farmers. Whereas only sugarcane outgrowers can access input credit from NMB through sugarcane companies, CRDB lends to farmers' organisations, which then on-lend to members. Smallholder farmers who

[1] http://www.tanzania.go.tz/economicsurveyf.html (July 2007)

are pensionable employees (e.g. teachers, civil servants etc) access loans from a variety of banks thus indirectly part of such loans are used to finance agriculture. All these credit delivery arrangements tend to reduce risks of non-repayments. Failure of the direct contact between borrower (farmer) and banks implies that the commissions paid to intermediaries raise the interest rate charged to final borrowers (farmers). Unlike NMB which has branches in almost each district, almost all banks are concentrated in the cities and if any at regional level. In addition, most of them have not yet adopted payment technologies such as use of credit cards that would reduce transactions costs and risks.

Other regulated sources of credit to farmers that emerged in the late 1990s in Tanzania are the community banks. They are locally based banks, implying low cost of screening and monitoring borrowers (see Table 3). These banks are faced with a lot of limitations regarding their fund-raising strategies. Their main funding sources are savings mobilised locally and to a lesser extent share capital. The scope for long term lending is usually determined by the amount of equity. Since these banks do not have branches or apex organisations, the possibilities to diversify their loan portfolio beyond the limits of their communities are restricted. Given the special features of agriculture, it's likely that these banks are marginally involved in agricultural lending. If any, they do offer short-term loans. Though borrowers might be farmers, it is unlikely that credit is used for agricultural purposes. However, community banks are crucial actors in providing complementary financial services (savings, payments etc) to help rural people manage their cash and monetise the rural economy.

Synthesis of forms of supply-side agrocredit transaction costs

To this point, it can be noted that the various agrocredit suppliers involve different forms of transaction cost. Table 3 presents incidence of each form of supply side transaction cost associated with each category of agrocredit supplier. Informal agrocredit forms may seem to have relatively low monetary transaction cost mainly due to their heavy investment in social relationships. As a result of this, agrocredit from the family members and friends experience minimal or no transaction costs resulting from screening (search) cost of a contracting partner and also of enforcing the repayment. The regulated forms of agrocredit experience higher transaction cost because of the implied requirement to both supplier and borrower having business licences and non-movable fixed

assets, which are in most cases related to asset fixity (Kuchler et al., 2022) . The regulated forms of agrocredit experience higher levels of default from the borrowers compared to unregulated ones implying that regulated agrocredit are subjected to both higher transaction cost and higher of default relative to unregulated ones. This implies that the higher the agrocredit supplier's transaction cost the likelihood of the borrower defaults. Business licenses are permits issued by government agencies that allow individuals or companies to conduct business within the government's geographical jurisdiction. It is the authorization to start a business issued by the local government. In agribusiness, requirement for business licenses to supply agrocredit seems to be associated with formal and regulated suppliers. Table 3 shows that such suppliers required to comply with business formalisation are associated with offering agrocredit at higher search, negotiation and enforcement transaction cost compared to those that are informally supplying credit. This implies that such suppliers can only recover higher transaction cost by charging higher interest rates and in some cases involving non-price levies, all of which turn up to be an additional burden to the borrower.

Policing and enforcement costs are also considered as other key sources of transaction costs associated with ensuring that the parties abide to the agrocredit contract. In real world, people often deviate from the contract, and thus, enforcement costs are incurred while governing contracts. To overcome failures by agrocredit borrowers to comply with contractual obligation, the agrocredit suppliers have to invest monetary and non-monetary mechanisms, some of which may involve coercive means and where need be use police forces and related legal machinery.

Table 3: Incidence of supply-side transaction costs by forms of agrocredit suppliers

Supplier	Asset fixity	Business License	Enforcem-ent cost	Tax evasion	Screening cost	Monitoring cost	Default rate
Family/friends	Low	No	Low	High	Low	Low	Low
In-kind	Medium	No	Low	High	Low	Low	Low
Input suppliers	Medium	No/Yes	Medium	High	High	High	Medium
Agricultural coop.	High	Yes	Medium	Low/No	Low	High	Low/Med
SACCOS/ROSCAs	Low	Yes	Medium	No	Low	High	Medium
NGOs/CBOs	Medium	Yes	Medium	No	Medium	Medium	Med/High
Public credit scheme	High	Yes	Low	No	High	High	High
Community banks	High	Yes	Medium	No	Medium	High	Low
Commercial banks	High	Yes	High	No	High	High	Low

Source: Modified from Ngaruko, 2014

Tax evasion is another possible motive for agrocredit suppliers to increase transaction cost agrocredit delivery to smallholder farmers. Tax evasion id illegal as it is the violation of the law. When the taxpayer refrains from reporting income from labour or capital which is in principle taxable, supplier is liable to legal action from the tax authorities. In evading taxes, he worries about the possibility of his actions being detected. Tax avoidance, on the other hand, is within the legal framework of the tax law. It consists in exploiting loopholes in the tax law in order to reduce one's tax liability. In engaging in tax avoidance, the taxpayer has no reason to worry about possible detection. However, efforts undertaken to avoid tax in some ways increases transaction cost, especially when the supplier is non-state. Table 3 shows that the informal and unregulated agrocredit suppliers are associated with low or no concern for evasion implying that they, not only avoid tax but they also evade taxes.

CONCLUSION AND RECOMMENDATIONS

The demand for agrocredit by smallholder farmers is determined by what happens to the marketing of the produce concerned in terms of commodity prices, marketing outlets and nature of contractual arrangements with credit suppliers. The cost of credit (interest rate) as stipulated in smallholder economy has low impact on demand for agrocredit. The supply of agrocredit is limited because of high transaction cost. The informality of agrocredit supply is associated with low transaction cost but with low levels of credit and low levels of repayment rates. The formalised and regulated suppliers are associated with higher levels of transaction cost with relatively higher levels of repayment. Search, negotiation and enforcement cost for credit from regulated, licensed or regulated suppliers are higher because in some cases they involve third parties to act a middleman between the borrowers and supplier. The third parties are those middlemen (agents) who charge for the services of giving confidence to both agrocredit borrowers and suppliers, who are distant from each other and rarely possess information on the motives of the contracting parties. This implies that in smallholder agribusinesses where the transaction involves small volumes of agrocredit, the transaction cost increases due to supplier’s compliance to legal formalisation and licensing. Thus, in order for a significant volume of agrocredit to be accessible to farmers, higher transaction cost is inevitable. The challenge remains in formalising non-monetary

transaction costs in the businesses especially when complying with legal requirements to formalise businesses.

This paper has argued that repayment of agrocredit is dependent on factors implied in bilateral relationship between farmers and agrocredit suppliers. This implies that no formal collateral is necessary to enforce repayment. Hence there is need for developing a more working agrocredit supply and repayment model outlining factors that may promote and/or inhibit the transactions. Some agrocredit suppliers prefer supplying in-kind agrocredit to cash agrocredit which is linked to commodity procurement after harvest. This supply model is highly recommended for very resource-poor smallholder farmers.

In order to increase access to agrocredit to resource poor farmers, this paper recommends that its essential for all stakeholders, under the leadership of the government to harmonise and improve coordination of agriculture and financial sector policies in order to improve capacity of smallholder farmers and subsequent supply of agrocredit, reducing the emerging agrocredit markets through market shocks. This will reduce nonmarket transaction costs which in turn will encourage more agrocredit market players to impose agrocredit supply policies that are friendlier to the resource poor farmers.

The establishment of the state-owned Tanzania Agricultural Development Bank (TADB) in 2015 is a major step towards increasing the flow of credit to rural farmers. The bank has an opportunity to use its existing mandate and infrastructure to raise more awareness and facilitate agrocredits. Being a public sectoral bank, TADB should increase its outreach for rural areas and smallholder farmers and participate more effectively and efficiently in awareness and access to finance in rural areas for smallholder farmers. This will certainly trickle down to other providers of agrocredit suppliers both formal and informal.

Formal and informal agrocredit suppliers including producers, suppliers need to engage in the provision of training on profitable farming systems and financial literacy to smallholder farmers. A well informed agrocredit supplier about the nature and form of farming systems is likely to design agrocredit products that involve less transaction costs which in turn increases more access to agrocredit. It is also recommended that instead of dealing with individual farmers the contracting supplier of in-kind

agrocredit may mitigate transaction cost by dealing with the farmer groups or primary cooperatives which act on behalf of member farmers. Working with farmer groups or farmer representatives reduces transaction cost of many small volumes of credit demanded by large number of small farmers.

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Information and Communication Technology towards Improving Teaching and Learning Process in Selected Hai District Secondary Schools

Pendamani Wisdom Tumaini
pendamani@gmail.com
Flora Kiwonde
flora.kiwonde@out.ac.tz
(Corresponding Author)

ABSTRACT
The purpose of this study was to investigate the usage of ICT towards improving the teaching and learning process in selected secondary schools in Hai District. The study established the extent to which teachers and students are endowed with skills in ICT use in enhancing teaching and learning process. Descriptive survey research design was employed in the study applying primary data drawn from a sample of 128 respondents. The findings revealed that majority of teachers have basic ICT skills or training in ICT, although the ICT knowledge is not necessarily linked to teaching and learning process. Moreover, majority of sampled teachers were confident in word processing, although not confident in other aspects such as creating and designing presentations that could have assisted in improving the teaching and learning process. Although majority of school heads had enough working experience, most of them had not attended in-service training in ICT. On the other hand, most students have demonstrated little experience on the use of computers and other ICT facilities. Furthermore, the findings revealed that majority of the respondents particularly students had little access to computers. The study recommends action from the education authorities to consider providing more pedagogical training to teachers in the area of ICT skills. It is envisaged that the integration of ICT will improve the teaching and learning process in schools. The study also recommends for the action from the education authorities to invest in providing and maintaining maximum and appropriate ICT facilities in schools to enable sustainable use of ICT in the teaching and learning process.

Keywords: *ICT, Improved Teaching and Learning Process, Pedagogical Skills*

INTRODUCTION

The use of ICT in the classroom has opened up new horizons and dramatically increased its use, which makes resources from all over the world available to students and teachers at the click of a button (Wahab, 2018). Teaching is therefore becoming one of the most challenging professions in our society where knowledge is expanding rapidly and modern technologies are demanding teachers to learn how to use technology (Ratheeswari, 2018;Wahab, 2018). The use of ICT has challenged traditional teaching methods, transformed instructional practices, and contributed to the development of new instructional methods (Tezci, 2011). With its prospects, ICT usage has become an important component of educational reform and an integral part of the school curriculum (Papanastasiou & Angeli, 2008).

The 21st century skills require the transformed society that can improve the skilled workforce and have a multiplier effect throughout the school system by enhancing learning and providing students with new sets of skills (Shaibou, 2017). The educational prospects of ICT include enriched learning environments, encouraging flexible knowledge construction in complex learning domains, and catering for individual differences (Sang et al., 2010).

The Tanzania Vision 2025 recognizes the role of education as a strategic change agent for the transformation of the economy to a knowledge economy and identifies the potential of ICT to address most of the development challenges, including those presented by education (URT, 2015). On the same note, the Tanzania national ICT policy of 2003 recognizes that ICT can enhance education opportunities and advocates for the introduction of an e-education system (Mafanga, 2016). The Education Sector Development Plan (ESDP) recognizes the role of computer studies in fostering technological and scientific developments, with the education sector review reiterating the need to expand the use of ICT to improve the quality of education. ICT has the potential to transform the nature of education and the roles of students and teachers in the teaching and learning process (Mafanga, 2016).

Tanzania's government, through the Ministry of Education, Science and Technology (MoEST), has implemented many programs and initiatives that aim at integrating ICTs into the teaching and learning process. The initiatives include the National Programme on ICT for Secondary

Schools, the ICT in teachers' colleges project, implemented from 2005 to 2008 by MoEST in Tanzania with the Government of Sweden through SIDA (URT, 2015). Despite numerous determinations made by the government of Tanzania, including fast development in ICT awareness by teachers and students, most teachers are not using ICT in teaching and learning process and persistently use traditional methods of teaching (Wahab, 2018). This implies that effective usage of ICT for teachers in terms of knowledge and attitudes has not yet been fully explored (Ngeze, 2017). ICT integration into teaching is limited to few specific resources and frequently applied to perform traditional teaching activities (Brun & Hinostroza, 2014). This shortfall in the learning output creates a gap because it is at secondary schooling where returns to student education are highest and it is important to acquire skills and competencies needed to become ideal to respond to social change (Obonyo, 2013).

The constructivist learning theory has been identified as the most suitable one for the use of ICT in teaching and learning process (Hung, 2001). Constructivist learning theory is based on educational psychologist Jean Peaget (1896–1980), who was the first theorist who regarded children as builders of their intellectual structures. He posits that learning takes place by learners completing tasks for which support (scaffolding) is initially required. Computer-supported learning environments are those in which computers are used to either maintain a learning environment or used to support the student learner in a Vyotskian sense. These educational theories have further been developed by a number of constructivists (Wilson, 1996; Duffy et al., 1993) in the recent years.

Regarding the application of ICT in a constructivist approach Eid (2014) in his study argued that the use of ICT enables opportunities for learning environments and practices that require interaction among individuals, co-operation with chances to experience learning, and the principles which constructionist supports. Anderson & Kanuka (1999) provide an example of the use of the internet for learning, as learners use the internet and explore it in different ways and in different directions. The integration of ICT into the teaching and learning process has been linked and/or based on constructivist learning paradigms and teaching methods.

There are substantial studies on the integration of ICT in the classroom. In a global context, both developed and developing countries recognize the

value of integrating ICT tools for their economic development. Developed countries like the US, for instance, spend more than US $10 billion annually on educational technology in public schools while Australia spends approximately AUD $8 billion on ICT integrated activities in schools (Albugarn& Ahmed, 2015). Similarly other developing countries like India and Uganda have adopted programs aimed at implementing ICT integrated pedagogies to reinforce the teaching and learning process (Ssewanyana & Busler, 2007). They believe the use of considerable ICT tools acts as sufficient drivers to boost the country's education towards creating economy-based development. Previous research indicates that the sheer presence of ICT does not directly influence teaching, but instead it should be effectively intergraded with teaching content and pedagogies (Earle, 2002). Not only does ICT benefit students, but it also provides a learning platform for teachers by enabling them to take ownership and practice knowledge renewal on their own (Li et al., 2018).

Ngeze (2017) conducted a study and found that the government of Tanzania has invested heavily on ICT in education activities, including provision of ICT training to secondary school teachers and supply of some of the ICT equipment in selected schools. Many programmes have been put in place to help increase access to ICT infrastructure in schools. Despite the efforts made by the Tanzania government in secondary schools, schools do not have enough ICT facilities where as the urban private schools prevail more in ICT use than government schools (Malekani, 2018; Malero et al., 2015,).

Other studies examined various issues particularly students' intention to use ICT as well as their happiness with it. By using Technology Acceptance Model significant relationship was found between computer self-efficacy, computer anxiety, and perceived enjoyment-factors that were all significant in determining perceived utility and usability. The study by Wahab (2018) revealed that students look forward to their computer classes and are quite familiar with search engines like Google. This implies that despite knowing that our students are technology savvy they are taught using traditional methods (Sayaf et al. 2021; Al-Rahmi et al., 2020).

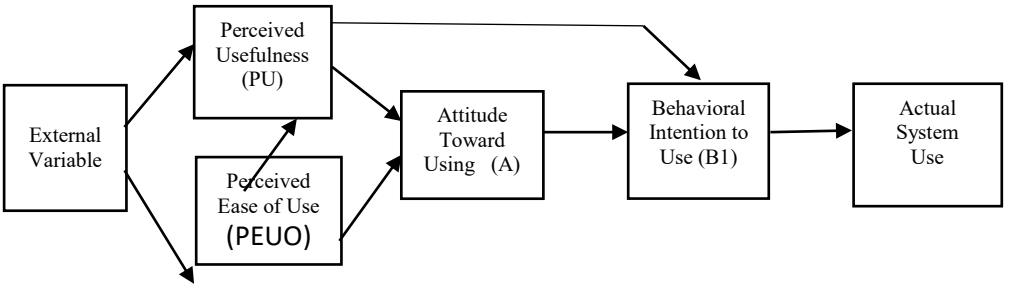
In other African countries the situation is the same where teachers' use of ICT was still confined to basic and traditional activities such as searching

for information and making class presentations (Buabeng, 2019). Also lack of basic understanding among both students and teachers of how equipment functions; lack of mastery of ICT teaching techniques; lack of teachers' training among other issues hinder the use of ICT in teaching and learning process ((Alkahtani, 2017).

Therefore, this study investigated the usage of ICT in teaching and learning process and conceptualized on teachers and students' levels in ICT skills by using the selected secondary schools in Hai district. The researcher justifies Hai district council in Kilimanjaro region as research site since according to Kate Dyer, (2008) the area is considered privileged in terms of access to basic services such as ICT. While ICT has been used in various ways to support teachers, some of the literature points to the fact that little evidence exists supporting the claim that ICT has transformed the education system (Twining & Henry, 2014) therefore a need for further studies.

Conceptual framework

Figure 1: *A conceptual framework for the usage of ict in teaching process*



Source: Technology Acceptance Model (TAM). Adopted from Davis (2003)

The frame work contains external variables that represent social-political factors which define the possible issues that can impact the actual system use in the frame work. On the other hand, the internal variables (two factors PU and PEOU) in the above frame work represents the degrees to which teachers both believe that using a particular technology (that is, ICT use in teaching and learning process in secondary schools) would enhance their job performance. In addition, teachers are more likely to have a positive attitude to use ICT in the classroom and easy-of-use of the

technology (that is, ICT use in teaching and learning process in schools) defined as the degree to which the prospective user (that is, teacher) expect the target system to be free of effort. These are important variables which determine the actual use, (that is, use of ICT in teaching and learning process).

In addition, the internal variables in the above frame work, that is, attitudes towards using (A), represents teachers' positive or negative attitudes about performing the target behaviour (that is, using ICT in teaching and learning process). On the other hand there is Behavioural Intention (B1), which is the degree to which teachers have formulated conscious plans to perform or not to perform some specified future behaviour. The two internal variables (A and B1) in the framework are strongly influenced by the external variables (PU and PEOU). Both external and internal variables in the frame work form the independent variables which determine the dependent variable, actual use of the system in the frame work.

RESEARCH METHODOLOGY

This study used qualitative and quantitative research approaches where as qualitative approach was the main research approach. Kothari (2014) argues that qualitative approach to research is concerned with assessment of attitudes, opinions and behaviour. Such an approach to research generates results either in non-quantitative form or in the forms which are not subjected to rigorous quantitative analysis. Kumar (2011) also argue that when the researcher needs to evaluate the opinions from the participants, there should be the use of qualitative approach because it allows in-depth interviewing to obtain the opinions from the respondents.

The study used descriptive research design which is mostly appropriate for social sciences research and particularly a cross-sectional design that allows the collection of data on more than one case at one point in time. In other words, descriptive survey research design presents an opportunity to fuse both quantitative and qualitative data as a means to reconstruct the "what is" of a topic. Trochim, (2006) states that, a descriptive survey design is a very valuable tool for assessing opinions and trends. The main purpose of a descriptive survey design is to obtain information from a defined set of people so as to generalize the sample results to the population. In the case of this study, descriptive survey design was therefore seen appropriate because of observing the phenomenon in

completely natural environment and the need of integrating the qualitative methods of data collection (Foxand,2007).

Sample size and its distribution

The sample in this study was selected to accept arguments that the target population should have some observable characteristics to which the researcher is intending to generalize (Mugenda, 2010). The sample size involved 8 selected secondary schools out of 43 schools which constituted an approximately 19 percent of the targeted population. A sample size of between 10 and 20 percent of total population is considered to be a representative of the population and it is therefore representative for a descriptive survey study (Gay and Airasian 2003). The researcher therefore expected the 8 schools to provide valid information about usability f ICT towards improving teaching and learning process from the target population.

The sample included four categories of respondents. The first category was the eight (8) heads of schools to represent 43 ordinary level secondary schools' heads in Hai district. The second category of teachers was 8 teachers who were involved in ICT programmes in each of the 8 schools. The third category of respondents was 111 form four students selected randomly from eight sampled schools to get at least 13 students in each school.The students were selected by using simple random sampling technique where the papers containing names of students were folded and picked randomly by the students. Random sampling technique is the one in which each element of the population has an equal and independent chance to be selected by stratified randomization (Probate et al, 2015). The fourth category was one DSEO. A total of 128 respondents from the entire population were involved in this study. Table 1 provides study sample categories.

Table 1: Study Respondents from Eight Sampled Schools

S/N	Name of school	Number of school heads	Number of teachers	Number of Form four students (enrolment)	Number of sampled Form four students	Number of DSEO 1
1	Boma	1	1	150	14	
2	Hai	1	1	226	14	
4	Lukani	1	1	63	14	

5	Mailisita	1	1	130	14	
3	Masama girls	1	1	90	13	
6	Nkokashu	1	1	90	14	
7	Roo	1	1	119	14	
8	Uroki	1	1	87	14	
	G total	8	8	955	111	1

Source: Field Researcher, 2021

The researcher employed a random sampling technique to select a sample of 128 teachers and students. The schools were carefully selected to balance both schools with computer used for instructional purposes and those which do not have the computer facilities. The sample in this study was selected to accept arguments that the target population should have some observable characteristics to which the researcher is intending to generalize as argued by Mugenda, (2010).

Data collection methods

The study comprised both primary and secondary sources of information. The researcher reviewed the existing secondary data sources to compliment the primary data. The documents were books, articles, journals, electronic data from various websites, policy documents and research reports all of these were carefully scrutinized and their findings were referred in this study.

Primary data were collected via questionnaires that were used to collect data from the school heads, teachers and students. Questionnaires were preferred because they require little amount of funds and materials as well as time (Meero, 2009) where as anonymity is also possible. In order to explore the availability and potentialities of ICT resources in teaching and learning process data was collected using three sets of questionnaires. The three sets of questionnaires included; heads of schools' questionnaires, teachers' questionnaires as well as students' questionnaires that were administered to the form four students. Form four students were used with assumption that they were relatively literate and therefore can respond well to the questions.

The questionnaires with likert scale and multiple-choice questions were administered to the teachers and students to get their responses about the

usage of ICT towards improving teaching and learning processes. Observation was also usedas a method that assisted to collect real data in a natural setting (Flick, 2017). The researcher observed the ICT infrastructure situation in schools, availability of computer laboratories, access and use of ICT facilities to teachers and students as well as the technical support available to enhance teaching and learning process.On the other hand, the interview was employed to collect data in the study because this data collection tool is considered superior to other tools since individuals are sometimes more eager to talk than to write. In addition, certain types of information may be acquired that respondent might be unwilling to put into writing, the researcher can also describe and clarify more clearly the purpose of research and the desired information as well as the probability to seek same information in several ways in order to check the truthfulness of the responses (Best and Kahn, 2014).Therefore, the interviews were adopted to help the researcher to gather relevant information from the DEO and teachers about their experience on the usability of ICT towards improving teaching and learning process. In view of the four objectives of the study, the interview guides for the school heads, teachers and students were organized.

FINDINGS AND DISCUSSION

Demographic information of the respondents

Findings in table 2 indicate that 76 (55.9%) of the respondents were females, while 52 (51.1%) of the respondents were males. The data revealed that majority (%) of respondents were females. Also, results in table 1 indicate that majority of the school heads and teachers (56.3%) were within the age range of between 35-45 years. Few school heads and teachers (25%) were in the age of 45 and above years and few teachers (18.5%) were in the age of between 25-35 years. The findings of the study imply that teachers and school heads differ in their age groups. This is a critical aspect of ICT use, as the youngest group of teachers have increased their self-evaluated ICT use more than the oldest group.

Also, in finding out the administrative experience of the school heads, school heads were asked to rate their own administrative experience as ICT coordinators by years in their current schools. The researcher grouped school heads into three administrative experience groups. The results show (12.5%) has served for 1-2 years while (87.5%) have served for more than 5 years. These findings imply that majority of the school heads had enough experience to help the study get relevant responses due

to their rich working experience. Further, the time that school heads had in a current school was considered important for the heads of school's engagement in planning and implementation of ICT integration in their respective schools. On the same note, teachers with more experience (62.5%) are more effective than less experienced teachers (12.5%). Moreover, the findings of the study in table 2 revealed that majority of the school heads, and teachers, 87.3% are first degree graduates and a few, 12.7% post-graduate, and therefore they have vast experience to plan and organize the use of ICT in teaching and learning process.

In addition, the findings in table 2 revealed that majority of teachers (62.5%) had experience on computers for more than 5 years, while 12.5%, 12.5%, and 12.5% of the teachers had experience of less than 1 year, 1-2 years, and 3-5 years respectively. This implies that teachers in schools under study have potential experience to use ICT in teaching and learning process since they have taught for more than a year.

Table 2: Respondents' profile

Characteristics	Profile	Frequency	Percent (%)
Gender	Male	52	51.1
	Female	76	55.9
	Total	**128**	**100**
Age of teachers	Below 30 years	3	18.5
	35 – 45 years	9	56.5
	45 above	4	25
	Total	**16**	**100**
School heads working experience	Less than 1 year	0	0
	1- 2 years	1	12.5
	3 -5 years	0	0
	Over 5 years	7	87.5
	Total	**8**	**100**
Teachers' qualifications	Diploma	0	0
	First degree	13	87.3
	Master	3	12.7
	Total	16	**100**
Teachers' working experience	Less than 1 year	1	12.5
	1 -2 years	1	12.5
	3 -5 years	1	12.5
	Over 5 years	5	62.5
	Total	**8**	**100**
Teachers' computer training	Yes	16	100
	No	0	0
	Total	**16**	**100**
Teachers' computer experience	Less than 1 year	1	12.5
	1 -2 years	1	12.5
	3 -5 years	1	12.5
	5 and above years	5	62.5
	Total	**8**	**100**

Source: Field Data (2021)

Teachers' computer possession

Teachers were asked to indicate their computer possession. The findings are shown in table 3.

Table 3: Teachers' computer possession

Computer Possession	Frequency	Percentages
Yes, a desktop computer	-	-
Yes, a laptop computer	8	50
Yes, both of them	4	25
No	4	25
Total	**16**	**100**

Source: Field Data (2021)

The findings in table 3 revealed that 8 out of 16 sampled teachers (50%) owned laptop computers. Few teachers owned both laptop and desktop computers (25%), while few of them (25%) did not possess any computer. The findings imply that majority of teachers owned either a laptop or desktop computer that could have assisted them in facilitating teaching and learning process in the classroom. However, the observation revealed that although teachers had availability of laptops, the application of these facilities in teaching and learning process was very minimal. When asked during the interview teachers revealed that they had limited skills and knowledge of using ICT facilities during the teaching and learning process particularly using computers and accessing materials from computers. Related findings were also reported in previous studies that, the success of educational innovations depended largely on the skills and knowledge of teachers (Pelgrum, 2001).

The study findings imply that, most teachers have some ICT facilities such as laptops but lack skills and knowledge in creating and designing computer-based lesson presentation. In addition the interview revealed that lack of technical support on ICT use is a major challenge that hinders the ICT use in teaching and learning process. The respondents reported the lack of technical support in preparation and presenting ICT lessons and ICT pedagogical skills. The similar study by Pelgrum (2001) found that in the view of primary and secondary school teachers, one of the top barriers to ICT integration in education is lack of technical support. It is envisaged that without good technical supports in the classroom teachers cannot be expected to overcome the barriers preventing them from using ICT in teaching and learning process.

Teachers' knowledge, skills and experience in the use of ict

The school heads and other selected ordinary teachers were also asked to indicate the core theme of the training that they had attended. The findings are summarized in table 4.

Table 4: ICT training core themes

Training Core Theme	School Heads		Teachers	
	Frequency	Percent	Frequency	Percent
Basic computer literacy, not necessarily linked to teaching	5	63	4	50
Use of ICT hardware and software linked to teaching and learning	1	12	2	25
Use of ICT for improving pedagogy and classroom management	2	25	2	25
Total	**8**	**100**	**8**	**100**

Source: Field Data (2021)

The findings in table 4 indicate that majority of teachers (50%) and school heads (63%) had attended courses or training in ICT whose core theme was basic computer literacy that was not necessarily linked to teaching and learning process. Few school heads, (12%) and teachers, (25%) had attended training on the use of ICT hardware and software linked to teaching and learning process, while 25% of heads of schools and 25% of ordinary teachers had attended training on the use of ICT for improving pedagogy and classroom management training.

The findings of the interview also revealed that all interviewed teachers and school heads attended courses or training in ICT whose core theme was basic computer literacy. In addition, it was observed that limited ICT facilities hinder the use of ICT in teaching and learning process. During the interview, teachers also indicated that they have basic computer literacy but it was difficult to apply the skills in teaching and learning process due to among other issues lack of technical support. The findings concur with studies conducted by Keengwe et al. (2008) and Ertmer (2014) who confirmed that effective use of ICT would require the availability of equipment, supplies of computers and their proper maintenance, including other accessories.

The observation schedule revealed that most teachers find difficult to get time to prepare ICT based lesson because they have heavy weight of daily time table class periods. The challenge is supported by Ihmeideh, (2009) who reported lack of time as one of the biggest constraints to the integration of ICT in the teaching learning situation. On the other side the DSEO was asked to indicate whether teachers in his respective district have ICT regular in-service training to equip them with skills on how ICT can be applied to enhance teaching and learning process. The response indicated that there is no organized in-service teachers' ICT training within Hai district ordinary secondary schools. The school heads and teachers were also asked to indicate the core theme of the course or training that they had attended. The findings are summarized in the table 5

Table 5: ICT training core theme

	School heads		Teachers	
Training Core Theme	**Frequency**	**Percentage**	**Frequency**	**Percent**
Basic computer literacy, not necessarily linked to teaching	5	63	4	50
Use of ICT hardware and software linked to teaching and learning	1	12	2	25
Use of ICT for improving pedagogy and classroom management	2	25	2	25
Total	**8**	**100**	**8**	**100**

Source: Field Data (2021)

The findings in table 5 indicate that majority of the respondents (50% of teachers) had attended course or training in ICT whose core theme was basic computer literacy not necessarily linked to teaching and learning process. A few school heads,13% and teachers, 25% had attended use of ICT hardware and software linked to teaching and learning while 25% heads of schools and 25% teachers have attended use of ICT for improving pedagogy and classroom management training.

Teachers interview responses revealed that all eight (100%) of the interviewed teachers, stated to have basic skills in ICT use but three teachers responded that they had very limited basic skills in ICT obtained from their pre-service teacher training. The findings from interview further revealed that only three teachers out of eight teachers responded to

have skills in ICT lesson presentation and two of them were observed by the researcher while teaching through laptop and projectors in the classroom.

Examples of the feelings shown by some of the teachers about their skills in ICT use in teaching and learning process are presented in the utterance below:

> *I have little basic skills in computer but particularly the use of ICT in teaching and learning process. In addition we are facing the challenge of insufficient available computers as compared to number of teachers in school* (Teacher respondent 03).

Another teacher respondent had this to comment

> *I have no skills in computer use. I can neither open a computer nor access material in computer but I can access teaching materials through a smart phone. I also think that teachers' skills in ICT use should be improved* (Teacher respondent 07).

These findings reveal that majority of school heads and teachers are computer literate. However, their training typically concentrated on the knowledge about ICT and not its use in teaching and learning process and hence lack of understanding and competence about how to readily use ICT skills in teaching and learning process. The findings concur with Obonyo, (2015) who suggested that more teachers are becoming computer literate to meet the demands of the 21st century. The findings provide strong indication that the use of ICT in improving teaching and learning process has not been fully contained by secondary school teachers. The trend is likely to influence teachers' pedagogical approaches in teaching and learning process as well as students' attainments.

Teachers in-service training in ICT

Teachers were also asked to indicate their status of ICT in-service training. The findings in table 4 revealed that 75% of school heads have not attended in-service training in ICT, while only 25% of them attended in-service training in ICT.

Table 6: Teachers' in-service training in ICT

Teachers in-service training	Frequency	Percentage (%)
Yes	2	25
No	6	75

Total	**8**	**100**

Source: Field Data (2021)

The findings in table 6 imply that although majority of the teachers had enough working experience (more than 5 years); most of them had not attended in-service training in ICT. Therefore, regardless of some of the teachers to be competent in some basic ICT applications such as Microsoft word processor and excel, they were seen to have limited skills in creating and designing computer-based presentations. Moreover, the interview schedule revealed that most of the teachers had ICT training via their own initiative. The findings from the interview indicated that teachers are taking their personal initiative to acquire ICT skills and knowledge although they are not able to apply the acquired skills due to insufficient ICT facilities among other reasons.

The observation findings have shown that few teachers were confident in creating and designing presentation using ICT facilities while majority of teachers were not confident because they did not attend in-service training. The challenge is not common in the sampled secondary schools of this study alone. The previous study by Morgan (1996) contended that integrating technology in the curriculum requires knowledge in the subject areas, an understanding on how students learn and a level of technical expertise. The study findings imply that the respondents' limited knowledge and skills hinder schools' expectations to use ICT in teaching and learning process.

Students access to computers

Students were asked to indicate if they have access to computers in learning process. The findings are analyzed in table 5.

Table 7: Students' access to computer

Students Access to Computer	Frequency	Percentage (%)
Yes	46	41.4
No	65	58.6
Total	**111**	**100**

Source: Field Data (2021)

The findings in table 7 show that 65 students (58.6%) had no access to computers, while 46 students, (41.4%) had access to computers. These findings reveal that majority of the sampled students had no access to

computers. It was envisaged that it is necessary for students to have ICT knowledge as they can apply the knowledge to facilitate their learning process.

However, the impact of ICT on education has just begun to be felt as teachers have started to take their own initiative to acquire ICT knowledge and skills in the teaching and learning processes. The internet brings information, data, images, and even computer software into the classroom from places otherwise impossible to reach, and it does this almost instantly. Access to these resources through the internet can facilitate meaningful learning individually as well as through collaborative learning arrangements (Wahab, 2018).

The findings from the observation schedule revealed that some of the sampled schools have access to the ICT facilities such as computers, internet, CD and DVDs particularly at their offices. However, these facilities were not integrated in teaching and learning process. The results concur with previous study by Keengwe and Onchwari (2008) who confirmed that effective use of ICT would require the availability of equipment, supplies of computers and their proper maintenance including other accessories. Further, few teachers were observed to own privately some ICT facilities in schools in their initiative effort to use ICT in enhancing the teaching and learning process.The implication of this study findings shows that most schools have insufficient ICT facilities that hinder the integration of ICT in teaching and learning process.

Using computers to do assignments

Students were asked to indicate the use of computers to do assignments. The results are indicated in table 8.

Table 8: Using computers to do assignments

	Frequency	Percent (%)
Very unconfident	14	12.6
Not confident	38	34.2
Unsure	15	13.5
Confident	27	24.3
Very confident	17	15.3
Total	**111**	**100**

Source: Field Data (2021)

Findings in table 8 show that 38 respondents (34.2%) were not confident in using computers to do assignments, while 27 respondents (24.3%) were confident. Also, 15.3% of the respondents were very confident in using the computer to do their assignment, while 12.6% of the respondents were very unconfident and only 13.5% of the respondents were very unsure about using the computers to do their assignment. Therefore, the findings of this study imply that majority of the respondents were not confident in using computers to do assignments. The study reflects the results by Ngeze (2017), which revealed that most of the surveyed secondary schools' (77.0%) possess either a laptop or a Smartphone or both. This implies that they are ready to use such tools in the teaching and learning process if they are directed on how best they can be used.

On the other side, the findings revealed that most students possess some skills in ICT including the ability to do assignments by using a computer and access materials from a computer. Related findings were also reported in previous studies that integrating technology into the curriculum requires knowledge in the subject areas, an understanding of how students learn as well as their level of technical expertise (Morgan, 1996).Students have positive attitudes towards integrating ICTs in learning process as well as enhancing students- teacher interaction. The study findings imply that students are willing and have positive perceptions towards using computers in doing their assignments although they are facing some challenges including insufficient ICT facilities to be used in learning process.

Searching of information on the internet

Students were also asked to indicate whether they were using computers to search information from the internet. The findings are indicated in table 9.

Table 9: Searching of information from the internet

	Frequency	Percent (%)
Very unconfident	13	11.7
Not confident	20	18
Unsure	19	17.1
Confident	19	17.1
Very confident	40	36
Total	**111**	**100**

Source: Field Data (2021)

Findings in table 9 show that 18% of the respondents were not confident in searching for information on the internet, while 17.1% of the respondents were confident. Also, 40 respondents (36%) were very confident in searching information on the internet, while 13 respondents (11.7%) were very unconfident and only 19 respondents (17.1%) were very unsure about searching for information on the internet. The findings revealed that majority of the respondents were very confident in searching information on the internet.

The findings indicate that although some of the students were confident in using technology to search for learning materials, the success of educational innovations depends largely on the skills and knowledge of both students and teachers. The study findings imply that most students have some basic potential skills in ICT usage but lack skills in searching information from the internet. Also, the study findings imply that most students have limited computer knowledge and skills or are computer illiterate. Moreover, there is a computer competency gap between teachers and students where the findings show that most of the teachers in the study possess more ICT skills as opposed to students. In addition, computer supported infrastructure is a barrier in usage of ICT in teaching and learning process. This study matches with Obonyo, (2013) who argued that the use of ICT in education is lagging behind expectation and desire in most of the secondary schools where only a fraction of computer laboratories was furnished with basic ICT infrastructure necessary for teaching and learning process. The implication of this study shows that limited ICT infrastructures hinder the ICT usage in teaching and learning process in sampled schools.

CONCLUSION

The study clearly indicates that there is a gap between teachers and students experience, knowledge and skills in ICT usage in teaching and learning process. This shows that while teachers are making their own initiative to acquire ICT skills and knowledge, little has been devoted to engage students in ICT. Even though, the study findings imply that regardless of numerous advantages of using ICT, teachers have insufficiency competency to implement ICT in their teaching and learning process. The findings signify limited use of computer and poor ICT use coordination in schools. Although the study findings show that most of the teachers have demonstrated proficiency in basic ICT applications such

as Microsoft Word, Excel, and others, however, teachers have insufficient competence in designing computer-based lesson presentations, thus being unable to integrate their limited ICT technological knowledge with pedagogical content. Teachers, therefore, require appropriate training for the full integration of ICT in teaching and learning process. On the part of the students, most students have limited skills and knowledge in using ICT in various classroom activities such as doing assignments by using computers and basic computer applications like Microsoft Word processor and the like.

It is envisaged that computer use enhances efficient teaching and learning process that can improve the students' performance, ICT enhances students - teacher interaction, computer use improves creativity and it provides opportunities to teachers to obtain teaching resources. Despite various challenges, teachers and students indicated to have positive attitudes in ICT use to enhance teaching and learning process in schools. The main implication of this study is that though most teachers have positive attitudes towards ICT integration and have basic ICT skills, little weight have been invested to fully integrate ICT in teaching and learning process and therefore, traditional paradigm of teaching delivery is applied in schools. ICT usage in teaching and learning process is crucial to improve students' performance and to enhance education technological transformation particularly in the 21st century**.** In line with the study findings, the following conclusions can be made; teachers and students require appropriate training for fully integration of ICT in the teaching and learning process. Schools should be provided with more ICT infrastructures, computer laboratories, technical assistance and coordination to successfully use of ICT in teaching and learning process. In order to ensure that ICT is extensively applied in teaching and learning process in secondary schools, the study therefore concludes that the ministry of education in Tanzania should facilitate the training as well as the provision of ICT facilities in schools.

RECOMMENDATIONS

The study recommends action from the education authorities to consider providing more training to teachers in ICT pedagogical skills in order to enable ICT integration to improve teaching and learning process in schools. The study further recommends the policy makers and planners to consider investment in ICT use in teaching and learning in secondary schools. The study also recommends action from the education authorities

to seriously invest in providing and maintaining maximum and appropriate ICTs facilities in schools to enable fully ICT use in teaching and learning contents and more encouragement to schools, students and teachers to own some ICT facilities such as laptops or desk tops and other ICT gargets to enhance more access to ICT facilities. Moreover, students should be equipped with ICT skills and knowledge in order to be involved practically in using ICT to support their learning activities such as doing assignments and searching for learning resources from the internet. The tradition method of teaching and learning is substituted with ICT usage paradigm delivery. Study findings suggest that teachers need to be supported in their effort to integrate ICT in the teaching and learning practices. It is moreover recommended that teachers should particularly be supported with technical support to encourage successful usage of ICT in teaching and learning process. Students should be equipped with ICT skills and practically involved in using ICT in learning activities such as doing assignments and searching the learning materials from internet.

The study recommends the following related areas for further research: The study was merely carried in Hai district secondary schools involving narrow sample, the researcher therefore recommends that comparable study can be done in other parts of Tanzania with large samples for generalization purposes to adequately disclose the status of ICT usage in teaching and learning and the underlying challenges affecting them. Further research should also be designed to investigate skills, experiences and perceptions of teachers and students on ICT usage in teaching and learning process. This can only be possible if teachers will be trained to change their teaching delivery from traditional teaching to ICT based teaching delivery.

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Hospital wastewater physico-chemical and biological characteristics in the Coastal Zone Hospitals of Tanzania: A case of Muhimbili and Tumbi Hospitals

Shadrack M. Sabai
Corresponding Author: shadrack.sabai@aru.ac.tz,
Jonas G. Balengayabo
jonasgervas@gmail.com
Ardhi University

ABSTRACT

Hospitals wastewater contains a wide range of contaminants which may pose potential risks to the environment, public health and ecological damage. However, knowledge on the extent to which the hospital wastewater is contaminated in Tanzania is still limited. The study aimed to investigate the quality of hospital wastewaters discharged from Muhimbili national (MNH) and Tumbi regional referral (TRH) hospitals. Eight sampling points were established and sampled in triplicates at each of the two hospitals and analyzed for physical, chemical and biological parameters following the standard methods as presented in APHA-AWWA-WEF (1998) and TZS 860:2005. The results showed that pH, electric conductivity, total dissolved solids, cadmium, chromium, zinc and Nickel are within Tanzania Standards. However, MNH, PO4 NO_3 Pb and COD quality exceed the Tanzania standards. The COD ranged from 53 mg/l to 776 mg/l and 92 mg/l to 1099 mg/l for MNH and TRH, respectively. The COD has value higher than permissible level of 60 mg/l. Bacteriological results indicated that hospital wastewater is contaminated with pathogenic microorganisms. Faecal coliform (FC) and total coliform (TC) for MNH ranged from 5-23 x 10^6 cfu/100ml and 14 - 41 x 10^6 cfu/100ml, respectively, while FC and TC ranged from 0.5 - 4x10^6 cfu/100 ml and 0.5-9 x 10^6 cfu/100ml for wastewater from TRH. The results of FC and TC from both hospitals are far higher than the allowable standard as specified in Tanzania standard (TZS 860:2005) which limits to 0.01x10^6 cfu/100ml, which may render the human health and other ecosystems. The hospital wastewater is polluted physically, chemically and biologically which need treatment before disposal in order to protect human health and another ecosystems' life.

Keywords: *Hospital wastewater, quality, characteristic, contaminants*

INTRODUCTION

Wastewater emanating from hospitals, health centres and dispensaries contain parameters of complex mixtures of organic and inorganic matter including pharmaceuticals, radionuclides, detergents, antibiotics, antiseptics, surfactants, solvents, medical drugs, heavy metals, radioactive substances and pathogenic organisms (Emmanuel *et al,* 2005, Mesdaghinia*et al,* 2009, Akin, 2016*).* Paulus *et al.,* (2019) reported that hospital wastewater contains antibiotic and antibiotic resistance gene (ARG) concentrations. Carraro *et al* (2017) reported that hospital wastewater contains chemical, biological, and physical constituents that can risk public and environmental health. The particular attention is on the biological constituents since they have relatively high potential of occurrence in hospital wastewater with respect to other constituents.

Jenssen *et al,* (2004) reported that water supply and sanitation are cornerstones of public health as well as social and economic well-being. Sanitary and industrial wastewater are derived principally from the water supply which ranges from 70% to 130% of the water consumed (McGhee, 1991). McGhee (1991) further argued that it is fairly in some of the community to assume that the average rate of sewage flow is equal to the average rate of the water consumption. This assumption goes hand to hand with the hospital wastewater in which most of the food for patients is brought from homes and patients together with family members visiting patients at the hospitals usually drink bottled water. Under this condition, the supplied water is used for other uses like washing (20-40%), processing activities (15-40%) and kitchen activities (5-25%) (D'Alessandro *et al*, 2016). In that situation, it is possible to assume that most of water supply in hospital about 80% is turned into wastewater (Kumarathilaka, 2015). Sanitary sewage for example, it typically consistswashing water, organic matter, urine, as well as laundry wastewater and other liquid or semi-liquid wastes (URT, 2007).

Wastewater discharge from hospitals is currently gaining attention in many countries due to its composition and concentration of its constituents as stated by Carraro *et al,* (2017). According to Carraro*et al* (2017), the hospital wastewater gains attention because it contains substances that are hazardous for example pharmaceutical residues, chemical substances, pathogens, and radioactive. Studies (Kumarathilaka, 2015) have shown that hospitals consume large amount of water per day ranging between 400 to 1200 litres of which more than 80% is generated

as wastewater. According to Tait and Dipper (1998), raw sewage from hospitals may contain large quantities of metals such as arsenic, cadmium, copper, mercury and lead as well as organic matter, petroleum products, fats, solvents and dyes. Due to the presence of heavy metals in the hospital wastewater and if not treated before discharged into the water bodies, may pose risk to anyone exposed to water contaminated with wastewater from hospitals. In hospitals, the wastewater originates from different sections of the hospital such as laboratories, surgery units, patient wards, and intensive care units (ICU), laundries and clinical wards. Therefore, the wastewater from hospital contains a wide range of contaminants depending on the activities in each generating unit. Because of many various origins, the composition of wastewater from hospitals consist of complex mixtures of organic and inorganic matter including pharmaceuticals, detergents, antibiotics, antiseptics, surfactants, solvents, medical drugs, heavy metals, radioactive substances and microorganisms (Prayitno *et al.,* 2013 and Kumarathilaka *et al.,* 2015). Furthermore, Amouei *et al.,* (2012) argued that wastewater from hospitals contains pathogenic organisms and hazardous constituents which may adversely affect the environment, biodiversity and public health exposed to this kind of wastewater. The presence of hospital wastewater in municipal wastewater treatment plants affects its performance by lowing treatment efficiency (Kaseva *et al*., 2008). This condition poses a challenge on how to improve livelihood for people through management of hospital wastewater and protect the environment, which is likely, to be contaminated/polluted by hospital wastewater in Tanzania. Since hospitals wastewater contains a wide range of contaminants which may pose potential risks to the environment, public health and ecological damage. However, knowledge on the extent to which the hospital wastewater is contaminated in Tanzania is still limited. The study aimed to investigate the quality of hospital wastewaters discharged from Muhimbili national (MNH) and Tumbi regional referral (TRH) hospitals that located in coastal zone of Tanzania and their health implications. The quality parameters analyzed were assessed against the Tanzanian standard to determine their compliance. The result of this study would inform on the proper management of hospital wastewater to safeguard public health, ecosystem, social and economic well-being in Tanzania.

MATERIALS AND METHODS

This section presents the materials and methods applied for data collection and analysis in this paper. The subsections include the case study area description, wastewater samples and sampling techniques, laboratory wastewater testing and analysis methods and procedures.

Description of the case study areas

The study was conducted at Muhimbili National Hospital (MNH) in Dar es Salaam and Tumbi Regional Referral Hospital (TRH) in Kibaha. The two hospitals were purposively selected based on the fact that they have wastewater management infrastructures, serve large number of people and are located in the coastal zone which was the target area for this study.

Muhimbili National Hospital (MNH) is located in Dar es Salaam City. It is a National Referral Hospital which receives approximately 2700 patients per week of which 1500 are in patients and 1200 out patients. In addition to hospital service, there is also an academic institution as an integral part of the hospital called Muhimbili University of Health and Allied Sciences (MUHAS). The hospital has approximately 2,866 employees and 840 students. The hospital is estimated to accommodate 8000 people every day. MNH is organized into 7 directorates which include clinical services, nursing services and quality, clinical support services, human resources, finance and planning, technical services, and information & communications technology directorates. The hospital gets water service from 2 main water sources namely groundwater and surface water sources. Groundwater source is found *in-situ* while the surface water is supplied by the Dar es Salaam Water Supply and Sanitation Authority (DAWASA). The total water demand is estimated to be 2500 m^3/day while, the water supply is estimated to be 2295 m^3/day. This condition makes 215 m^3/day (8.2%) water deficits. However, most of patients, doctors, nurses and attendants use bottled water for drinking. If we consider that everyone drinks 3 litres per day (bottled water), this gives 8.1 m^3/day of water added. It is estimated that the use of bottled water can reduce the water deficit by almost 8%at MNH to complement the water supply from Utilities. This condition may be the same as other hospitals and other health facilities like TRH. Almost all water supplied to the hospital functions turns into wastewater except that used for domestic activities of which 80% of water supplied becomes wastewater. With this situation, wastewater generated at MNH may be estimated to be 1836 m^3/day. This amount of wastewater is collected in the sewerage

system that combines with wastewater from MUHASat one of the inspection chambers located near to the DAWASA wastewater pumping station.

Tumbi Regional Referral hospital (TRH) is located in Kibaha district, Coastal region about 40 km west of Dar es Salaam city. The hospital is located within Kibaha Education Centre (KEC).KEC is composed of Tumbi hospital, Kibaha secondary school, Nurse and Clinical officer training institutes and staff houses as well as student hostels. The institution gets water from the DAWASA and in-campus boreholes. The KEC like MNH has wastewater management infrastructures for collection, transportation and treatment. The treatment plant also receives faecal sludge from Kibaha area and the Soga Standard Gauge Railway camp.

Collection of wastewater samples at the hospitals

Sampling points were purposefully located at each of the two hospitals to generate information on the characteristics of wastewater from wards, theatres, mortuary, OPD and central wastewater treatment plants. At each hospital, eight (8) sampling points were established along the wastewater collection network based on the source of wastewater including medical wards, outpatients and pharmaceutical building, offices and laboratories and residential buildings. The residential buildings include the students' hostels, and staff houses as presented in Table 1. The samples were collected in triplicates at each of the sampling location and analyzed in the laboratory at Ardhi University.

Table 1: Description of sampling locations for the16wastewater samples at MNH and TRH

Name of Hospital	Sampling point code	Description	Remarks
Muhimbili National Hospital	MNH-1	Wastewater from wards	Mostly originated from food remains, sewage, and medical wastes.
	MNH-2	Wastewater from wards and physiotherapy clinic together with administration block.	
	MNH-3	Wastewater from kitchen, laundry and mortuary	Mostly originated from food remains, detergents and medical wastes.
	MNH-4	Combined wastewater from laboratory and blood banks	Mostly originated from chemical and medical waste.
	MNH-5	Wastewater originated from residential, hall of residence, church, mosque and MOI	Mostly contains sewage, food remains, chemical and medical waste
	MNH-6	Combined wastewater from MNH before mixed with those discharged from MUHAS	
	MNH-7	Combined wastewater from MNH and MUHAS	
	MNH-8	Contains wastewater that by-pass from MNH-7.	It (wastewater) is directly discharged into Msimbazi river.
Tumbi Regional Referral Hospital	TRH-1	Wastewater from OPD and hospital offices, wards and mortuary	Mostly contains sewage, food remains and chemical
	TRH-2	Wastewater from Tumbi health training institute, staff quarters, student dormitories, kitchen, public toilets and offices.	
	TRH-3	Wastewater from laboratory, theatre, and mother and child wards	

	TRH-4	Wastewater from private wards, maternity wards and general wards.	Mostly contains sewage, food remains, chemical and medical waste
	TRH-5	Combined wastewater from hospital buildings and buildings of Tumbi health training institute (TRH-1 to TRH-4)	
	TRH-6	Combined wastewater as influent of the WSP (TRH-5 and stream of sludge discharge point Combined wastewater)	
	TRH-7	Effluent from WSP	TSS, TDS, BOD, COB and dissolved chemicals
	TRH-8	Effluent discharged to the agricultural field	

Laboratory testing and analysis

The wastewater samples from Muhimbili National hospital (MNH) and Tumbi Regional Referral hospital (TRH) were collected and analyzed following standard methods as prescribed in Standard Methods for the Examination of Water and Wastewater APHA-AWWA-WEF (1998) and TZS 860:2005. The physical, chemical and biological parameters were analyzed to determine the quality of hospital wastewater. As stated before, the samples were analyzed at Ardhi University laboratory for physical, chemical and biological parameters. The hospital wastewater quality parameters analyzed include Faecal and Total coliforms, Streptococcus, Salmonella as bacterial parameters. Others parameters include pH, electric conductivity (EC), total dissolved solids (TDS), temperature, colour, nitrate-nitrogen, phosphorus, sulphate, chemical oxygen demand (COD) as chemical parameters. Heavy metals were also analyzed including: lead (Pb), copper (Cu), Zinc (Zn), Chromium (Cr) and nickel (Ni). The analysis of these parameters was in line with what was carried out by Mesdaghinia *et al (*2009) who quantified and qualified hospital wastewater of Tehran University of Medial Sciences by analyzing the Physical, chemical and biological parameters such as pH, total suspended solids (TSS), biological oxygen demand (BOD_5), chemical oxygen demand (COD) and total coliforms.

RESULTS AND DISCUSSION

Hospital wastewater characterization

The physical, chemical and biological characteristics of hospital wastewater sourced from Muhimbili National Hospital and Tumbi Regional Referral Hospitals are presented in the subsequent sections

Physical wastewater characteristics

The physical wastewater characteristics analyzed from Muhimbili National Hospital and Tumbi Regional Referral Hospitals include pH, colour, electric conductivity (EC) and total dissolved solids (TDS). The results and discussions are presented in the subsequent sections

pH value

The pH results for wastewater at MNH and TRH are presented in Figure 1. The pH values ranged from 6.79 to 7.35 and 7.0 to 7.6 for wastewaters from MNH and TRH respectively. The results showed that wastewater discharged from both hospitals is within the acceptable Tanzanian Standards of Municipal and Industrial Wastewater (TZS 860:2005) which

ranges from 6.5 to 8.5. Since pH is an indicator for the degree of chemical contaminants whether acidic or alkaline, the results indicate that the hospital wastewater at MNH and TRH are relatively neutral. This suggests that organic matter and pharmaceuticals (chemical in nature) are likely to be the dominant constituents in the hospital wastewaters. The organic waste may be originating from residential area including staff residents, student hostels and wards, while, chemical wastes (pharmaceuticals) may be originating from wards, theatres, and OPD. The wastewater characteristics indicate that the quality of hospital wastewater is relatively similar to the domestic wastewater quality as reported by Abd l-Gawad and Aly (2011). On the basis of these findings, it can be concluded that hospital wastewater can be treated biologically like municipal wastewater to produce effluent that can be released in the environment without adverse impacts subject to further confirmation.

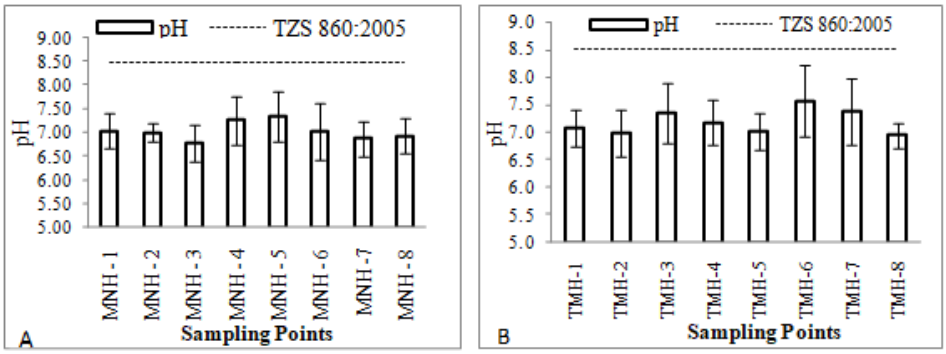

Figure 1: pH values for wastewater from (A) MNH and (B) TRH at different sampling locations

Electric conductivity and total dissolved solids

The electric conductivity (EC) results for both hospitals are presented in Figure 2. The results show that in MNH, the EC ranges from 500 µS/cm to 1000 µS/cm while, in TRH ranges from 500 µS/cm to 2000 µS/cm. Since, Electric conductivity (EC) is a measure of the ability of water to conduct electricity; it is sensitive to variations in dissolved solids, mostly mineral salts like chloride and sodium (Chapman and Kimstach, 1996). These results indicate that the wastewater at TRH is more polluted by mineral salts because its (EC) value exceeds 1000 µS/cm (Rusydi, 2018; Malandi *et al.,* 2013; Chapman and Kimstach, 1996). The results are in line with what was observed at both hospitals which indicated that the wastewater is composed of mixture of wastewaterfrom staff houses students' hostels and hospital operations and wards. The wastewater

treatment plant at TRH is also receiving faecal sludge from a nearby workers construction camp. The camp accommodates more than 200 people who are workers at a standard gauge railway line (SGR) in Tanzania. Additionally, EC is an indicator of mineral content and hence used to establish a pollution zones in water surface when the value of EC exceeds the maximum allowable concentration value of 1000 µS/cm (Rusydi, 2018; Malandi *et al.,* 2013; Chapman and Kimstach, 1996). From these results, it can be concluded that hospital wastewater from TRH is highly polluted by mineral salts compared to those discharged from MNH and therefore the hospital wastewater especially from TRH should be treated before its dischargedirectly into water bodies.

Furthermore, Rusydi (2018) and Chapman and Kimstart (1996) described the relationship between electric conductivity (EC) and total dissolved solids (TDS) in ratios as ranging between 0.55 and 0.75 thought not always linear. When the ratio is close to 0.67, it implies that the water/wastewater is mainly dominated with sodium and chloride (domestic wastewater), and higher values imply high concentration of sulphate (Rusydi, 2018; Chapman and Kimstart, 1996). The results show that at MNH and TRH, the TDS ranges from 301 mg/l to 492 mg/l and 333 mg/l to 1030 mg/l, respectively. The ratio between TDS and EC ranges from 0.49 to 0.60 for MNH and 0.51 to 0.67 for TRH wastewaters. These ratios suggest that the hospital wastewater from TRH is rich in mineral salts like sodium and chloride than MNH, which seems to have relatively low mineral salts probably due to mixing of wastewater from hospital and university premises. These wastewaters mixing at MNH suggests that their possibility of dilution and hence reduce mineral salts concentration than those discharged from TRH.

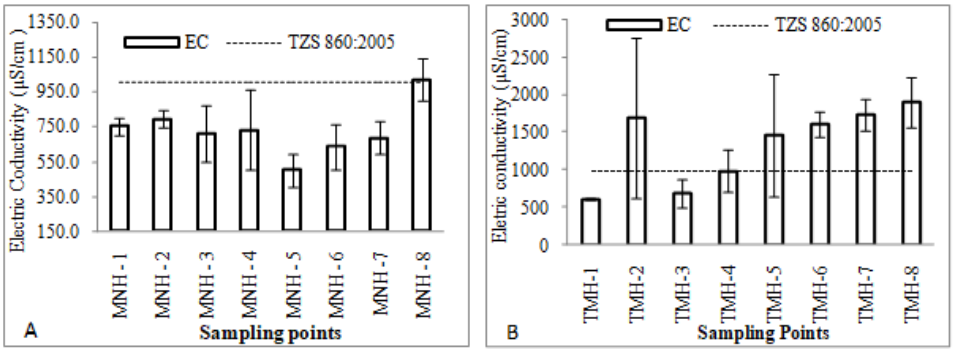

Figure 2: Electric Conductivity for wastewater from (A) MNH and (B) TRH at different sampling locations

Colour

According to laboratory testing and analysis, the color results of hospital wastewater at MNH show that the colour values ranged from 98.3 MgPt/L to 350.3MgPt/L. The results are relatively within TZS 860:2005 permissible value of 300 MgPt/L except 2 (25%) out of 8 sampling locations at MNH had colour values beyond the permissible limit. Since the sampling was carried during dry-season, there was no influence of storm water and therefore the results represent the true colour of hospital wastewater at MNH. These results indicate that most of constituents in hospital wastewater have less effect on the colour of wastewater. The results therefore reveal that the hospital wastewater requires treatment prior to disposal. This practice will ensure the effluent from hospital wastewater treatment plant is clean and therefore will not pollute the ecosystem in its discharge.

Nitrate and phosphate concentrations

Phosphate concentrations

The results for phosphate (PO_4) concentrations are as presented in Figure 3 which indicate that wastewater at MNH has phosphate concentration which range between 10 mg/l to 25 mg/l while it ranges from 30 mg/l to 90 mg/l at TRH. The levels of phosphate are higher than the acceptable (6mg/l) as specified in TZS 860:2005. This indicates that the wastewater discharged from some hospitals is rich in phosphates probably due to extensive use of detergents in cleaning operations plus wastewater from residential houses and student hostels. However, it was found that the levels of phosphate were higher for wastewater at TRH compared to MNH wastewater. Higher phosphate content for wastewater at TRH may be associated with lower dilution as compared to MNH where generation rate of wastewater is high. Furthermore, at the wastewater treatment plant at TRH, there is a disposal of faecal sludge from Kibaha area and the Soga SGR camp as observed during fieldwork, which could be another contributor of high phosphate level at TRH. Additionally, the results conform with the feedback received during interview with hospital management, which showed that TRH is one of the components of the special project that comprised of schools, medical college and residential houses for staff and students' hostels and hence the wastewater from TRH is well mixed with various sources of wastewater compared to that from MNH. Furthermore, the variation of phosphate in the wastewater at TRH was very high as indicated by the error bars, which is an indication of inconsistence of Phosphate concentration in the wastewater and may be

associated with wastewater generation from multiple sources. Additionally, these results suggest that the hospital wastewaters from two hospitals that represent other hospitals in Tanzania should be treated before discharge into water bodies in order to protect the environment against eutrophication and generation of algae toxins that can harm human and animal health (EPA, 2020).

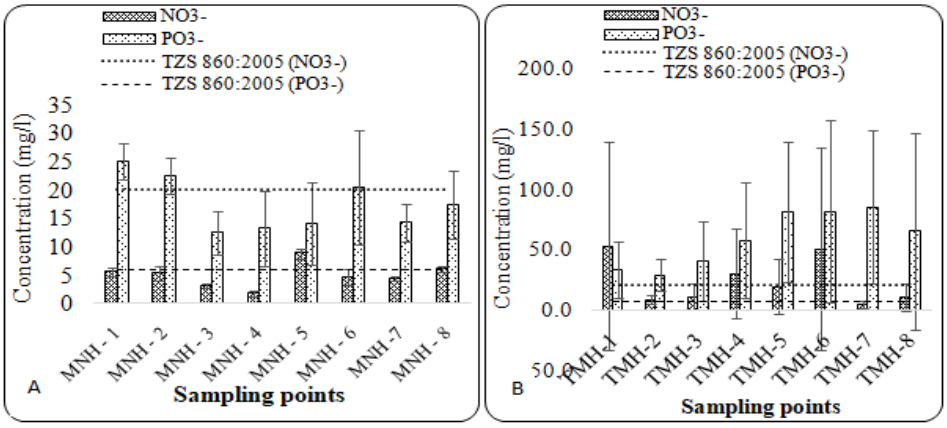

Figure 3: Nitrate and phosphate concentrations for wastewater from A) MNH and B) TRH at different sampling locations

Nitrate concentration

The results for concentrations of Nitrate for wastewater at MNH and TRH are presented in Figure 3. The concentrations of nitrate (NO_3) for wastewater at MNH ranged from 2 mg/l to 10 mg/l while for wastewater at TRH ranged from 2 mg/l to 55 mg/l. The results show that the NO_3 concentrations for wastewater from different source at MNH were below the acceptable level of TZS 860:2005, which stipulates that the NO_3 concentration should be not more than 20 mg/l for effluents discharged to the receiving water bodies. For wastewater at TRH, the concentrations ranged from 4.1mg/L to 52.7mg/L. The results show that wastewater from hospital operations (TMN-2 and TRH-3) had low NO_3 concentration compared to the wastewater from students' hostels and staff houses (TRH-1) and at a point where all wastewater combines(TRH-4). The NO_3 concentration for wastewater from students' hostels and staff houses was above to 20 mg/l that is acceptable level as specified in the TZS 860:2005 which suggests that the wastewater is rich in organic matter from human excreta. When wastewater from hospital operations is mixed with wastewater from residential houses it becomes rich in organic constituents and nutrients; and may have direct environmental and public health

problems especially eutrophication and blue baby syndrome respectively if discharged to the environment without adequate treatment.

Chemical oxygen demand concentration

The results for concentration of chemical oxygen demand (COD) for wastewater at MNH and TRH are presented in Figure 4. The results show that the concentrations of COD ranged from 53mg/l to 776 mg/l for wastewater at MNH and 92mg/l to 1099mg/l for wastewater at TRH. The COD concentration for both hospitals is higher than the acceptable level as specified in the TZS 860:2005of 60 mg/l. This condition indicates that both hospital wastewaters contain higher chemical constituents which end up polluting the wastewater discharge and therefore require treatment before final disposal.

These COD concentration results reveal that hospitals wastewater originated from pharmaceuticals, laboratories, wards, mortuaries, laundries, offices and others which contribute to chemical ingredients of the wastewater emanating from hospitals (Carraro *et al*, 2017). The chemicals in the wastewater affect the treatability of wastewater by biological methods and may necessitate appropriate chemical treatment technologies prior to discharge into the receiving environment. The hospital wastewater can be treated to reduce COD by using Coagulation method, which was found to reduce the COD concentration by 64% (Gautam *et al.,* 2007).

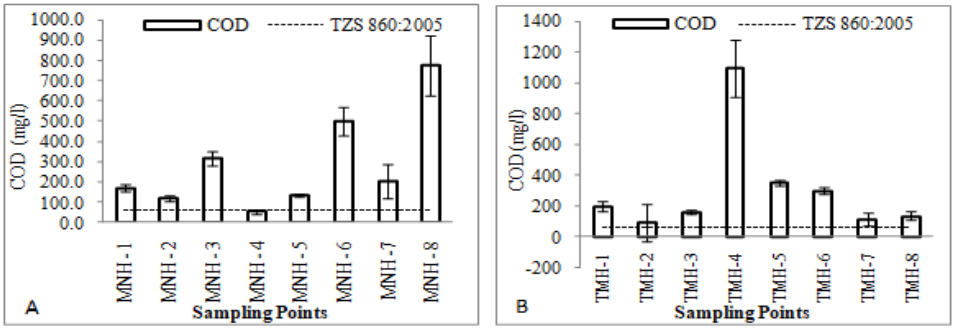

Figure 4: COD concentration for wastewaters at A) MNH and B) TRH

Heavy metals concentrations

Different heavy metals were analyzed for all samples from MNH and TRH following standard methods as presented in the laboratory testing and analysis section. The results are presented in the subsequent sections.

Lead concentration

The results for concentration of Lead (Pb) for wastewater at MNH and TRH are presented in Figure 5. The results show that wastewater from different sources for both hospitals have low concentration of lead (Pb) and below the level specified in TZS 860:2005 (i.e., 0.01 mg/l). Exceptions of relatively high concentrations of lead were observed for two sampling locations at MNH on MNH-5 and MNH-7, which represent combined wastewater from the hospital, student hostels, staff houses and Muhimbili University of Health and Allied Sciences (MUHAS). The high levels of lead at the two sampling locations may be associated with the use of unregulated cosmetics (WHO, 2020) in the student hostels and staff houses that eventually get into the wastewater streams through the bathrooms and laundries. Therefore, on the bases of the results from this study it may be deduced that hospital operations do not contribute significantly to the generation Lead (Pb) in the wastewater.

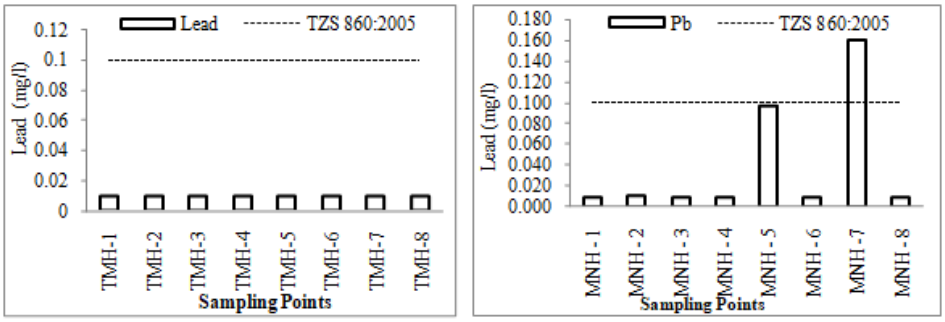

Figure 5 Lead (Pd) concentration for wastewater at A) MNH and B) TRH

Copper, zinc, chromium, cadmium and nickel concentrations

The laboratory results for other heavy metals such as copper, zinc, chromium, cadmium and nickel show that all heavy metals from both hospitals (MNH and TRH) were within the allowable values as specified in TZS 860:2005. More specifically, copper concentration ranged from 0.01mg/l to 0.06mg/l for wastewater from both hospitals, which are within the permissible level set at 2 mg/l (TZS 860:2005). The concentrations for zinc ranged from ≤0.01 mg/l to 0.37 mg/l for wastewater from both hospitals, which are within 5 mg/l as acceptable amount (TZS 860:2005). The concentrations for chromium and Cadmium were below the detection limit (≤ 0.01 mg/l) at all sampling locations

while the permissible level is set at 1.0mg/l. The results of cadmium and nickel and TRH have the same trend in which their concentrations are within the allowable levels according to TZS 860:2005. These results suggest that hospital operations do not contribute significantly to the generation of most heavy metals that get into the wastewater streams. On the basis of these results, it may be deduced that wastewater from hospitals has less heavy metals contribution to the effluent receiving environment. These results are in agreements with findings from hospital wastewater in Turkey as presented by Akin (2016). His results show that Cd, Zn, Cu, Ni, and Cr concentrations were within the acceptable limits allowable for direct discharge into the water bodies in Turkey.Even though the concentrations of most heavy metals were found to be within the acceptable limit, still it is not recommended to discharge the hospital wastewater direct to the water bodies' prior treatment. The reason is that the continuous discharge of the raw hospital wastewater without treatment will result to the accumulation of these heavy metals in the discharged water bodies. Consequently, this direct discharge and disposal without treatment of hospital wastewater will eventually result into adverse impacts to the environment as well as human health. It can be therefore concluded that the hospital wastewater treatment is vital before being discharged into water bodies and/or land for its ultimate disposal.

Biological contaminants

The results for concentration of faecal coliform (FC) and total coliform (TC) for wastewater at MNH and TRH are presented in Figure 6. The results show that at MNH feacal coliform (FC) and total coliform (TC) ranges from 5-23 x 10^6cfu/100ml and from 14-41 x 10^6cfu/100ml respectively. At TRH the concentration of faecal coliform (FC) and total coliform (TC) ranges from 0.5-4x10^6cfu/100ml and 0.5-9 x 10^6cfu/100ml respectively. The results of FC and TC for both hospitals are far higher than the allowable standard as specified in Tanzania standard (TZS 860:2005) which stands at 0.01x10^6cfu/100ml. The FC and TC results show that the hospital wastewater is highly polluted with pathogenic organisms, which may render the human health and other ecosystems. In addition, the Salmonella results of up to 10 count/ml for MNH and 35 count/ml for TRH confirms that the hospital wastewater in Tanzania is contaminated by pathogenic organisms similar to the report by Liu *et al* (2018). The results suggest that treatment is necessary for wastewater before discharging the wastewater to the environment. During field visit, it was observed that that the wastewater generated from MNH was

directly discharged into the Msimbazi River and then to Indian Ocean before pre-treatment. This discharge practice endangers public health.

At TRH, there is a WSP, which is used for wastewater treatment. However, some technical faults like blockage of sewer line was observed at combination chamber (TRH-4) which leads to overflow of wastewater to the forest. Since the TRH wastewater demonstrated pollution with pathogenic biological microorganism, the continuing overflow to the land surface and spread on the nearby surrounding to the human settlement may risks the human health (Alm *et al*, 2014). It is therefore, recommended that both hospitals should treat the wastewater before discharge to the environment to safeguard public health.

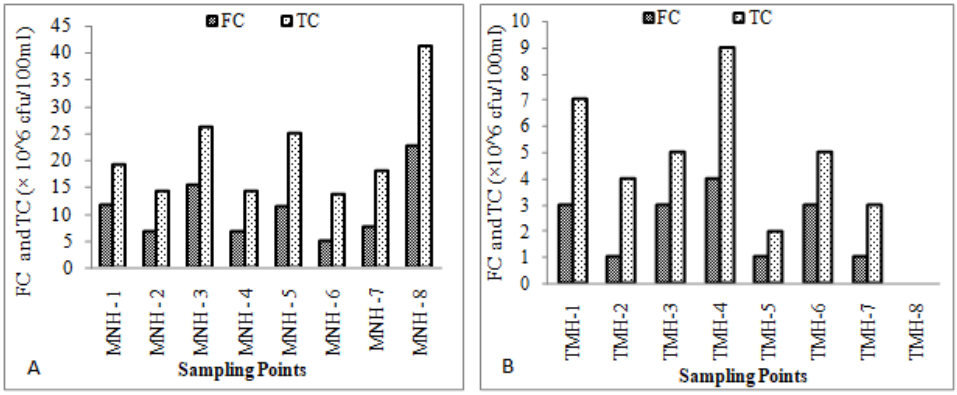

Figure 6: Faecal and Total coliforms present in the wastewater from A) MNH and B) TRH

CONCLUSIONS

This study concludes that the hospital wastewaters from both NMH and TRH hospitals are physically, chemically and biologically contaminated. The laboratory analysis results reveal that wastewater from hospitals located in Coastal Zone of Tanzania focusing to NMH and TRH hospitals is polluted with pathogenic organisms which may render the human health and other ecosystems if discharged directly to the water bodies and environment without proper treatment. Furthermore, the continuous discharge of hospital wastewater into water body prior treatment will result in accumulation of heavy metal and hence render the public health. The hospital wastewater pollutes the environment when they are discharged directly to the environment prior treatment. It is therefore recommended that treatment of hospital wastewater from NMH and TRH hospitals is important in order to safeguard the ecological system which

may be affected if the hospital wastewater is discharging into the water bodies and environment in general without treatment.

Acknowledgement
Authors would like to convey sincere gratitude to the funder of this research which is USAID through Peri-Peri U at Ardhi University. More heartfelt gratitude goes to the Ardhi University management for granting us permission to execute this research. Others include NIMR, Muhimbili National hospital together with Tumbi Regional Referral hospital managements for granting the permission to carry out research in their hospitals. The research was carried out by observing all ethical requirements, rules and regulations.

Ethical consideration
This study was conducted by observing ethical issues which include applying and securing ethical clearance from the National Institute for Medical Research (NIMR), Tanzania with a certificate number NIMR/HQ/R.8a/Vol.IX/2648. Consents of the participants were first requested prior to willful participation.

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Plant Species Composition and Diversity in *Dalbergia melanoxylon* Dominated Zones in Mitarure Forest Reserve in Kilwa District

Agnes M.S. Nyomora
agnesnyomora@gmail.com
St Augustine University of Tanzania
Washa B. Washa
wbugalama@yahoo.com
University of Dar es Salaam
Stephen I. Nnungu
nnunguh@gmail.com
University of Dar es Salaam
Corresponding author

ABSTRACT
The study was designed to assess the plant species composition and diversity in the Dalbergia melanoxylon dominated zone in Mitarure Forest Reserve and the nearby community forests particularly Ngea and Nambawala in Kilwa District, Tanzania. Thirty (30) circular concentric plots were established in the forest reserve and fifteen (15) plots in each of the two-community forest and used to collect vegetation data. The plant species diversity was determined using Shannon-Wiener diversity index, evenness, richness and Simpson and their indices were compared using ANOVA. Plant species diversity and evenness assessed in Mitarure Forest Reserve did not differ significantly from those from community forests. However, the plant species diversity based on Simpson index and richness were significantly higher in the Mitarure Forest Reserve compared to those in community forests. A total of 56 plant species were recorded in Mitarure forest reserve, 39 plant species in Ngea forest and 36 plant species in Nambawala forest. Mitarure forest reserve and the nearby community forests have high plant species diversity with a good stand characteristic of a typical natural forest. However, with an intensive human disturbance, the tree species composition decreases that needs an intervention through local community involvement. This strategy may contribute in the future survival of species and the natural forests in Kilwa District. Data from this study stand as baseline information for the future monitoring of the performance of stands in the natural forest ecosystem in the Dalbergia melanoxylon dominated zones in Kilwa District.

Keywords: *Plant composition, plant diversity, Importance Value Index (IVI), Dalbergiamelonoxylon, Mitarure forest reserve, community forest*

INTRODUCTION

Plant biodiversity is the variation of plant species in a specific area, which influences healthy ecosystems (Luoga, 2000). This is because the existing minor variation in a stand is an indication of poor health as opposed to healthier ecosystem with wider variation in plant community composition and diversity (WWF-SARPO, 2001). Biodiversity of plant species also involves variation of life forms, structure, biomass accumulation and composition where by regenerative success of one or several species depends on the presence of other plant species in a community (Mafupa, 2006).

There has been an increasing interest to understand whether plant species composition and richness reported over the past ten (10) years in the southern forests of Tanzania still exist and to what extent the forest cover inform the need for intensified plant biodiversity conservation (Munishi et al., 2008). Plants biodiversity in the southern Tanzania forests particularly in Kilwa district, Lindi Region forms part of the global ecological importance because of high level of endemism, coastal climate stabilization effects and their roles they play as a source of livelihoods for local communities (Malimbwi et al., 2005; Monela, 2007).

Regardless of being ecological, important that command the highest conservation attention at global and regional scale, these forests face a big threat from exploitation and the associated impacts of human activities that include fire and clearance for cultivation (Malimbwi et al., 2005). These activities contributed to their degraded form and consequently affecting species composition and diversity. High intensity of human pressure impairs individuals of the plant species capacity to recover through natural regeneration. It was not known of the composition and diversity of plant species regenerating in the local community managed forests as opposed central government managed forests. This comparison understanding on the best option suitable for protecting valuable plant stands existing in forests of the southern part of coastal Tanzania.

Regenerative stability and conservation status of Mitarure forest reserves at Kilwa depends on its close proximity to the nearby community forests that absorb pressure from human activities in the reserves. The local community managed forest reserves around Mitarure are Nambawala and

Ngea (Malimbwi, 2002) and these provide for human needs under the control of community leaders while the national forest reserves are freely accessible that makes it heavily degraded (Malimbwi, 2002).

The commercial harvesting of forest resources by Mingoyo soul timber traders from Mitarure forest reserves is monitored by local community leaders where traders are licensed by the regional and district forest officers under the guidance of the ministry of forestry and natural resources (Malimbwi, 2002). This cooperation among stakeholders at all levels ensures sustainable exploitation of natural resource while conserving the national reserves in the study area. Malimbwi, (2002) pointed out that high plant species biodiversity in Mitarure forests can be achieved through maximum participatory conservation. It is 20 years up to this study whether we still have the same healthier forests with high plants biodiversity or low as result of over exploitation and habitat degradation. It was not known whether the local community-based forest resources that have been subjected to licensed harvesting, recover to maintain the same composition and diversity similar to that in the national based conserved forest reserve. It was indented in this study to explore the impacts of conservation at different levels on species composition and diversity and identify an effective alternative for forest resources conservation.

MATERIAL AND METHODS

Description and location of the study area

Mitature forest reserve is located in Kilwa District, Lindi Region in the southern coast of Tanzania. Mitarure forest reserve covers an area of 60,484 ha. It is found between longitudes 38°53' and 39°14'E and latitudes 8º45'-9°03' N) and was described by the Kilwa District forestry records as forest containing miombo with 'good green thicket in places'. (Shechambo 2004). Mitarure Forest Reserve is surrounded by local community managed forests that include Ngea community forest found in Ngea village and Nambawala community forest found in Kipindimbi village.

Sampling of procedures

Thirty circular concentric plots with a radius of 20 m were laid out in Mitarure Forest Reserve and 15 in each of the community forests. The inventory design, which was used in this study, was purposive sampling. The reason for the selection of this design was based on the fact that, we

were interested on the plant species distributed in the *Dalbergia melanoxylon* ecological zone.

The plant species were identified to species level in the field and the total number of individuals per plot were enumerate recorded. However, in cases where species were not possible to identify in the field samples of the plant, species were collected, pressed and transported to the herbarium of the University of Dar es Salaam and identified using respective flora or by matching with dried herbarium specimens of known identity.

Data analysis

The plant species data were summarised and converted into Shannon's and Simpson's diversity indices. Shannon Diversity Index was computed as by the use of the formular H' = ΣPi*ln Pi where; H' is the index of diversity, Pi is the importance value of a species as a proportion of all species whereas the Simpson's Diversity Index was computed based on the formular C = ΣPi2 where C is the diversity index and Pi as defined above (Munishi et al. 2008). The difference in diversity indices between the central government managed forest reserve and local community managed forests were compared using Analysis of Variance (ANOVA).

The plant species composition was computed for its Importance Values Index, which is the summation of the relative frequency, relative density and relative dominance (Curtis and McIntosh 1952).

Relative frequency, Relative density, and Relative dominance indicate different aspects of the importance of a species in a plant community. Therefore, the sums of these three values were used to give a good overall estimate of the importance value index of a tree species.

RESULTS

Plant species diversity in forest reserve and community forests in Kilwa District

The overall species diversity in terms of Shannon Diversity Index (*H*) was highest in Mitarure Forest Reserve (2.12), followed by those in Ngea community forest (1.90) and Nambawala community forest (1.88) registered the lowest (Table 1). The same pattern was observed in

evenness index values (J) where the highest value was recorded in Mitarure forest reserve (0.44), followed by Ngea forest reserve (0.392) and Nambawala forest reserve (0.39) (Table 1). However, based on the Analysis of Variance (ANOVA) the difference in species diversity and evenness between the forest reserve and the community forests were not statistically significant. It was observed highest Simpson diversity index values in Mitarure forest reserve (11.43) followed by Ngea community forest (9.51) and Nambawala community forest (7.11) (Table 1). Based on ANOVA, the difference in Simpson diversity indices in central government managed forest reserve was significantly higher than those in local community managed forests. The same pattern was observed in plant species richness such that Mitarure forest reserve (10.4) was significantly more plant species rich than Nambawala (8.55) and Ngea forest (7.83).

Table 1: The plant species diversity, evenness and richness in the reserve and community forests in Kilwa District.

	Forests			Statistical Test		
Parameter	**MT**	**NB**	**NG**	**F-Value**	**P-Value**	**Conclusion**
Diversity (H)	2.12	1.88	1.90	3.21	P > 0.05	Not Significant
Evenness (J)	0.44	0.39	0.392	3.20	P > 0.05	Not Significant
Richness	10.40	8.55	7.83	4.22	P < 0.05	Significant
Simpson	11.43	7.11	9.51	3.65	P < 0.05	Significant

MT = Mitarure forest reserve, **NB** = Nambawala community forest, **NG** = Ngea community forest

Plant species dominance in forest reserve and community forests in Kilwa District

A total of 108 different plant species were identified and recorded during the survey in Mitarure forest reserve and nearby community forest of Ngea and Nambawala in Kilwa District. (Trees and shrubs contributed 56 plant species in Mitarure forest reserve, 39 plant species in Ngea community forestforest and 36 plant species in Nambawala community forest. Of the plant species identified in Mitarure forest reserve a total of 29 trees, 19 shrubs, 4 herbaceous and 4 grasses. Plant species with the highest Importance Value Index (IVI) were those represented with high density (Fig 1). Ten tree species with highest IVI were *Dalbergia melanoxylon, Brachystegia longifolia, Combretum molle, Bauhinia tomentosa, Acacia spp, Acacia nigrescens, Albizia petersiana, Brachystegia boehmii, Ochnasp* and *Albizia harveyi* (Figure 1). On the

other hand, *Markhamia zanzibarica, Maytenus senegalensis, Ochna moss, Ochna mossambicensis, Sterculia quanzensis, Dichrostachys cinerea, Doberaloranthi folia, Manilkaramochisia, Mimusops spp and Ochna holstii* were the least dominant tree species.

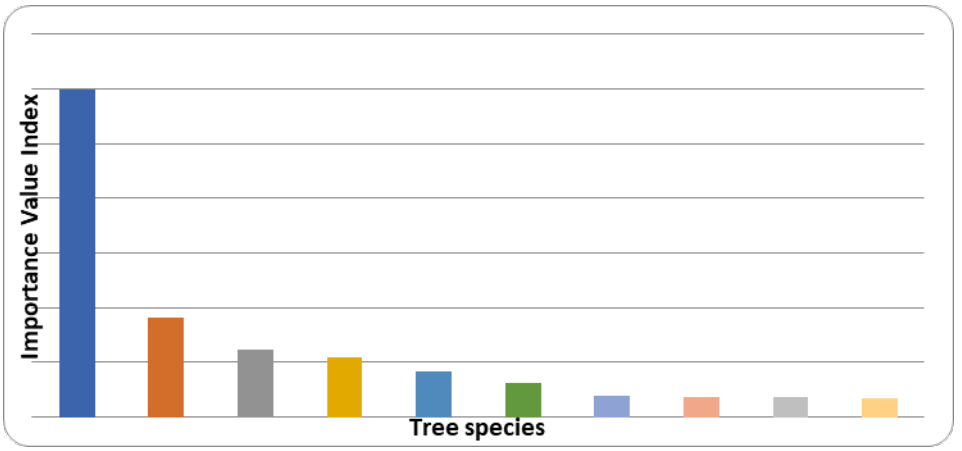

Figure 1: Tree species richness in Mitarure forest reserve in Kilwa

A total of 29 trees, 9 shrubs and 1 grass were identified and recorded during the survey in Ngea forest. The maximum trees Importance Value Index (IVI) (Fig 2) in Ngea forest were represented by *DalbergiaMelanoxylon* followed by *Combretum zeyheri, Crossopteryxfebrifuga, Diplorynchoscondylocarpon, Commiphoraafricana, Acacia nigrescens, Terminalia kaiserana, Acacia nilotica, Tamarindusindica*and *Diospyros loureinana*while the other plant species had IVI values lower than 6.0.

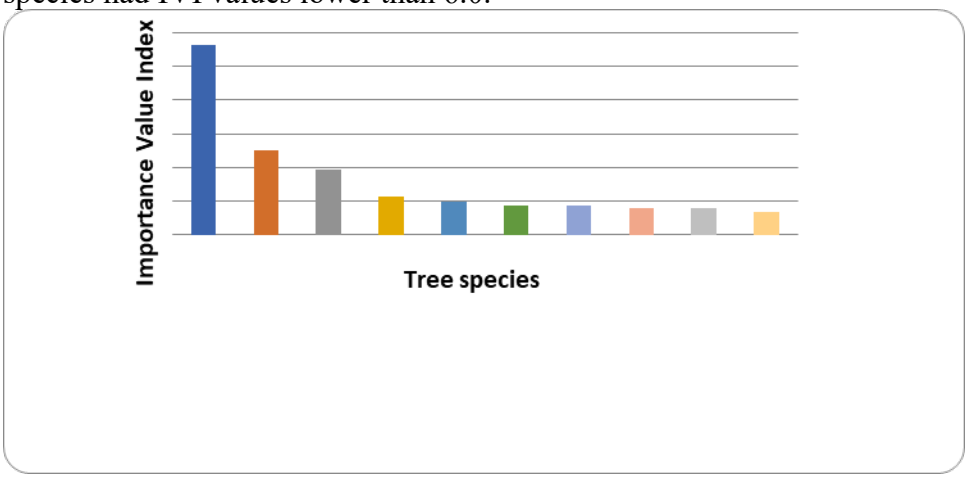

Figure2: Tree species richness in Ngea community forest in Kilwa

A total of 21 tree species, 14 shrubs species and 1 herbaceous species were identified and recorded during the survey in Nambawala community forest. Considering IVI as an indicator of dominance, the results showed that *Dalbergia melanoxylon* was the most dominant species with the highest dominance values in Nambawala community forest, followed by *Commiphora africana, Markhamia zanzibarica, Ehretia amoena, Spirostachys africana, Tamarindus indica, Diplorynchos condylocarpon, Capparis tomentosa, Pseudolachnosty maproneifolia* and *Combretum molle*.

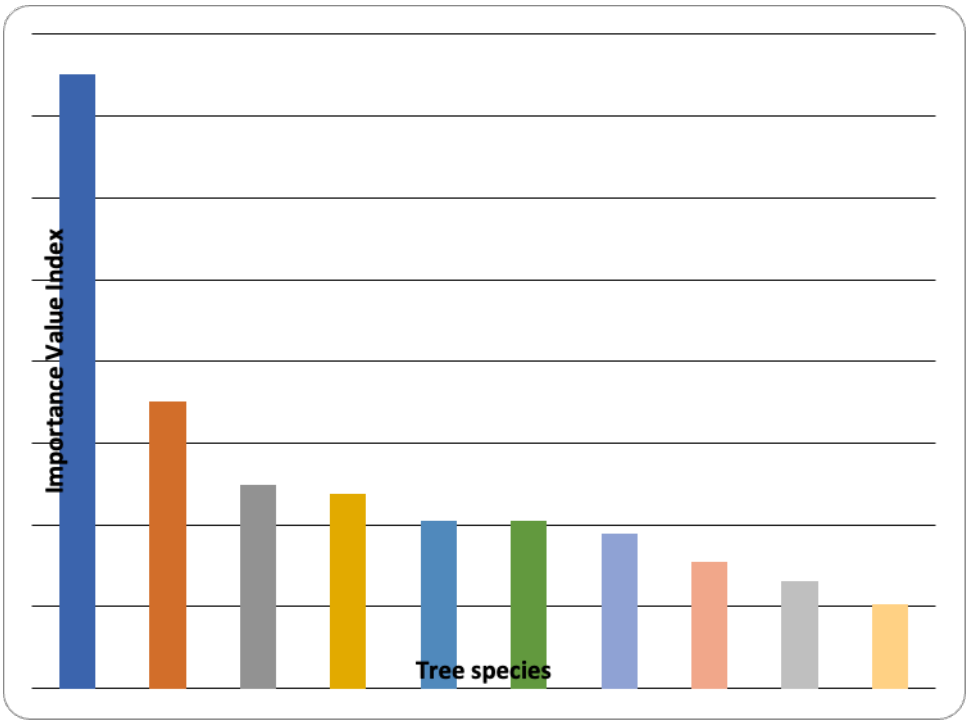

Figure3: Tree species richness in Nambawala community forest in Kilwa

DISCUSSION

Species diversity and composition are the most commonly used representation of ecological diversity and can be measured from the number of species known as species richness, relative abundance of individual within each species known as species abundance, species

evenness and Importance Value Index (Hamilton, 2015). Therefore, species diversity and composition may be used as an indicator for assessing the biodiversity (Husch et al., 2002). The difference in species diversity is associated with climatic condition, edaphic variability and anthropogenic activities (Chidumayo, 1989).

The present study revealed observable variation in plant species diversity between Mitarure forest reserve and nearby community forests namely Ngea and Nambawala in Kilwa district that are well known for their highest abundance of *Dalbergiamelanoxylon*. The results indicate the negative impacts of the anthropogenic activities since trees cutting were observed in Mitarure, Ngea and Nambawala forests. The number of coppices observed from stumps indicating that *Dalbergiamelanoxylon* stems were cut. According to Malambo and Syampongani (2008), illegal and selective logging of valuable species such as *Dalbergiamelanoxylon* contributes to over exploitation. The observed variation in plant species diversity highlights the important discrepancy in effectiveness in managing forest resources among different levels of conservation management organizations in Kilwa District. However, the central government managed forest registered highest species diversity than those in community forests. This observation can be supported by a number of studies which reported that protected areas accommodate diverse plant species, evenness and density than the unprotected areas (Dhaou et al., 2010). This assumes that habitat protection reduces plant resource extraction and consequently maintains higher plant species richness than in unprotected areas (Bruner et al., 2011; Andam et al., 2008; Joppa et al., 2008).

Regardless of high plant diversity in *Dalbergia melanoxylon* dominated zone in Mitarure forest reserve, valuable timber tree species such as *Pterocarpus angolensis* and *Afzelia quanzensis* were not found because of nature of the soil that were not conducive for their growth.

The Shannon-Wiener diversity index values recorded in Mitarure forests reserve, suggest that centralization in managing forest resources may be better approach than local community-based approach. Shannon wiener diversity indices greater than 2 signify medium to high diversity of species as pointed out by Barbour et al. (1987). On the other hand, all community forests in this study had Shannon-Wiener indices values lower than 2 which signify low plant species diversity as opposed to unprotected

forests. These results indicate that conserving natural forests based on local community participation approach are less effective protected compared to national centralized management approach. Okland (1990) pointed out that less protected areas are vulnerable to anthropogenic disturbance such as grazing pressure, cultivation, fire and extraction of timber and non-timber products, which tend to their degradation. For example, Ngea which is one among local community managed forests were heavily disturbed by cultivation, exploitation of plant resources and other forms of disturbance that contribute to habitat heterogeneity that provides a nurse effect for the establishment of diverse plant types and hence high species diversity and richness in unprotected areas.

Since the study was conducted in *Dalbergia melanoxylon* ecological zone, which is one of the valuable timber tree species, there was much illegal harvesting in forests reserve than community forest to the extent that lead to reduction of plant diversity. Similarly, the study revealed that charcoal making is a crucial activity in Ngea and Nambawala community forests since there was availability of species frequently used for charcoal such as *Combretum molle* and *Brachystegia sp*.

Other factors such as climate, genetic and edaphic could also account for the differences in the diversity of plant species between the forest reserve and community forests. However, these factors were not assessed in the present study though their role is considered important.

The results presented in Fig 1 indicateranking of plant species based on their Important Value Index (IVI) from the highest to the lowest found in *Dalbergiamelanoxylon* dominated zones in Mitarure Forest Reserve.

The IVI is also used for prioritizing species conservation whereby species with low IVI value need high conservation priority compared to those with high IVI (Kacholi, 2013). The high IVI exhibited by *Dalbergia melanoxylon* in Mitarure forest reserve is largely due to its higher relative frequency, density, and dominance compared to other species. *Dalbergia melanoxylon* grows habitat with poor soils (Högberg, 1986). It also inhabits rainforests and open miombo woodlands with marginal rainfall patterns and dryland areas (Washa et al., 2012). The dominance by *Dalbergia melanoxylon* in terms of IVI is mainly due to its higher basal area or relative dominance with large number of stems compared to other species in the study area. The presence of many species with low IVI

values in the study area is an indication that *Dalbergia melanoxylon* tolerates and performs better than other species.

CONCLUSION

The study revealed that the Miombo woodland of Mitarure forest reserve and nearby community, forests of Ngea and Nambawala have a reasonably good trees, shrubs and grass species composition and richness. Since the study carried out in Dalbergiamelanoxylon dominated zone, *Dalbergia melanoxylon* was noted to be both dominant and with high species diversity followed by *Brachystegia longifolia, Combretum molle, Bauhinia tomentosa, Acacia sp, Acacia nigrescens, Albizia petersiana, Brachystegiaboehmii, Ochnaholstii and Albizia harveyi.* However, the impacts of anthropogenic disturbances were highly observed and expected to increase further with the growing population and enhanced accessibility. Mitarure forest reserve had a reasonable number of young seedlings of Dalbergiamelanoxylon than the community forests of Ngea and Nambawala. Despite the fact that Mitarure forest reserve and nearby community forests still hold an important proportion of trees species richness, there is a need to prevent further human disturbance within the forest so that it can sustain its ecological function. Strict law enforcement on exploitation of forest should be encouraged. On the other hand, restoration of the ecosystem through reforestation in most degraded areas of the forest should also be given immediate attention by forest management authorities.

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Economic Viability of Mucuna Intercropped with Maize Cropping System in Muheza District

William George
wgeorgelumwaga@gmail.com
University of Dodoma, Dodoma, Tanzania

ABSTRACT
Mucuna (Mucuna puriens) intercropping with maize is one of the alternatives to revive the declining maize production caused by low soil fertility and pest infestation. However, there is paucity of knowledge on the economic viability of the technology being studied. This research assessed the maize yields, variable costs and economic viability of adopting mucuna-maize intercropping in Muheza district, Tanzania. A total of 400 farmers were selected randomly (200 farmers who adopted mucuna intercropped with maize and 200 farmers growing maize after maize (continuous cropping). The Partial Budgeting approach was used to determine the net change in income when farmers decide to switch from continuous cropping. The results indicated that switching from continuous maize cropping to Mucuna intercropped with maize resulted in a positive net change in income of TZS 235,304.60/ha. The study concluded that mucuna intercropped with maize is economically viable. The use of mucuna intercropped with maize is hereby recommended to farmers.

Keywords: *Adoption, income, mucuna, partial budgeting, soil fertility*

INTRODUCTION

In many districts of Tanzania, soil productivity is considered to be below its potential due to degradation (Graene, 2018). Twenty five percent of 494 million hectares of land are highly degraded (loss in the productive capacity) and 39% is moderately degraded. Nitrogen is among the major nutrients, which is degraded and limits the production of maize (URT, 2016). Many parts of Tanzania including Muheza district, have a negative nitrogen balance valued at about $27kg^{-1}hayr^{-1}$ (URT, 2016). According to Kaizi *et al*. (2017) some of the causes of negative nitrogen balance are growing or planting the same crop in two or more consecutive cropping

seasons (continuous cropping). There is inadequate replenishment of the degraded nutrients when maize is grown after maize each season. The continuous cropping and inadequate replenishment of nutrients often lead to the reduction of soil organic matter, the deterioration of soil structural properties, changes in physiochemical parameters, enzymes, micro-organisms community and thus, low soil fertility (Bekunda *et al.,* 2014).

The most sustainable approach to improve fertility of the soil at farm level is the integrated nutrient management (Graene and Casee, 1998). This is a combination of inorganic inputs and soil organic inputs, which serve as compliments in fertility management. According to Graene (2018), maize producers consider chemical fertilizers as substitutes than as compliments because lack of capital limits farmers' utilization of chemical fertilizers in their farms. Place and Dewees (1999) pointed out that chemical fertilizers are not substitutes due to the fact that they increase water holding capacity and help farmers to produce the income same as organic inputs. The balance of nitrogen source in the soil can be improved by combining both Biological Nitrogen Fixation (BNF) and utilization of chemical fertilizers (Kaizi *et al*., 2017). However, Kimetu *et al*. (2004) noted that the combination of BNF and chemical fertilizers has been shown to reduce the quantity of Nitrogen as opposed to the situation when each is used in isolation.

Thus, incorporation of soil nitrogen enriching herbaceous legumes in isolation into the cropping system should be among the strategies to manage noxious weeds (striga) and sustainable nitrogen replenishment under small scale farming (Ali and Narciso, 1996; Charan, 2000; Rao and Mathuva, 2000; Cherr, 2004; Marshall, 2016). Leguminous plants such as *Canavalia, Mucuna and Crotalaria* with high biomass production can improve the productivity and sustainability of smallholder farming.

Any intervention that attempts to introduce a new set of technologies is often confronted with questions such as: how profitable is the technology? What are the impacts on income? What is its return on investment? Answers to these questions are needed by farmers (technology users) who desire information on field levels. The limited studies on economic viability of mucuna intercropped with maize motivated this study. Therefore, the study was undertaken to determine the economic potential of switching from continuous cropping system (maize after maize) to mucuna intercropped with maize. The findings are

expected to help as a basis of advising maize producers a better alternative to improve soil fertility and managing striga weeds in maize farming systems at farm level.

METHODOLOGY

Study area

The study was conducted in Muheza district in Tanga region (Eastern Zone of Tanzania) in 2019/2020 cropping season. The district was selected because projects were implemented in the area. Mucuna intercropped with maize as a new technology was promoted to reduce the impact of pests in particular the parasitic weed Striga (at the same time improving soil fertility). The leguminous species of interest in this study is *Mucuna puriens*. In Muheza district, 85% of the farmers adopted and are using the mucuna technology to manage weeds and improve soil productivity.

Design of the research

Data for this study were collected by using a cross-sectional research design. Data were collected at single point in time from a sample selected to represent some large population (Creswell, 1994). The design provided a snapshot of ideas, opinions and information (Bryman, 2004). This design is most preferred because of its broad scope and can incorporate many variables of interest to the study. The design is suitable for purpose of description as well as for determination of relationship among variables at the time of the study (Williman, 2006; Babbie, 2010). The design is considered favourable as it allows a researcher to efficiently utilize the economic resources in terms of time and funds, for collecting data.

Sampling procedures

According to the 2012 Tanzania National Census, the population of Muheza District was 204,461. The sampling frame to conduct this study shall constitute maize farmer in the district. Based on the URT (2016) report of the National Sample Census of Agriculture 2012/2013 there is a total of 90,789 maize growing households in Muheza district. In selecting farmers to be interviewed, a multistage random sampling was used to select 400 respondents comprising of 200 adopters of mucuna i.e. farmers who intercrop mucuna with maize and 200 non- adopters i.e. farmers who grow maize after maize in each season from the three villages.

Data collection and instruments

A survey method was used in this study. A structured questionnaire as a tool was administered to 400 household heads between September 2020 and November 2020. Information obtained in the surveys included yields, costs of operations and prices. Participating farmers were asked to record information throughout the cropping season (2019/2020). Desk review was used to collect secondary data such as maize yields, prices of maize, costs of using mucuna in maize farming systems from the data base of Prime Minister's Office and Local Government Office, annual reports of the district, published articles from journals. The secondary data was used to triangulate the primary data collected in the field.

Data analysis

Computation of Income: The gross income was computed as the product of quantity for maize yields and producer prices as presented in Equation 1.

$$I = QP \quad \ldots\ldots [1]$$

Where: I = Gross Income,
Q = Output Quantity
P =Producer price.

Variable costs for inputs per treatment (i.e. mucuna intercropped with maize and continuous cropping system) were computed as product of the quantity of inputs used and the price of the variable inputs as presented in Equation 2.

$$VC = XP \quad \ldots\ldots [2]$$

Whereby: VC = Variable Cost,
X = Quantity of input
P = Input prices.

Computation of Net Income: The net income was calculated as the gross income less the total costs that vary as presented in Equation 3.

$$NI = GI - VC \quad \ldots\ldots [3]$$

Whereby: NI = Net income,

GI = Gross income,
VC = Variable Cost.

Using partial budget, the advantages (incremental income) were compared to the disadvantages (incremental costs). Decision on the viability of adopting the new production system was made based on the resulting net change. If the net change is positive, mucuna intercropped with maize has economic advantages. That is, if (c) + (d) > (a) + (b) the change is profitable, given that it is a feasible change (Table 1).

Table 1: Partial budget: comparison of mucuna intercropped with maize versus continuous cropping system

	Particulars	Total (TZS/ha)
Costs	a) **Additional costs:** costs from mucuna intercropped with maize (alternative situation) that is not required when using maize after maize practices (current situation).	a
	b) **Reduced income:** the income from maize after maize practices that will not be received when using mucuna intercropped with maize.	b
	Total costs	$a + b$
Benefits	c) **Additional income:** is the income from mucuna intercropped with maize that is not obtained from current situation (maize after maize).	c
	d) **Reduced costs:** costs from maize after maize practices that will be avoided when mucuna is intercropped with maize.	d
	Total Income	$c + d$
Net change in Income	$= [c + d - (a + b)]$	

RESULTS AND DISCUSSION

Crop budgets

The effects of mucuna intercropped with maize on the variable costs and income of maize at farm level was compared with the continuous maize cropping (maize after maize). The information provided was used to construct the budget for maize production *with* and *without* framework of technology assessments

The resulting effect of adoption of mucuna intercropped with maize increased variable cost by 23.90% brought about by the cost of sowing mucuna and potential increase in labour to harvest increased maize yields

(Table 2). The adoption of mucuna intercropped with maize increased marketable yields of maize by 77.17%. This additional marketable yield is an additional return to the farmers brought about by reduction of striga weeds and improved soil fertility. Thus, farmers who adopted mucuna intercroped with maize increased the net income by 95.93%. This result agrees with the study of Crowder and Reganold (2015) who reported that legume intercrops inclusion in cropping systems suppress weeds. Vissoh *et al*. (1998) observed that *Mucuna pruriens* suppressed weeds through shading whereas Smith et al. (2016) reported good spreading of mucuna suppressed weeds.

Table 2: Crop budget per ha of mucuna intercropped with maize and continuous cropping systems (maize after maize) based on 2019/2020 data

Particulars	**Options adopted by farmers**		**Changes (+ve or –ve) from adopting mucuna**	
	Mucuna intercropped with maize (N = 200)	**Continuous cropping systems (maize after maize) (N = 200)**	**Quantity change**	**% change**
Variable Costs per acre				
Maize seeds	1,680.00	1,680.00	0.00	0.00
mucuna seeds	0.00	0.00	0.00	0.00
Land preparation	20,550.00	20,550.00	00.00	0.00
Sowing of maize seeds	17,100.00	17,100.00	0.00	0.00
Sowing of mucuna seeds	6,000.00	0.00	6,000.00	100.00
Weeding	21,067.50	21,067.50	0.00	0.00
Harvesting	20,000.00	5,350.00	14,650.00	73.25
Total Variable costs	86,397.50	65,747.50	**-20,650.00**	23.90
Income				
Maize yields (kg) per acre	1,116.80	255.00	861.80	77.20
Prices of maize grain per kg	297.00	297.00	0.00	0.00
Gross Income	**331,689.60**	**75,735.00**	**255,954.60**	**77.17**
Net Income	**245,292.10**	**9,987.50**	**235,304.60**	**95.93**

Sources: Survey 2020

Partial Budgeting

Partial budget of switching to maize intercropped with mucuna from the current situation. The relative attractiveness of mucuna intercropped with maize over the performance of the current practices (maize after maize) was assessed using a partial budget from the information derived from the interview with farmers during surveys as presented in Table 3.

Table 3: Partial budget of maize intercropped with mucuna

Particulars		Based on 2019/2020 crop budget (TZS/ha)
Incremental Costs	a) Additional costs	
	• Sowing of Mucuna	6,000.00
	• Harvesting	14,650.00
	b) Reduced income:	-
Total Incremental Costs (TIC)		**20,650.00**
Incremental income	c) Additional income:	
	• Increased income	255,954.60
	d) Reduced costs:	-
Total Incremental Income (TII)		**255,954.60**
Net change in Income (TII – TIC)		**235,304.60**

Sources: Survey 2020

The partial budget analysis showed that a positive net change in income of TZS 235,304.60 per hectare is earned by farmers by switching to maze intercropped with Mucuna. The results indicated that at the farm level, mucuna intercropped with maize appears favourable in terms of reducing costs and increasing net income to farmers, hence farmers should accept the new option if mucuna seeds become available in the market each season. The findings of this result conform to that of Evans (2015).

CONCLUSION AND RECOMMENDATIONS

The objective of partial budget was to examine the economic viability of soil fertility management practices used by farmers that are economically superior and socially acceptable to smallholder farmers in Muheza district. The proposed technological change in this study was from continuous maize cropping (maize after maize) to mucuna intercropped with maize. A partial budget result indicated positive net change in income when switching from maize to maize cropping to mucuna intercropped with maize. Smallholder maize farmers in the study area are advised to intensify their efforts in the use of mucuna intercropped with maize to improve the income of their families.

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Assessment of the needs in Communication Skills[2] Courses in Tanzanian Universities

Zelda Elisifa
Zelda.elisifa@ouit.ac.tz
The Open University of Tanzania

ABSTRACT
The study sought to analyse the needs of university students in Tanzania in Communication Skills Courses. The study involved a total of 315 students from two public and two private universities who were randomly chosen, whereas the respondents were selected via convenience sampling. The sole tool used for collecting data was a questionnaire that consisted of items inquiring whether the respondents would opt for communication skills if it were an optional course. The second part sought their perceived needs of different aspects of language skills areas. The participants were first asked for their consent before filling in the questionnaire. The responses were posted to SPSS software for computation of frequencies of occurrences per each thematic area, and the resulting data were organized into themes and summarized in tables and figures. The findings show that the respondents were divided in their opting for the course, were it optional. The analysis shows that 122 out of 315 (similar to 38.7%) would still opt for the course, while 104 (33%) would not opt for the course; and 89 (28.3%) were not sure. In the area of reading, eye-mapping was rated as highly needed by the majority of students in all universities, while in writing skills referencing and footnote and end-note writing were noted as highly needed mainly by students from public universities. On the whole, there were notable differences between public and private university students in their communication skills needs.

Keywords: *Academic writing, Academic Reading, Communication Skills, Needs Assessments, University Students*

INTRODUCTION

Traditionally, literacy has been closely associated with the ability to read and write. According to United Nations Educational, Scientific and Cultural Organization (UNESCO, 2006, as cited in Adelore and Itasanmi,

[2] This term 'communication skills' means academic communication via the language skills of listening, reading, speaking and writing that involves receiving and presenting ideas effectively and formally in a scholastic university environment.

2016), there are different dimensions to literacy as it often emphasizes the ability to understand and communicate through a written text. However, no universally accepted definition captures all its facets. UNESCO (2008) in Keefe and Copeland (2011) observed that a person is literate if she/he can both read and write a short, simple statement, with understanding, on their daily life. It went further to state that a person is functionally literate when she/he can engage in all those activities in which literacy is required for the effective functioning of his/her group and community. Expanding the scope of literacy from the traditional notion of it, UNESCO (n.d.) defines literacy as the ability to identify, understand, interpret, create, communicate and compute using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential to participate fully in their community and wider society.

According to Scribner (1984), three metaphors are used to describe literacy. These are: i) Literacy as a form of adaptation that emphasizes the survival or pragmatic value inherent in literacy skills acquisition. ii) Literacy is power, which portrays literacy as either the "potent tool" of the elites to keep the masses down or the means for the "poor and politically powerless" to claim their place in society. iii) Literacy is a state of grace, which describes the tendency in society to endow the literate person with special virtues, which serve as an interesting use of literacy to increase culture within a society.

In the field of second language acquisition, conducting a needs analysis is commonly accepted as an indispensable step in curriculum design (Zhu and Flaitz, 2005). Long (2005a: 1) observes that "just as no medical intervention would be prescribed before a thorough diagnosis of what ails the patient, so no language teaching program should be designed without a thorough needs analysis". Similarly, Jasso-Aguilar (2005: 150) has asserted that "language training that does not meet the needs of students is a recipe for failure from the stand point of motivational factors". However, there is not a single universal method that can be used in all situations.

Recent syntheses on methodological issues concerning needs analysis, such as the opening chapters by Long (2005a) on the second language needs analysis and Brown's (2009) thorough discussion, provide researchers with an overall framework. Brown (2009 p. 269) defines

needs analysis or needs assessment as a "systematic collection and analysis of all information necessary for defining a defensible curriculum". He states that a defensible curriculum "satisfies the language and teaching requirements of the students and teachers within the context of a particular institution(s) involved" (p. 269). Moreover, Brown (ibid) specifies that "the information necessary to achieve the defensible curriculum includes all subjective and objective information and any other types of information that turn out to be appropriate in the particular needs analysis" (p. 269 – 271). The question arises, then, on how such relevant information can be systematically collected. According to Long (2005a, 2005b), a crucial feature of a professionally conducted needs assessment is the use of multiple sources and methods, which will enhance the quality and reliability of the data.

In the domains of foreign and second language acquisition, needs analyses have commonly been accepted as a valid starting point for developing syllabuses, courses and curricula. Empirical research has deepened our understanding of the complexity of conducting a needs analysis and has led to new operationalization (Dudley-Evans and St. John, 1998; West, 1994). Various approaches have been adopted, including target-situation analysis, present-situation analysis, deficiency analysis, strategy analysis (or learning needs assessment), and discourse analysis. The concept of needs has been broken down into rights, necessities, wants and lacks. For some, needs analysis has become something of an "umbrella term" (e.g., Hyland 2006; West 1994), which increases the risk of getting lost in a "confusing plethora of terms" (Dudley-Evans and St. John 1998 p. 123). Recent syntheses on methodological issues concerning needs analysis provide researchers with an overall framework. Brown defines needs analysis or needs assessment as a "systematic collection and analysis of all information necessary for defining a defensible curriculum" (Brown 2009: 269). He states that a defensible curriculum "states the language and teaching requirements of the students and teachers within the context of a particular institution(s) involved" (Brown 2009: 269). Moreover, Brown specifies that "the information necessary to achieve the defensible curriculum includes all subjective and objective information and any other types of information that turn out to be appropriate in the particular needs analysis" (p. 269–271).

Hutchinson and Waters (1987) differentiate between two types of needs. The first one is target needs, which refer to what students are required to do in the target situation. Target needs can be further divided into three classes. The first class refers to necessities, which means what students have to experience to perform in the target situation. The second class is lacks, which refers to the gap between what students already know and what is needed in the target situation. Finally, wants, which is used to refer to what students feel they need. The second type of needs is the learning needs. This type involves taking into consideration how learners learn. Furthermore, it includes information about learners, reasons for learning the language, and the ESP course time and location.

According to Sikiti (1998 p.1), "communication is a purposeful process of expressing, receiving and understanding messages containing factual information, feelings, ideas and needs by two or more individuals through common symbols". Communication Skills is one of the general courses taught in most tertiary institutions. Asemanyi (2015) adds that the communication skills course is a course that enables students to have knowledge or the ability to use the requisite skills to communicate properly.

The nature of the Communication Skills course appears quite unique from other subjects. Tortor (2006, cited in Asemanyi, 2015) asserts that communication skills is the foundation of language learning from which effective speaking, writing and reading emerge and it is the bedrock of human language learning. One distinctive aspect of communication skills is that it is integrated into nature. This is so because communication skills as a course is one of the prime factors of human expression. It is a practical course and students are expected to practice the skills of communication. The concept of communication skills is technical and students need certain attitudes to grasp these concepts (Tortor, 2006 (cited in Asemanyi, 2015). Thus, communication skills as a course exposes student to conceptual skills like sentence pattern, concord, ambiguity and many others.

According to Asemanyi (2015), the communication skills course includes a range of skills. It includes both oral and written skills. The written skills are note-taking, outlining, subject-verb agreement (concord), spelling, effective paragraph and essay writing and so on. The oral skills include listening skills, reading skills – skimming, scanning and close reading

though these are not the only topics in the Communication Skills course. Therefore, the study of communication skills would be useful to students by enhancing their academic performance and would be of immense help in the job market.

This area of communication skills teaching and its curricular review has been widely studied in different geographical and educational contexts. Tavakol, et al. (2005), for instance, investigated the views and experiences of medical education course planners in Iran with respect to the current status of communication skills training within Iranian medical schools. The data were collected via in-depth interviews with Iranian medical course planners. The findings indicated a deep concern about the lack of communication skills training within the Iranian medical curriculum. Medical students' acquisition and use of communication skills was found to be consistently poor. Bhagat et al. (2019) assessed the need for teaching communication skills to ophthalmology PG students and developed and introduced a module for the same. The study was done at the ophthalmology department of a tertiary hospital, and a validated 8-day CS workshop was conducted for 60 PG students through interactive lectures, observations, video sessions, and role play. Feedback were obtained through narratives, validated Google survey, reflections and verbal method and analysed. Findings indicated that all faculties agreed that CS should be taught to medical students. Statistically significant improvement in CS awareness was noted among students after the workshop. Lack of CS training, work burden, and language were identified as the main barriers to effective communication. All the students were satisfied with the workshop and wanted it to be conducted regularly.

There have also been relevant studies on communication skills in Africa. Mohamed and Nur's (2018) study focused on identifying the teaching assistants' purposes for learning English and discovering the most important skills, language areas, and academic sub-skills they needed. The study also attempted to determine the teaching assistants' proficiency in the English language. Data were collected through a questionnaire and a test. The results revealed that the teaching assistants needed English for their social life and academic purposes so as to communicate with the outside world and to teach their students. The skills that were regarded as most important were writing and speaking. In addition, the findings

showed that the level of proficiency of the participants in the English language was below average in all the language skills.

In South Africa, Boakye and Mai (2016) explored students' reading challenges as an initial step in designing an appropriate reading intervention programme for first-year Sociology students. The aim was to suggest conditions for the production of an effective reading intervention programme by determining the needs of the students in the first-year Sociology class. The researchers used an open-ended questionnaire to explore students' reading challenges. The analysis showed a variety of learner needs and revealed that most of the students had difficulties with reading their first-year Sociology texts. Comprehension was the main challenge, but other specific areas such as vocabulary, length of texts, language, and affective issues such as motivation and interest were also mentioned. The findings show that this cohort of first-year Sociology students had reading challenges that involved cognitive, language and affective issues.

In Nigeria, Ayoola, Olutayo and Banji (2017) surveyed the language and communication skills required for first-year students in a Nigerian university. The survey was done to use the information gathered to revise the use of the English curriculum to conform to the specific needs of first-year students at the university. Data were gathered through observations of the authors, who were experienced English usage instructors, a questionnaire administered to 320 first-year students and unstructured interview sessions with 30 lecturers across academic faculties on the linguistic and communicative skills required by first-year students at the university. The questions asked during data gathering centred on the four basic language skills: listening, speaking, reading and writing. The data were analysed, using simple percentage statistics. The findings revealed that colloquial and non-standard forms greatly influenced English usage by Nigerian first-year university students. The results further showed that the linguistic and communicative needs of the present generation of first-year Nigerian university students differed markedly from those of their predecessors.

In Zimbabwe, Garira (2020) conducted a needs assessment as a preliminary study for developing a specific educational intervention, a School Self-Evaluation (SSE) framework for Zimbabwean primary schools. A qualitative research methodology involved eighteen schools,

thirty-six teachers, eighteen school administrators and three Education. Interviews and questionnaires were used to collect data which were analysed through thematic content analysis. Findings indicate that there is no SSE framework for Zimbabwean primary schools and no meaningful SSE takes place. The study concluded that there is a need for an SSE framework for Zimbabwean primary schools if an effective evaluation of education quality is to be realized. The study recommended that the Ministry of Education develop an SSE framework to evaluate education quality in schools for its realisation and improvement.

In Tanzania, Komba (2015) appraised the perceived importance of communication skills courses among Tanzanian university students. A total of 134 undergraduate students, randomly selected from two Tanzanian universities, were involved in this study. The study adopted a case study design to have an in-depth understanding of the phenomenon under investigation. The data were collected through interview schedules and they were analysed using thematic content analysis in which they were coded and classified according to themes generated from the responses. The findings revealed that the majority of the respondents perceived communication skills courses as important courses for the acquisition of communication skills needed in academic settings. It is recommended that universities strive to improve the delivery of the courses by ensuring that both human and material resources are adequately available to enable students to benefit more from the courses.

Shishiwa (2016) examined challenges in the teaching of Communication Skills (CS) course in higher education institutions in Tanzania. The study was informed by relativist-interpretivist research paradigm, which is consistent with the qualitative approach and case study method. It involved 55 participants, including students, lecturers, Heads of Departments and Academic Deans from one public and one private university in Tanzania as well as officials from the Ministry of Education and Vocational Training. The respondents were sampled purposively. The interviews, observations, focus group discussions and document reviews were used to generate data that were analysed mathematically. The key challenges revealed include poor background of the students and lecturers, interference of other languages and lack of appropriate resources. In view of the findings, it is recommended that teaching the CS course should start from the lower levels of education, among others.

Mwakapima (2020) evaluated the efficacy of the methods and strategies used in Communication Skills (CS) course teaching and learning in Tanzania. Specifically, the study identified the methods and strategies used and examined the appropriateness of the same in upgrading students' CS. The study involved 596 respondents, and data were collected through questionnaires, interviews, and group discussions. It is indicated that instructors use varied methods, but questions and answers, web browsing, and library research are perceived as the most appropriate. Besides, students also use multiple strategies but group discussions, web browsing, and listening to English conversations are considered the most appropriate. Therefore, instructors are urged to spend some time during students' entry to university to study the incoming students, particularly on how they learn/ behave during the learning process, to accommodate students' learning differences, difficulties, and preferences when selecting teaching methods.

The review of the literature done above has been insightful about the multidimensionality of needs analysis. However, most of these studies are single case studies and focus on single homogenous categories of respondents. The current study is more diverse in involving a number of institutions seeking to compare the needs of university students between public and privately-owned universities. This will not only give a comprehensive picture of the degree of commonalities or lack thereof of communication skills needs but also do justice to the country as a case study rather than individual institutions.

METHODOLOGY

The study is comparative in design, seeking to compare private and public universities. This was aimed to establish whether the kind of university in terms of ownership is a factor variability in needs analysis for communication skills course. In addition, the study adopted a quantitative approach in data handling whereby quantification involved the computation of frequencies and percentages.

The study involved a total of 315 students in four clusters chosen via convenience sampling. The distribution of the respondents is summarized in figure 1 below.

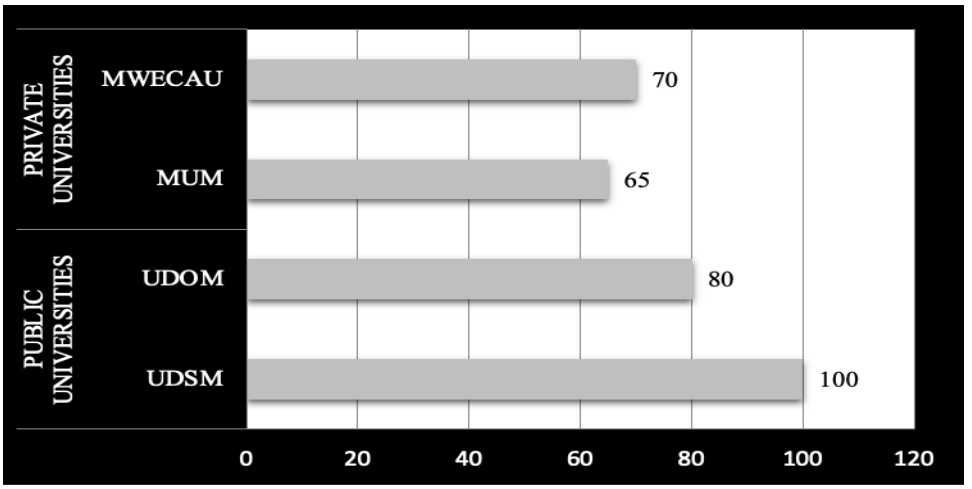

Figure 1: Distribution of respondents

Legend: UDSM = University of Dar Es Salaam
UDOM = University of Dodoma
MWECAU = Mwenge Catholic University
MUM = Muslim University of Morogoro

As detailed in figure 1, the study involved two private and two public universities selected through convenience sampling. The public universities had 180 (57%) of all respondents, whereby the University of Dar es Salaam had the majority 100 (31.7%), while UDOM had 80 (25.4%) of all respondents. Private universities were represented by the Muslim University of Morogoro (MUM), with 65 respondents (20.6%) and Mwenge Catholic University (MWECAU), with 70 (22.2%) respondents. Generally, there were more respondents from public universities than from private ones, reflecting the current enrolment trends where the majority of university students enrolled in public universities.

Questionnaire was the sole tool used for collecting data. It consisted of two parts. The first part had items inquiring whether the respondents could opt for communication skills if it were an optional course. The second part sought the students' perceived needs of different aspects of language reading skills and of writing skills.

The participants were first asked for their consent before filling in the questionnaire. The responses were posted to SPSS software for

computation of frequencies of occurrences per each thematic area and resulting data were organized into themes and summarized in tables and figures.

FINDINGS

The findings are organized into two major themes: the students' choice of the course if it were an optional one and their indication of different needs for the course in the areas of academic reading and writing.

Choice for the course

The respondents were first asked about their choice of course, supposing it was being offered as optional. Their responses were varied, as illustrated in In Figure 2.

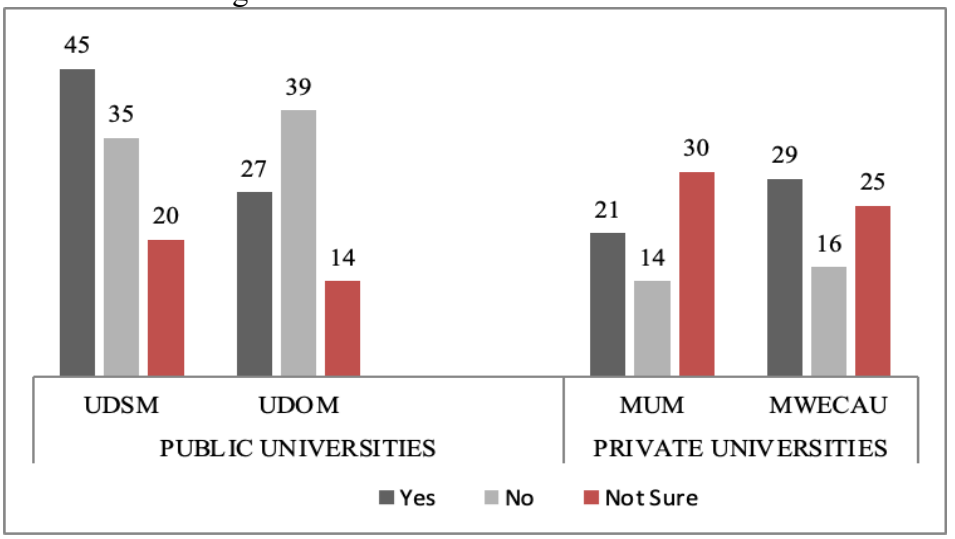

Figure 2: Students' option for the communication skills courses

The data show that UDSM had the highest number of students (45, similar to 45% for its population but 25% of all participants from public universities) that indicated their choice of the course if it were optional. However, UDOM had 39 (48.8% from among its respondents, but 21.7% of respondents from the public universities category) indicating their not opting for the course. This means the majority of the respondents from UDOM were not interested in studying communication skills. A significant number of both public universities also indicated they were not certain about opting for the course.

In the category of private universities, MWECAU had 29 (41.4% of its participants but 21.5% of total participants from private institutions) indicating their choice of the course. Conversely, at MUM, 21 (32.3%) of its all participants but 15.6% of participants from private universities) indicated they would opt for the course. Generally, a significant percentage of students in both private universities indicated their need of the course. However, there was also a significant number (30, equal to 46.2% of its participants but 22.2% of all participants in private universities) who were not sure of whether or not they would opt for the course.

Generally, taken as a whole, a fairly big number of all participants (122 out of 315, similar to 38.7%) as contrasted to 104 (33%) and 89 (28.3%) who said 'no' and 'not sure', respectively, one could thus conclude that the respondents were divided in their opting for the course if it were optional.

Respondents' perceived needs in language skills

The respondents were asked to indicate the perceived extent of their needs in the two language skills: reading and writing. The findings are presented, analysed and discussed in the subheadings below.

Reading skills

According to Martiarini (2018), academic reading requires so much more from readers than other types of reading. He adds that reading for academic purposes is inevitable given the knowledge it provides, whether as a primary source of knowledge or a supporting source for writing academic papers. Undoubtedly, the more effectively one reads, the more thoroughly he or she understands the topic and, of course, the more successful he or she can present his or her ideas through writing. It is from this importance attached to reading in academic contexts that the readers were asked to show the extent to which they engage in reading using three strategies. Their responses are summarized in Table 1.

Table 1: Respondents' perceived needs in reading skills

Reading Skill Strategies		Very Much needed		Needed		Not so much needed		Not Needed at all		Total
		PUB	PRI	PUB	PRI	PUB	PRI	PUB	PRI	
a)	Passage reading and understanding	35	44	46	32	39	41	38	40	315

	(comprehension)									
b)	Reading speed	51	32	33	51	29	32	67	20	315
c)	Eye-mapping and eye-focusing (‘reading between the lines’)	70	61	21	24	42	36	47	14	315

Legend: PUB=Public Universities
PRI=Private Universities

Table one above shows that eye mapping and eye focusing was the one in which a significant number (70, which equals 22.2%; and 61, which equals 19.4%) respondents from public and private universities, respectively, indicated that ‘it was very much needed. Similarly, 21(6.7%) and 24(7.6%) from public and private universities showed that the skill was needed, as opposed to 47(14.9%) and 14(4.4%) from private and public universities, respectively, who indicated that the skill was not needed at all.

Second in popularity is reading speed which was perceived as highly needed by 83 (26 %) respondents (51 from public universities and 32 from private universities). It was also rated as ‘needed’ by 33 (10.5%) and 51(16.2%) respondents from public and private universities, respectively. However, 67 (21.3%) from public universities and 20 (6.3%) from private ones) felt that reading speed was not needed at all. Thus, a slight majority of respondents, largely from public universities, indicated that reading speed was not needed.

The third and last skill under academic reading was passage and reading and understanding to which 35 (12.9%) and 46 (17%) respondents and 44 (16.2%) and 30 (9.5%) respondents from public and private universities, respectively, rated as very much needed and needed. However, 38 (14%) and 40 (14.8%) respondents from public and private universities, respectively, felt the skill was not needed at all.

Even though at varying magnitudes, most respondents showed their need for academic reading skills in the three strategies that were given. Elsewhere, Martiarini (2018) investigated reading for academic purposes problems of undergraduate students of Visual Communication Design at the University of Indraprasta PGRI academic year 2016-2017. The findings revealed that the problems faced by most students were taking

brief and relevant notes, understanding the organization of the text, paraphrasing by using own words, and understanding register word. What are referred to as problems are actually needs in the sense of deficits, which are the foci of the current study. Similarly, the study by Wahyono and Puspitasari (2015) explored students' needs for English reading skills among students of English Language Studies and students' difficulties in reading skills for academic purposes (English for research). The participants of the study were 13 graduate students of the English Language Studies of Post-Graduate Program in the third semester. Questionnaire (just as was in the current study) was the sole instrument for data collection. The study showed that most students often had difficulties in reading English texts for academic purposes. They thus showed their want to improve their comprehension level through EAP course and enable to improve their writing performance.

Writing skills

Writing for academic purposes, assert Aydin and Baysan (2018), is a type of writing that begins with determining the problem. This indicates that academic writing needs technical planning and rules. In EFL contexts, according to Al Fadda (2012), there are three problem statements in this study, namely: (1) lack of student confidence in writing, (2) lack of student knowledge about theoretical knowledge and skills in writing, such as creating a writing framework, paraphrasing, and summarizing, and (3) academic writing sometimes expect students to write from expert positions, even when they are not experts in particular topics.

Thus, to empirically establish the extent of the needs of Tanzanian university students in academic writing, a list of 13 writing skills was presented to the respondents for them to present their perceived need for each. Their responses are summarized in Table 2.

Table 2: Respondents' rating of needs of writing skills

Kind of Skill		Very Much needed		Needed		Not so much needed		Not Needed at all		Total
		PUB	PRI	PUB	PRI	PUB	PRI	PUB	PRI	
a)	Sentence construction	27	40	19	24	80	14	54	57	315
b)	Styles of writing evidence	60	21	39	47	21	40	60	27	315
c)	Referencing and reference citation	54	51	62	11	26	70	38	3	315
d)	Researching and	12	4	75	66	81	25	12	40	

	planning for a topic									315
e)	Analysing and approaching essay questions	18	27	41	33	38	44	83	31	315
f)	Paragraphing	62	61	40	9	60	11	18	54	315
g)	Coherence and cohesion	90	76	32	12	8	1	30	66	315
h)	Acknowledging sources	42	41	55	16	30	62	53	16	315
i)	Citation and quotation (direct and indirect, brief and extended)	71	63	82	37	11	20	7	24	315
j)	Paraphrasing and avoiding plagiarism	47	49	48	21	21	17	84	28	315
k)	Footnotes and referencing systems	97	39	52	19	19	33	12	44	315
l)	Creating and utilising a bibliography	45	35	63	25	24	25	48	50	315
m)	Proof-reading and editing	21	88	46	18	81	21	32	8	315
n)	Hedging (generalisation, qualification, probability, certainty) and accuracy	12	29	35	13	102	61	31	32	315
o)	Writing style; formal/informal language	70	10	32	75	22	26	56	24	315

Legend: PUB=Public Universities
PRI=Private Universities

Data in Table 2 show that 5 out of 13 skills were perceived as 'very much needed' by over 50% of all respondents from both categories of public and private universities. The most notable is the footnotes and referencing systems which was rated 'very much needed' by 136 from public universities and 39 from private universities), which is equal to 43% of all respondents, plus another 52(16.5%) and 19 (6%) from two categories who rated it as 'needed', thus making overall total of 207 (65.7%) respondents needing the skill. Elsewhere, a study by Jomaa and Bidin (2017) explored the difficulties in citing and integrating information from academic sources into the literature review chapter of Arab Ph.D. proposals in a Malaysian public university. The findings showed that EFL Arab students lacked both awareness of using citations and advanced skills in academic writing. This underscored the need to enhance EFL

Arab students' skills in citing, evaluating, and writing academically. This could probably be achieved by developing discipline-specific teaching materials that consider the different practices of citation in various academic disciplines.

Similarly, 90 (28.6%) and 76 (24.1%) respondents from public and private universities rated coherence and cohesion as 'very much needed', plus another 32 (10.2%) and 12 (3.8%) from the two categories who rated the skill as 'needed.' Citation and quotation and writing styles skills were each rated as 'very much needed' by 70 (22.2%) of public universities respondents while the former was also felt as a big need by 63 (20%) of respondents from the same category. This is concurrent to a study by Ahmed (2010) that appraised students' cohesion and coherence problems in EFL essay writing. Analysis of findings revealed that students encounter some problems (thus showed need for) in the cohesion and coherence of EFL essay writing. Another similar study by Rahmatallah (2020) examined coherence in English essays written by 46 female Saudi EFL third years at Unaizah College of Sciences and Arts, Qassim University. The results demonstrated that learners are not competent in achieving coherence in their writing tasks.

However, 4 out of 13 skills were rated 'not so much needed' by respondents from public universities. These were: Hedging 102 (32.5%) respondents, proofreading and editing (81, similar to 25.7%), researching and planning for topic (81, similar to 25.7%), and sentence construction 80, equal to 25.4%). As for the private universities category, over 60 (19%) rated three skills as not so much needed. These are referencing and citation (70, equal to 22.2%), acknowledging sources (62, equal to 19.7%) and hedging (61, which equals 19.4%).

There was another category of writing skill that was perceived as not 'needed at all' by the majority of respondents. The most notable was analysis and approaching essay questions which were rated as not needed by 83 (26.3%) and 31 (9.8%) respondents from public and private universities, respectively. Another was paraphrasing and avoiding plagiarism which was felt as not needed by 84 (26.7%) and 28 (8.9%) from public and private institutions, respectively. The third one is styles of writing evidence, to which 60 (8.9%) and 27(9.2%) from the two categories, respectively, rated as not needed at all.

The rating of these academic literacy skills as 'not needed' and 'not needed at all'-irrespective of which university category-is, most likely attributed to either ignorance of what these skill areas mean or misguided self-pride resulting in wrong self-rated proficiency levels. A study by Macias and Zuniga (2006) of action research aimed at helping advanced English students of the Foreign Language Teaching Program (English) at Universidad Surcolombiana refine their academic writing skills. It was established that the skills of process writing — outlining, revising, and editing with peers' and instructor's feedback – as well as the use of sources, content, grammar, coherence, cohesion and feedback, were of paramount importance and thus highly needed. Similarly, a study by Khazaal (2019) sought to work on strategies to improve postgraduates' academic writing skills with summarizing strategy for students in the College of political sciences at A-Nahrain University, Iraq. The findings indicated that the summarizing strategy has a significant effect on postgraduates' learners in academic writing skills, so it was recommended to be applied in the curriculum of the schools and universities.

CONCLUSION

The findings have revealed a high level of heterogeneity in the perceived needs of the students in Tanzanian universities, such that differences between public and private universities are marginal. The findings have also shown that communication skills is generally perceived positively and that the students are in great need of the courses irrespective of the ownership of their respective universities. While universities are autonomous in their curricular designs, saliences of the needs as concurrently agreed with, students call for periodic checks and balances in content harmonization across universities is a necessity.

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Investigation on the effective substrate for high yields of *Pleurotus ostreatus*: A case study of Kinyerezi Tanzania

Washa B. Washa
wbugalama@yahoo.com
University of Dar es Salaam, Mkwawa College, Biological science Department
P.O. Box 2513, Iringa Tanzania

ABSTRACT
Investigation on what substrate combination is more effective in producing high yields of Pleurotus ostreatus in local greenhouses was conducted at Kinyerezi (6°50'27.2"S, 39°10'26.5"E) in Dar es Salaam in 2020 aiming on producing a substrate protocol which will maximize yielding of mushrooms in local greenhouses. Sugar, grain chaff and lime were added in specified ratios to the compost of sliced banana leaves and saw dust and followed by sterilization for 4 hours and cooling for 24 hours before being packaged in 1 kg bags for fungal inoculation. 450 plastic bags of compost were inoculated with mushroom spores and left for 28 days for colonization. The compost was sparingly watered to maintain the optimal humidity, temperature and pH for germination of mushrooms. Mushroom germination in 100 bags with additional sugar, 100 bags with additional grain chaff and 100 bags with additional lime were monitored for four months where germination percentage and germination number were monthly recorded and used for statistical analysis. Bags with additional sugar indicated a significant difference in the monthly germination percentage (P=0.002248, df = 2). Additional sugar descriptively increased germination number from 30 to 173 than other substrates which increased from 0.5 to 16.5. However, the increase was statistically not significant P=0.25246, df = 2. Mushroom growers are advised to use the compost formula as indicated in this investigation as a new knowledge contributed by the research. The use of added sugar as a substrate in the compost is mandatory.

Keywords: *Substrates, compost, mushrooms, inoculation, local greenhouse*

INTRODUCTION

Mushrooms have a broad range of uses including medicinal use and as nutritive food materials. They are a good source of vitamins, protein and minerals. They have a saprophytic type of life inhabiting soil, farm lands,

open fields, roadsides and woods by saprophytic mode of life. Mushrooms belong to the class Basidiomycetes and order Agaricales. Fresh mushrooms contain 80-95% moisture, 3% protein, 0.3-0.4% fats and 1% vitamin and minerals (Venturella et al., 2015).

In recent years, there has been a rapid increase in mushrooms cultivation by local growers and interprenuers aiming at gaining money but also domestic consumption. Among preferably cultivated mushrooms includes Oyster mushrooms (*Pleurotus spp*), *Agarics spp* and others (Okigbo et al, 2021). To date there are no standard protocol agreed upon as to what compost substrates should be used at what ratio to grow successfully what mushroom species. Different mushroom growers have been using different substrates to grow different mushrooms species in different shelters and plastic bags and most of them do not report their substrates used (Moonmoon et at, 2011). Few researches have conducted research based on the experiences of local mushroom farmers leading to absence of standard protocol which can be maximized to improve yields in mushrooms (Venturella et al., 2015).

Pleurotus ostreatus are commonly edible, nutritive and worldwide cultivated for commercial and home consumption. Is mostly cultivated by local farmers and entrepreneurs (Venturella et al., 2015). *Pleurotus ostreatus* can be easily identified by the presence of an oyster-shaped cap, decurrent gills, gills are white running down the cap and stem, caps are white to brown, smooth with no scales, a flesh stem is white with no rings, spores are white to lilac-grey. This species is saprophytic growing on logs and dying trees and found on deciduous trees, they smell sweet like liquorice; they grow during summer or winter and in warmer areas (Moonmoon et al, 2011).

Due to the higher demand for Oyster mushroom from the family level for consumption to the national level for commercial, it was found significant to investigate and obtain a standard substrate protocol which can be used by local as well as big farmers and researcher to obtain maximum yields of mushrooms for livelihood consumption and commercial. This research was conducted to initiate a beginning of researches towards standard methods for higher production of Oyster mushrooms in local and technological green houses. This is therefore; the objective of the study was intended to investigate the effective substrate for high yields of

Pleurotus ostreatus in local greenhouses by testing the effects of additional of sugar, grain chaff and lime to the substrate.

MATERIAL AND METHODS

The study area

A research was conducted at Kinyerezi Mnembwe, (6°50'27.2"S, 39°10'26.5"E) Dar es Salaam where materials for green house construction, material for substrates formation and mushroom spores were easily purchased. A local greenhouse was constructed from January to February 2020.

Collection of materials

Purchased materials included: timber reject, nails, boxes, iron sheets, stock blocks of woods, bags of cement, trips of concrete stones, trip of clay, sacks of sliced banana leaves, sacks of saw dust, lime, teen of grain chaff, sugar, plastic bags, and bottles containing mushroom spores. The mushroom spore bottles were 100ml each. This was self funded research.

Preparation of a local green house

A local greenhouse of 12m x 7m x 3m (12m lengths, 7m widths and 3m heights) was constructed using timber reject for walls and covered by iron sheets but with boxes under the sheets. Rolls and cages were constructed using stock blocks of wood as indicated in Photograph 1a&b below.

(a) **(b)**

Photography 1a&b: a=Outer part of green house, b=Inner part of green house with colonized bags in cages

Timber rejects and boxes materials were used to reduce temperature and retain darkness as a mushroom growth requirement. A higher temperature above 30^{o}C (85^{o}F) will kill mycelia, first growth of spore and reduce yield. Darkness is a requirement for Oyster to grow. Sliced banana leaves, saw dust and grain chaff in compost are used to initiate mycelia formation. Cement, concrete stones and clays were used to construct a flow where nails were used to strengthen timber reject, sheets and stock blocks of woods.

Preparation of the compost (growth media) and sterilization

Sliced banana leaves (10 sacks), saw dust (10 sacks) and grain chaff (50 kg) were soaked in water for 4 days then left to dry for 4 days. Then,

sliced banana leaves, saw dust and grain chaff were mixed with lime (50 kg) as minerals and sugar (50 kg) as an additional source of energy. The mixture was to be used as a growth media to initiate fungi colonization. A total of 450 plastic bags, 1 kg each were filled with the made growth media. Sugar was used as a source of energy, grain chaff as a source of food and lime as mineral rising pH to 7.5 and preventing the hardening of the compost. Additional of extra 2 kg sugar, 2 kg lime and 2 kg grain to compost were done to test their effect to germination percent and germination number of mushrooms in the green house.

The 450 plastic bags of growth media were tightly closed in both sides and boiled for 4 hours at boiling temperature to sterilize the media and kill the ammonia producing bacteria then were left to cool for 24 hours to dissipate ammonia before being transferred to cages for inoculation (photograph 1b). Both sides of the bags were inoculated in a sterile condition and closed with papers on 1 March 2020 and kept in cages.

Mushroom spore inoculation for mushroom germination initiation
One bottle of mushroom spores was used to inoculate two sides of 9 bags. Bags were monitored on cages for 1 month to allow fungi colonization (Photograph 1b). Every day the covering papers were removed prior to water spraying on the bags and the bags were covered again. Recording of germinated mushrooms was done daily to obtain germination number and germination percentage. Harvesting was conducted once a week for 4 months to allow recording of observations.

Experimental design:
A Split plot design was used to handle the experiment where substrate additional rows were used as the main plot and the monthly observation column was used as a sub plot (statistical able 1&2 below). Monthly observations on data were summed to obtain monthly germination numbers and monthly germination percentages. Observations were first transformed into arcsine before computation (Zar, 2020). Results from the experiment were analysed. Means and Least Significant Difference (LSD) for germination number and germination percentage for all treatments were computed to get an inference.

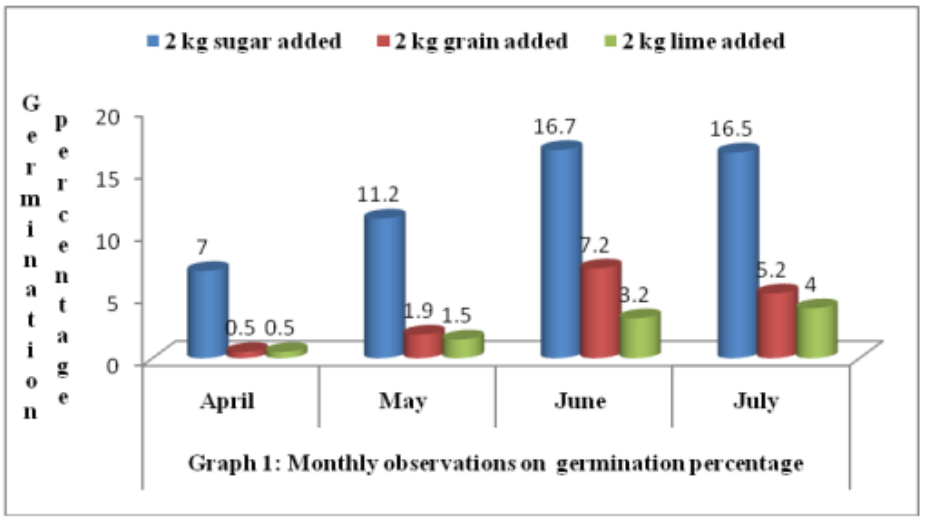
Data analysis

Data analysis was accomplished according to (Zar, 2020), using Statistical Packages for Social Sciences (SPSS version 14) software for analysing germination percent and germination number. Descriptive statistics were first performed to observe the characteristics of the study variables. The characteristics of the study variables were presented by using frequency tables and charts. Since the study constitute of only one dependent variable with three independent categories, the one factor Analysis of Variance (ANOVA) were suitable in observing the presence of significant effect among the categories. The effect of groups was considered significant if the P-value were less than 5%.

RESULTS AND DISCUSSION

Effect of additional sugar to germination percentage of *pleurotus ostreatus*

The findings in graph 1 shown germination percentage ranged from 7 to 17 between April 2020 and July 2020 in the compost with an additional of 2 kg sugar while the compost with an additional of 2 kg grain chaff and 2 kg lime, germination percent ranged from 0.5 to 7 and 0.5 to 4 respectively in the same duration, the same greenhouse and the same environmental conditions of temperature, humidity, pH and precipitation. Moreover, the inferential statistics in table 1 revealed the statistically significant difference in mean germination percentage due to the additional sugar P-values = 0.002248 and df = 2 as it came from (N-1 = 2) in table 1 where N is the number between the groups which were 3 groups (sugar, lime and grain chaff) and df is the degree of freedom.. Other scholars have been reporting that Mushroom growers have been using different compost and substrate ratios as a probability game. The same probabilities have been conducted on the type of materials used for the construction of the greenhouse (Moonmoon et al, 2011). Photograph 2 and 3 are examples of germinated mushrooms in bags and cages in the greenhouse of the study.



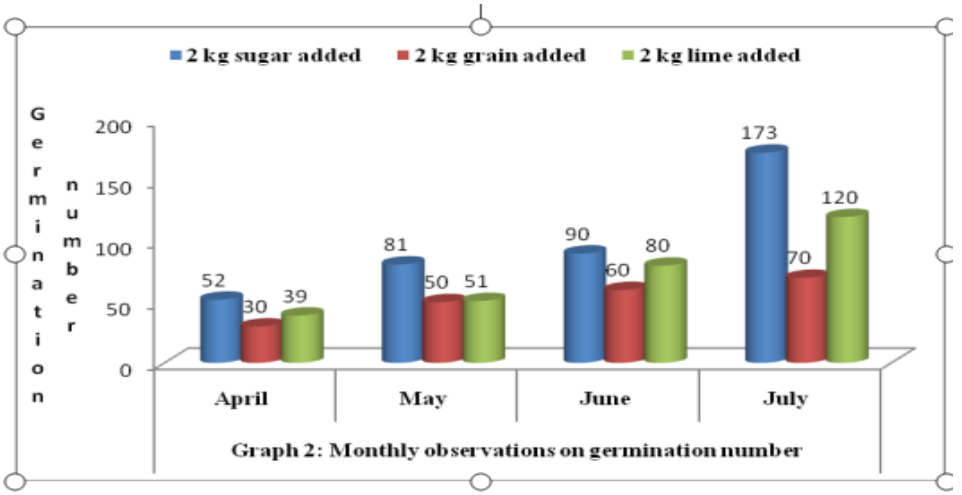
Graph 1: Monthly observations on germination percentage

Table 1: Analysis of means

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	245.7622	2	122.8811	19.90157	0.002248	5.143253
Within Groups	37.04667	6	6.174444			
Total	282.8089	8				

Effect of additional sugar to germination number of *pleurotus ostreatus*

As table 2 and graph 2 indicated, the highest germination number was observed in compost with additional of 2 kg sugar which ranged from 52 to 173. The lowest germination number was observed in compost treated with 2 kg grain chaff which ranged from 30 to 70. Germination number in compost treated with lime was moderate (39-120) next to sugar treatment. Descriptively, it is evident that additional of sugar was associated with higher number of Mushroom germination than other treatments (graph 2). However, statistical results indicated that there was no significant difference of germination number between treatments ($P>0.05$) with P-value = 0.25246 and df = 2 as it came from (N-1 = 2) in table 2 where N is the number between the groups which were 3 groups (sugar, lime and grain chaff) and df is the degree of freedom.



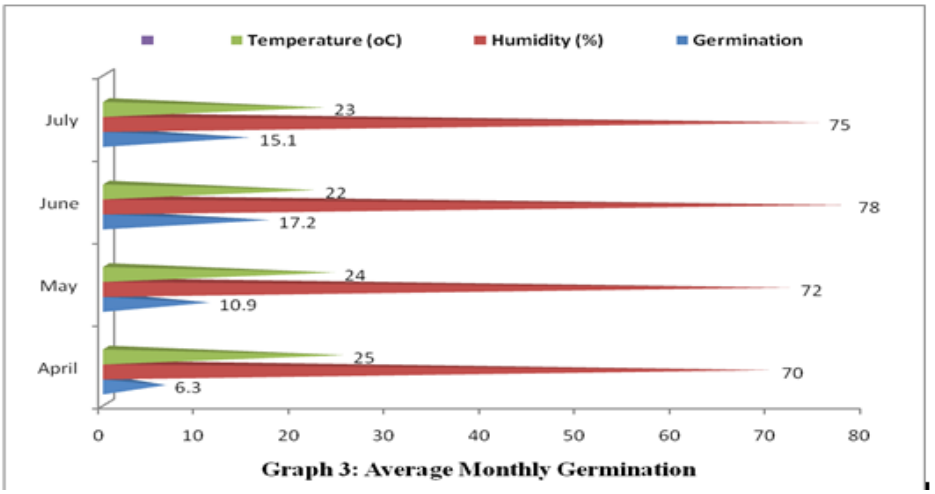
Graph 2: Monthly observations on germination number

Table 2: Analysis of mean

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4509.556	2	2254.778	1.746686	0.25246	5.143253
Within Groups	7745.333	6	1290.889			
Total	12254.89	8				

Average monthly germination

Results in graph 3 indicated high average germination in June (78%) followed by July and May (75% and 72) respectively while the lowest average germination was 70% in April (graph 3). Rise and fall in the average monthly germination reflected the effect of humidity and temperature as determining conditions for mushrooms germination in the greenhouse (Oh et al, 2003). A higher temperature above 30ºC (85ºF) kill mycelia, first growth of spore and reduce yield. At such temperature the levels of humidity for a greenhouse which do not have humidify is below 70% (Oh et al, 2003). The month of June during the research had higher humidity (78) which was attributed by high rainfall which influenced higher average monthly germination (17.2). At such higher humidity the temperature is always around 20^0C. The high temperature in April and May (25^0C and 24^0C) respectively affected the average monthly germination (6.3 and 10.9) respectively compared to the moderate temperature in July (23) in which average monthly germination was 15.1%



Graph 3: Average Monthly Germination

Potography 2: Mushroom germination arising from bags

Photography 3. Mushrooms grown out of the bags.

Successful production of mushroom as observed in this investigation depends on growth media and growth condition as influenced by atmospheric condition and maintained optimal in the local greenhouse. Observation also realized that, substrate and growth condition are all specific in such that substrate will support sprouting and growth of mushroom at specific growth conditions. Specified growth condition which was maintained in this local greenhouse was as follows: humidity above 75% was more favourable, humidity below 70% dried the mycelia and brought death of Mushrooms, temperature below 30ºC but above 20ºC was more favourable. These conditions influenced high average monthly germination of 17.2 in June at 78% humidity and 22^0C compared to low average monthly germination of 6.8 in April at 70% humidity and 25^0C. The effect and influence of atmospheric conditions in this research to mushrooms germination and growth agree with many other researchers including Moonmoon et al (2011) and Washa (2015).

Temperature above 25ºC killed the mycelia, first growth of spore and reduced yield. Higher precipitation above 200 mm a month kept humidity optimal provided materials constructed in the local green house maintain the humidity optimally.

Sugar, grain chaff and lime as substrates used to add in the compost in this research differ in supporting mushroom germination and growth; they are all good and proper for growing Oyster mushroom. Content differences from their structural composition is obviously the source of different performance in supporting mushroom in the compost provided the growth condition of the atmosphere and that of local greenhouse are optima. The effect of substrate used in this research and results reviled in the research are in agreement with the findings by (Gerrits, 1981) and (Oh et al., 2004b and Washa, 2015).

Sugar in the growth media

.Sugar is a carbohydrate yielding 3.94 calories per gram as do all carbohydrates. This stored energy in form of calories was used for initiating mushroom germination and growth through all months of the research and brought significant growth in additional of 2 kg in the growth media as indicated in (Table 1&2, figure 1&2). Sugar as a substrate is cheaper for local mushroom growers to buy than Agar and Murashige and Skoog used in technological laboratories.

Grain chaff in the growth media

Grain chaff used as a substrate in this research is composed of cellulose, lignin, hemicelluloses, and a protein matrix. These compositions are nutritive materials to be absorbed by the mushroom through mycelia parasitically as mushroom have parasitic mode of life. The composition also prevents solidification of the media (compost) to allow parasitic penetration of the mycelia. Grain chaff are the cheapest substrate to be bought by the local mushroom growers compared to Agar and Murashige and Skoog used in technological laboratories. The composition of grain chaff presented in this research agree with the findings by (Oh et al., 2004b).

Lime in the growth media

Lime used as a substrate in this research is a calcium-containing inorganic mineral composed primarily of oxides, and hydroxide, usually calcium oxide and/ or calcium hydroxide. Lime in the compost of this research was of two functions: One was to sticky the mycelia but also the media. This means solidified the growth media to the required level to support standing of the germinated mycelia and sticky mycelia is when the flegile mycelia which is not able to stand by its own tissue, the tissues to some extend harden and mycelia can stand in the media. The other function of lime was to balance and maintain the pH of the media at optimal level as a growth requirement. This is why the average pH in the months of mushroom cultivation of the research was 7.45. Recommended growth media pH range is (7-8), Gerrits (1981). As it is, lime used in this research as a substrate is cheaper than the Agar and Murashige and Skoog. The composition and functions of the lime substrate as elaborated in this research is in agreement with findings by (Chang and Miles, 1989).

Wood rejects in the local greenhouse

Woody materials used to construct local green house in this research as poor conductor of heat were able to minimize the destructive temperature especially in June 2020 to optimal level (22^{o}C). In additional to reduction of temperature, timber reject in this research was used to retain darkness as a growth requirement (Moore and Chiu, 2001, Washa, 2015). Darkness is a requirement for biosporous to grow (Oh et al., 2004b).

The growth media (compost)

Compost used in this research which comprised of sliced banana leaves and saw dust were able to create good parasitic environment for rising,

feeding and growth of mycelia, biosporous and mushrooms as well. This is because they easily decompose and its decomposition is a good food for mycelia but also in presence of lime and grain chaff substrate they do not solidify easily.

CONCLUSION AND RECOMMENDATIONS

As reflected from results of this research, the optimal mushroom growth condition are (moisture > 75%, temperature < 25ºC and pH ranges 7-8). The relevant compost is sliced banana leaves (50 kg), saw dust (50 kg), sugar (10 kg), grain chaff (10 kg) and lime (10 kg). Additional of extra 2 kg sugar to the compost increases mushroom germination. Woody materials succeeded to maintain growth conditions at optimal.

Mushroom growers are advised to use woody materials in constructing a local green house, use sliced banana leaves and saw dust to form compost and add sugar as a substrate in the compost. More research is encouraged to improve the compost, substrate and shelter but also the possibility of constructing a local humidifier. Mushroom growers are advised to use the compost formula as indicated in this investigation as a new knowledge contributed by the research.

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Vicarious Experience as a Predictor of Self-efficacy in Condom Use among Adolescents in Tanzania: Reflections from Media, Peers and Adults

Daniel Fedrick Marandu
daniel.marandu@yahoo.com,
Chris Mungubariki Mauki
Email: chrismauki57@gmail.com
University of Dar es Salaam

ABSTRACT

Inadequate condom use among adolescents is a health and behavioural concern across countries. Adolescents are largely vulnerable to sexually transmitted diseases and early pregnancies. However, little attention has been paid to studying objectively and scientifically the factors that are associated with condom use self-efficacy among adolescents. This study presents results on the influence of vicarious experiences on condom use self-efficacy among adolescents in Tanzania. The study was conducted through a quantitative approach using a sample of 552 respondents from two districts in Mpanda and Njombe regions in Tanzania. Data were collected through questionnaires and analysed using independent t-test and multiple regression analysis. The results from regression analysis indicated that media and peers significantly predicted adolescents' condom use self-efficacy. Adults were not a statistically significant predictor of condom use self-efficacy. The model further showed that media was a strongest predictor (β = .263, p value <.001), followed by peers ((β = .250, p value <.001). Thus, adolescents' judgments about their perceived ability to use condoms are generally influenced by the observation and imitation of their peers, and the more they watch and listen to radio and television advertisements about condom use. The study recommends that health behaviour change programmes such as condom use targeting adolescents should encourage the use of vicarious experiences such as peer educators' programmes and TV/radio ads which could assist strengthen condom use self-efficacy, and it is practically effective in preventing HIV/AIDS and early pregnancies, and these programmes should be differently packaged for boys and girls.

Keywords: *Vicarious Experiences, Self-efficacy Condom Use, Media, Peers, Adults*

INTRODUCTION

Condom use among adolescents is a global concern as they are a vulnerable group with regard to sexually transmitted diseases and early pregnancies (World Health Organization (WHO), 2014). The adolescents are expected to use condoms because condoms to adolescents have proved to produce positive health outcomes (Shariati et al., 2014). Among other sexual and reproductive health services offered to adolescents, condom use is now recognized within the international arena as an effective and essential strategy for HIV/AIDS prevention and early pregnancies (Folayan & Ezeanolue, 2016; Mugisha et al., 2011). In addition, World Health Organization has identified inadequate access to condoms among adolescents as a contributing factor to AIDS-related adolescent deaths, most of which occur in sub-Saharan Africa (WHO, 2019). Studies among the African counties have also shown that even when adolescents are aware of HIV/AIDS, the majority do not use condoms as was expected (Dirar et al., 2013; Fikadie et al., 2014; Mugisha et al., 2011; Ntsepe et al., 2014; Peltzer et al., 2013). A study by (WHO, 2014) has shown that condom use helps adolescents to reduce their risk of contracting HIV/AIDS and getting pregnancies. However, the available literature from Ferrand et al. (2010) and United Nations Population Fund, (2015) indicate that many adolescents in Sub-Saharan Africa still underutilise condoms.

The World Health Organization estimates that every year, approximately 16 million girls aged 15-19 years and one million under 15 years give birth, with the majority coming from low and middle-income countries encounter unplanned early pregnancies (WHO, 2014). Recent data has also indicated that young men and women aged 15–24 represent almost 50% of all newly acquired STIs worldwide (International Planned Parenthood Federation, 2020). Moreover, the 2018 data estimated that the adolescent birth rate globally was 44 births per 1,000 girls aged 15–19 years, with the highest rates of 115 births per 1,000 in West and Central Africa (UNICEF, 2020). In regard to HIV/AIDS, it was estimated that 2.1 million adolescents were living with HIV/AIDS in Africa in 2012 among them approximately two-thirds of all new infections were girls from Sub-Saharan Africa (UNICEF, 2013). The aforementioned statistics indicate that the problem of HIV/AIDS, early and unplanned pregnancy in Africa is a matter of serious concern. Apparently, the underutilisation of

condoms exposed adolescents to unwanted pregnancies, and STIs, including HIV/AIDS (Urassa et al., 2018).
In Tanzania, studies by Exavery et al. (2011), Jeckoniah (2018), Mrema (2015) and Sanga et al. (2015) also report underutilization of condoms among adolescents, whereas less than one-third of them reported using a condom at their first sexual intercourse. This implies that despite the high vulnerability among adolescents to HIV/AIDS infection, and pregnancies condom use is significantly lower including at the time of sexual debut. A report from the Ministry of Health and Social Welfare (2014) also revealed that among adolescents 10–19 years found among other things that more than 60% of those who reported having had multiple sexual partners in the past year did not use a condom. Similarly, TDHS-MIS (2015-2016) indicates that condom use is low as 37% in adolescent girls and 35% in adolescent boys between the ages of 15-19. This evidence is supported by the studies conducted by Jeckoniah (2018) and Mrema (2015), who also reported that a small number of adolescent populations have access to condom, amounting to about 40% of the country's total adolescent population.

Notably, self-efficacy condom use can be defined as a person's confidence in his/her ability to purchase condoms, negotiate and use condoms during sexual intercourse (Asante & Doku, 2010). Additionally, literature has revealed that self-efficacy condom use is an important determinant of condom use and intention to use condoms (Closson et al., 2018; Kwok et al., 2010). Specifically, it is established that adolescents who have a high sense of self-efficacy in condom use are likely to use condoms, while those who have low condom use self-efficacy are less likely to use condoms (Kwok et al. 2010). Literature has also revealed the differences in the prevalence of condom use behaviour between boys and girls (Singh et al., 2000). This implies that understanding sex differences is vital for developing appropriate sexual and reproductive health programmes that promote condom use among adolescents. A study by Mehra et al. (2014) revealed the association between low condom self-efficacy among girls who were found to be at a higher risk of inconsistent condom use.

Studies have also revealed that increasing adolescents' condom self-efficacy promotes condom use and leads to low pregnancy rates, Sexual Transmission Infections (STIs), and HIV/AIDS risk reduction (Coffman et al. 2011 & Free et al. 2011).This suggests that increasing adolescents'

self-efficacy on condom use remains an important suggestion for improving condom use among adolescents. Bandura (1997, p. 37) define self-efficacy as an individual's personal belief in his or her capability to perform a particular behaviour. Bandura adds that self-efficacy is concerned not with the number of skills, knowledge, attitudes or resources that people have but with what they believe they can do with what they have under various circumstances. Bandura's theory of self-efficacy is grounded on the following premises: first, individuals are not only reactive to external influences but are also proactive and able to self-regulate. In other words, individuals become both products and producers of their environments. The self-efficacy theory provides a framework for understanding, predicting, and changing human behaviour. Secondly, the key argument regarding the role of self-efficacy beliefs in human behaviour is that "*peoples' level of motivation, affective states and action are based on what they believe than what is objectively true* (Bandura 1997, p. 2)*"*. In the context of adolescents, the belief in condom use can often be better predicted by the beliefs they hold about their capabilities to use a condom than what they are actually capable to accomplish. Thus, self-efficacy helps determine what adolescents will do with their knowledge and skills about condom use. The theory of self-efficacy helps to link what the notion of self-efficacy entails concerning condom use as part of sexual and reproductive health services and why adolescents' condom use is low even when they have similar knowledge and skills.

Based on the self-efficacy theory, self-efficacy of an individual can be determined in four main sources which are mastery experience, vicarious experiences, verbal persuasion and physiological and emotional states. Thus, in the concept of vicarious experience as sources of self-efficacy, Bandura contends that individuals develop their self-efficacy beliefs through observational learning. This source of self-efficacy is weaker than mastery experience in developing self-efficacy beliefs, but when individuals are not sure about their abilities or when they have limited prior experience, they become more strong, sensitive and important to vicarious experiences. Bandura (1977) further posits that people tend to imitate those who appear mostly like them, referring to them as social role models, including parents, peers, and TV/ads. The more a person observes another similar person behaving in a certain way, the more likely they will repeat that behaviour (Bandura, 1986, 1997).

Studies have also shown that vicarious experience is one of the strongest predictors of one's self-efficacy on condom use (Abigail et al., 2013; Asare & Heights, 2015; Fikadie et al., 2014; Olumide & Ojengbede, 2016). For example, a study conducted in the United States of America by Asare and Heights (2015) found that a vicarious experience was a significant predictor of the participants' intentions to use condoms (*p* value=.001). In the same vein, a study conducted in rural South Africa by Abigail et al. (2013) found that boys' perceptions of male peer behaviour were associated with condom use self-efficacy (r=.480, *p* value= 0.01). Likewise, Olumide and Ojengbede (2016) in Nigeria found that television programmes related to condom use had a strong association on adolescents' condom use. This indicates that through television ads as an observational learning tool, adolescents often sought information on the television programmes related to condom use and were motivated to imitate the behaviour. However, the findings of these studies contradict with the studies conducted in Asia, and Nigeria by (Babalola et al., 2008; Habibov & Zainiddinov, 2017). For example the study conducted in Asia by Habibov and Zainiddinov, (2017) on effect of TV and radio ads on condom use found no significant relationship on condom use among adolescents(*p* value= .089). This results are in line with the study done in Nigeria by Babalola et al., (2008) on the assessment of the effectiveness of peers, adults and television and radio programs on condom use in Nigeria which found no relationship between observational learning and condom use (*p* value= .072). The implication is that, while vicarious experiences have a significant effect on adolescents' condom use in one context, it may not be the case in a different context. The data are also controversial, and there are no consistent results about the association between vicarious experiences and adolescents' self-efficacy in condom use.

Overall, the foregoing review pinpoints three limitations about the influence of adolescents' vicarious experiences condom use self-efficacy that warrant further investigations. First, most of the studies on adolescents' condom use that have been conducted in Tanzania and other parts of the world mainly focused on socio-cultural and contextual factors towards condom use among adolescents. Second, studies on self-efficacy have been conducted in Tanzania but mostly focusing on the relationship between students' self-efficacy and academic achievement, career choice, sports and physical activities (Amani, 2018; Mkongo, 2006; Hofman & Kilimo, 2014; Raphael & Mtebe, 2017). Third, the studies conducted in

Tanzania on self-efficacy sources and condom use among adolescents is limited by scope, context and inconsistency in findings. Given these limitations, there is a need for an empirical study to be conducted in Tanzania to inform about the influence of vicarious experiences as source of self-efficacy on adolescents' self-efficacy condom use. Therefore, this study aims to examine the influence of vicarious experiences on condom use self-efficacy among adolescents in Tanzania. Specific objectives of the study were to: determine variation of age and sex on adolescents' condom use and examine significance influence of vicarious experiences on self-efficacy condom use among adolescents.

MATERIALS AND METHODS

The study was conducted in Katavi and Njombe regions. The selection of the two regions was based on the prevalence rates of teenage pregnancy and HIV/AIDS compared to other regions in the country based on the data given by the Ministry of Health, Community Development, Gender and Children (2017) and TACAIDS (2018). Katavi region had the highest prevalence rate of teenage pregnancy in the country, with 45.1% of teenage girls aged 15-19 compared to the overall prevalence rate of adolescents' pregnancies of 27% in the country, followed by Tabora (42.5%), Morogoro (38.6%), Dodoma (38.5%), Mara (37.5%), Mbeya (37.4%) and Shinyanga (33.5%). On the other hand, the data also indicate that the Njombe region had the highest HIV/AIDS prevalence (14.8%) in Tanzania among adolescents aged 14-24, followed by Iringa (11.3%), Mbeya (9.3%), Mwanza (7.2%) and Pwani (5.5%) (TACAIDS, 2018). Specifically, the study was conducted in Njombe and Mpanda districts. The researchers purposively selected the districts because of the following reasons; firstly, the districts were among the districts with the highest teens' pregnancy and HIV/AIDS prevalence rate in Tanzania Ministry of Health, Community Development, Gender and Children (2017) and TACAIDS (2018). Secondly, districts had secondary schools that implement programs on HIV/AIDS at schools with trained teachers teaching sexual and reproductive health education in schools (Basic Education Statistics in Tanzania (BEST), 2020).

The study employed the quantitative research approach. The approach was chosen because it provides scientific grounded results derived from the rigorous application of theory testing through examining the influence of vicarious experiences on condom use self-efficacy among adolescent students. A total of 11 secondary schools were selected in a sequence of

four main steps. First, the researcher requested and obtained the list of all secondary schools from the District Education office in each of the two districts. Second, from the list of schools the researcher with the assistance of District Education Officers identified all schools that provided education on sexual and reproductive health and with trained teachers who were teaching sexual and reproductive health education. Third, the obtained lists of all schools in each district were stratified based on ownership (Private and Public) and gender composition of the students (single-sex or co-education). These selection criteria for schools were used based on the insights obtained from the literature review (Masinde & Chege, 2017). Specifically, the reviewed literature established that students' experiences, maturity and perception on condom use differed based on their sex and class level or level of education. Fourth, after having the list of those schools, the researchers wrote names of schools on pieces of paper, put them in in an empty box, then, shook the box. Initially, the researchers randomly picked 6 schools' papers from the box to obtain names of schools from Mpanda and from Njombe, respectively. Thus, a total of 12 schools were sampled in both districts to participate in the research. However, one head of school in Mpanda district declined his school to take part in the research because the students were taking part in inter-examination. Therefore, eventually a total of 11 schools (5 schools in Mpanda and 6 schools in Njombe) participated in the study.

Selection of students involved the researchers meeting with each head of school of the participating schools and explained about the purpose of the research, the targeted classes and how students would participate in the study. Then, the researchers and head of school discussed the options that the researchers had planned for recruiting students to participate in the study by filling out the questionnaires. Four classes, namely, Forms III, IV, V, and VI in each school were included in this study. The reason for opting to the four classes include the fact that, given the age entry of 6 years and 13 years for completion of primary education, thus, it was presumed that students in Form III at age 15 and above were the ones who would be sexually active. This was consistent to what the literature reports about sexual debut among adolescents (Masinde & Chege, 2017; Mathews et al., 2016). Existing studies also revealed that adolescents begin engaging in sexual intercourse between 15 to18 years of age (Masinde & Chege, 2017). Thus, it was considered that involved students attending Forms III, IV, V, and VI with age between 15 and 21 years would enable the researcher to include student respondents who were

sexually active. Hence, they were assumed to possess reasonably sufficient information about condom use. Also Forms III, IV, V, and VI students were selected partly because their maturity as compared to Form I and II which puts them in a better position to fill in the self-report questionnaire.

Stratified and simple random sampling techniques were used to select secondary school adolescent students from Form III to VI, each in a separate class. In these techniques**,** each individual in the target population was given an equal and independent chance of being selected (Kumar, 2011)**.** Therefore, before conducting simple random sampling, the researchers employed stratified sampling to get demographic characteristics based on the information needed in the study. The stratification process was based on sex and class levels. Therefore, the stratified sampling technique facilitated the selection of students based on sex (boys and girls) and class levels (Form III, IV, V, and VI). Then, from each stratum, the required number of participants was randomly selected. The random selection was achieved by assigning letters on special cards which were written YES and NO. To select the respondents, the researchers took the cards, put them in an empty box, and then shook the boxes. Then the researchers gave the boxes to the students and asked each student to pick the cards at random as per the sample size required for both boys and girl's students in each class. Those students who picked the cards written YES were selected for the study.

The information on vicarious experiences was collected using a questionnaire adapted from Music Performance Self-Efficacy Scale (MPSES) developed by Zelenak (2010). The items for vicarious experiences were developed to reflect Bandura's (1986) sources of self-efficacy. Coding and data entry were done as qn1, qn2 qn3 qn4, qn5, to qn6. During analysis, the items were transformed into two levels, high and low, to simplify interpretation and discussion of the results (Field, 2014). The minimum scale score was 3 and 12 was the maximum scale score. All the respondents who scored 3-6 were considered to have high level and those who scored 7-12 were considered to have low level vicarious experiences in condom use. The information on adolescents' condom use self-efficacy was collected using the Condom Use Self-Efficacy Scale (CUSES), adapted from Brafford and Beck (1991). This scale is a tool for measuring an individual's degree of belief that they can successfully engage in particular health behaviour, and many researchers

have widely used it (Brafford & Beck, 1991; Brien et al., 1994; Langer et al., 1994; Mahoney et al., 1995). The respondents were prompted to indicate their confidence in their capability in the utilisation of condoms in four Likert scale levels; *1= strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree.* Data were coded and entered as qn1, qn2 qn3 to qn12. During data analysis, the total scale score was calculated after reversing the items 12 which was positively worded. A total of 30 students from private schools and 30 from public schools took part in the pilot study. The data obtained from the pilot study were first entered into the SPSS Version 25. Thereafter, the confirmatory factor (CFA) analysis was conducted using SPSS to determine whether or not the data generated from vicarious experiences as sources of self-efficacy was consistent with the Bandura's proposed model. In addition, the methods and techniques used in the current paper have been used in previous analyses of sources of self-efficacy scales (Lent, Lopez, & Bieschke, 1991; Matsui, Matsui, & Ohnishi, 1990; Usher & Pajares, 2006, 2009; Zelenak, 2010) to provide evidence on the validity of the scale.

During the analysis of CFA, four indexes, namely the Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residuals (SRMR), Goodness of Fit Index (GFI), and Comparative Fit Index (CFI), were presented as fit statistics. The Root Mean Squared Error of Approximation (RMSEA) values below .10 and the Root Mean Square Residuals (SRMR) values below .05 are accepted as regular fit values. Moreover, the Goodness of Fit Index (GFI) greater than .90 and Comparative Fit Index (CFI) higher than .90 indicate a good fit to the data (Hu & Bentler, 1999). The CFA results from the pilot study revealed a fit index as follows; RMSEA =.07, SRMR =.08, GFI= .94 and CFI=.79. The results from the fit indexes model fit for vicarious experience were unsatisfactory. Considering the CFA results during the pilot study, two items from vicarious experiences that did not well contribute to the total variability had very low loading factors were ignored. A second CFA was conducted on the remaining items.

The second CFA revealed a good model fit for all the remaining items, as follows RMSEA =.07, SRMR =.04, GFI= .81 and CFI=.07. Therefore, in the current paper, these problematic items were not included in the analysis. The numbers of the items were 4 for vicarious experience. Generally, the second confirmatory factor analysis was found to measure a unique form of sources of self-efficacy that demonstrated modest

relationships with vicarious experiences in condom use. Additionally, the validity of the results was ensured through the clear match of the research objectives, hypothesis, theory and problem of inquiry. The respondents involved in the study were randomly selected to ensure their representativeness. Each component of the questionnaires' internal and overall reliabilities was tested using the Cronbach's Alpa Coefficient. The items in all scales used in this study met the international internal consistency value of .07 for social science studies (Creswell & Creswell, 2018). The overall Cronbach alpha for vicarious experiences was α =.08. Similarly, the Cronbach alpha for the condom use self-efficacy scale was .073. This implies that the items in all scales were correlated, measuring the intended construct. The quantitative raw data was systematically analysed using the Statistical Package for Social Sciences (SPSS) version 25. Furthermore, independent t-test was used to test the variation of adolescents' condom use based on age and sex and liner regression analysis was used as a statistical test to determine significant effect vicarious experiences on adolescents' condom use self-efficacy. Furthermore, confirmatory factor analyses were conducted to reduce the number of vicarious experiences variables that had low loading factors to the convenient level.

For ethical purposes, the researchers adhered to the procedures by requesting letters of permission from the University Vice Chancellor's office. The letters were thereafter directed to Njombe and Katavi Administrative Secretary (RAS) and then to District Administrative Secretary (DAS). The DAS introduced the researchers to the Municipal Executive Directors who forwarded the permission letter to the heads of secondary schools allowing that the study be conducted in the area. During the study, all respondents, school heads, students and academic masters were informed about the purpose of the study, its objectives, the manner in which it would be conducted and its significance. Throughout the study period, the respondents were guaranteed that the information they provided would be kept confidential and only to be used for the purpose of the study. To make this a reality, the ethical issues were taken into consideration between the researchers and the respondents. To ensure confidentiality, the respondents were not required to indicate their names or any other identities on the research instruments.

RESULTS

Background characteristics of the respondents

The background information of the respondents included four characteristics. The characteristics were about type of school, class levels, age, and sex. The demographic characteristics of the respondents are summarized in Tables 1.

Table 1: Background characteristics of respondents by type of school, sex, class level and age (N=552)

Variables		Frequency	Percentage
Age group	15-16	152	27.5
	17-21	400	72.5
	Form III	213	38.6
Class Level	Form IV	219	39.7
	Form V	58	10.5
	Form VI	62	11.2
Sex	Boys	279	50.5
	Girls	273	49.5
	Private	158	28.6
Type of school	Public	394	71.4
	Total	552	100.0

The results from Table 1 indicate that a total of 552 questionnaires were returned from the respondents. Majority respondents were students from public secondary schools, 394 (71.4%). There were almost an equal proportion of boys and girls students who participated. More of the respondents were ordinary secondary school cohort compared to advanced secondary school cohort and there was almost equal proportion between classes in each of the two secondary level cohorts. Form IV 219 (39.7%), whereby 141 (25.1%) were from the public, and 78 (14.1%) from private schools, followed by Form III students 212(38.4%) whereby 133 (24.1%) were from public schools and 80 (14.5%) from private schools. Likewise, based on age group majority were 17-21 years 400 (72.5%) followed by 15-16 years 152 (27.5%).

Levels of adolescents' vicarious experiences in condom use

The prevalence of vicarious experiences in condom use among adolescents in secondary school was something the researchers felt was crucial to determine. As summarised in Figure 1, the findings revealed varying levels of vicarious experiences in condom use among adolescents.

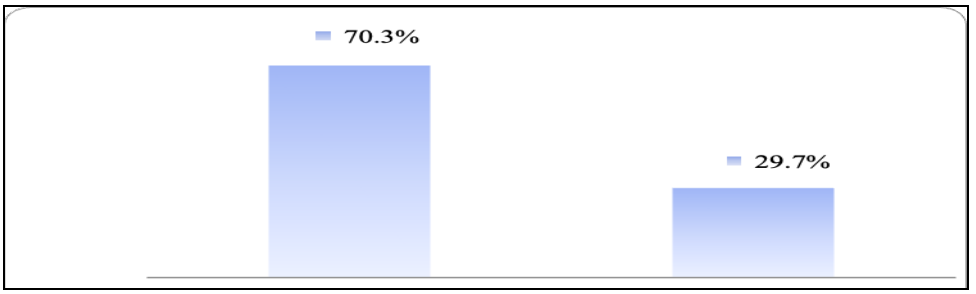

Figure 1. Levels of adolescents vicarious experiences in condoms

The results in Figure 1 reveal that the majority of adolescents (70.3%) had high levels of vicarious experiences in condom use and less than a quarter of the adolescents reported low level of vicarious experiences in condom use. This suggests that the majority of adolescents in secondary schools have a high level of vicarious experiences.

Variation of adolescents' condom use by age and sex

The first objective of this study was to determine the variation of adolescents' condom use based on their age and sex. The researchers assumed that there could be differences in the extent of condom use based on their attributes. These attributes are presented in Table 2.

Table 2: Respondents' variation on condom use based on sex, Age (N=552)

Variables	Vicarious experience	Category	Mean	SD	Test values	P values
Sex		Boys	2.16	.07		
		Girls	2.36	.69	-3.299	.001
	Condom Use					
Age		Middle	2.31	.72	1.959	.022
		late	2.19	.66		

As it is shown in Table 2, the results from an independent t-test which was performed to compare condom use scores for boys and girls reveal that the means scores for girls (M=2.36, SD= .69) was statistically significantly higher than mean score of the boys (M=2.16, SD= .07; t=3.299, df=550, *p-value*<.001). The magnitude of the differences in the means was very small (eta squared = .006). This suggests that through

vicarious experience girls are more likely to use condoms as they learn and imitate from peers, adults and TV/radio ads than their counterpart. Similarly, the independent test was performed to assess whether there were statistically significant differences in condom use between middle and late adolescents. The results revealed that, the condom use mean scores of middle adolescents was significantly higher (M=2.31, SD= .72; t=1.959, df=550, *p-value* .022) than the mean score of late adolescents (M=2.19, SD= .66). This indicates that middle adolescents (15-16 years) were more likely to use condom by observing, learning and imitating from peers, adults, TV/radio ads than late adolescents (17-21 years). The results also imply that adolescents' imitation and observation learning from peers and adults on condom use is more likely to go down as their age goes up.

Vicarious experiences as a predictors of condom use self-efficacy among adolescents

The second objective was to determine the influence vicarious experiences on adolescents' condom use self-efficacy among secondary school adolescent students. Before performing regression analyses to examine the influence of Media, Peers and adults on adolescents' self-efficacy on condom use. The researcher though it was important to check on the multicollinearity of the independent variables. The assumption was testing the predictors or independent variables which should not be too highly correlated. The results on multicollinearity is summarised in Table 3.

Table 3: Results of multicollinearity

		Media	Peers	Adults	Condom use
Media	Pearson Correlation	1	.589**	.227**	.413**
	Sig. (2-tailed)		.000	.000	.000
Peers	Pearson Correlation	.589**	1	.201**	.407**
	Sig. (2-tailed)	.000		.000	.000
Adults	Pearson Correlation	.227**	.201**	1	.121**
	Sig. (2-tailed)	.000	.000		.005
Condom use	Pearson Correlation	.413**	.407**	.121**	1
	Sig. (2-tailed)	.000	.000	.005	

**. Correlation is significant at the 0.01 level (2-tailed).

The results from Table 3 reveal that there is a moderate positive relationship between media and peers (r=.589, p<.001) media and

condom use (r=413, p<.001). There was also a weak positive relationship between media and adults (r=227, p<.001). Furthermore, there was a moderate positive relationship between peers and condom use (r=.407, p<.001) and weak positive relationship between peers and adults (r=.201, p<.001). Moreover, adult was positively related with condom use (r=.121, p<.001). Here the absolute value of the Pearson correlation coefficient is less than 0.8; it shows collinearity is very unlikely to exist (Pallant, 2016). Thus, the results allowed the researcher to proceed with further analyses. Therefore, to examine the influence of the media, adults, and peers on condom use self-efficacy among adolescents. A multiple regression analysis was carried out to investigate whether media peers, and adults could significantly predict adolescents' condom use self-efficacy. The respective hypothesis stated that vicarious experiences do not influence self-efficacy in condom use among adolescents. The results are summarised in Table 4.

Table 4: Multiple regression analysis results on the influence of media, adults and peers on condom use self-efficacy

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.215	.113		10.795	.000
	Media	.413	.074	.263	5.540	.000
	Adult	.022	.079	.011	.275	.783
	Peers	.370	.070	.250	5.313	.000

a. Dependent Variable: Condom use

The regression model was significant (R2 =.21, F (548) =49.021, p value =<.001). Further, the regression results indicated that media and peers statistically significantly predicted adolescent' condom use self-efficacy. Adults was not a statistically significant predictor of adolescents' condom use self-efficacy. The model further showed that media was a strongest predictor (β = .263, *p* value <.001), followed by peers ((β = .250, *p* value <.001). This suggests that adolescent who watch and/or listen condom use adverts on TV or radio as well as observing condom use among their peers will be confident to use condom whenever they want to have sex. That is, as adolescents are exposed to media advertisement about condom use, as more they observe peers buying condoms, their self-efficacy in condom use increases as well. Therefore, the null hypothesis which

hypothesised that vicarious experiences do not influence self-efficacy in condom use among adolescents was rejected.

DISCUSSION

The results from multiple regression analysis indicated the media and peers predicted adolescents' condom use self-efficacy by 21% of the variance (R2 =.21, F (548) =49.021, p value =<.001). It was found that media significantly predicted condom use self-efficacy (β = .263, *p* value <.001) as did peers (β = .275, *p* value=<.01). These results imply media and peers influences the levels adolescents' self-efficacy in condom use. This can be attributed to the view that as more adolescents interact and get exposed to peer educators and TV/radio programmes related to condom use, the more their self-efficacy in condom use increases. This is to say, educative messages from TV and radio ads about condom use and persuasive models, including peers, increase adolescents' self-efficacy in condom use.

The results of this study provide a theoretical link between the literature and Bandura's (1986) social cognitive theory. He contends that vicarious experiences are compelling when observers see similarities in some attributes and then assume that the model's performance is suggestive of their own capability. The more a person observes another similar person behaving a certain way, the more likely they will repeat that behaviour (Bandura, 1986, 1997). Through vicarious experience, adolescents persuade themselves by comparing their ability and failures and drawing conclusions about their capability. Thus, through observing how peers and watching TV and radio ads, other adolescents develop a sense of self-efficacy and believe that they could also use condoms in the future. This study produced results which corroborate with some basic facts documented from previous studies, which found a significant influence of vicarious experiences on adolescents' self-efficacy condom use. These results seem to be consistent with the study conducted in America by Asare and Heights (2015) on the application of the theory of planned behaviour in explaining condom use behaviour among college students. The study found that vicarious experience influenced students' self-efficacy in using condoms (*p* value =.001). The results of the current study and those of Asare and Heights (2015) suggest that adolescents' vicarious experiences through peers help to increase adolescents' beliefs about their perceived ability to buy and use condoms. The more

adolescents obtain the chance to observe others purchasing condoms, the more they can develop the belief and confidence to use them.

In the same vein, a study conducted by Abigail et al. (2013) on peer influences on adolescent HIV risk in rural South Africa found a strong and positive relationship between vicarious experiences and self-efficacy in condom use (r =.072, *p* value =.001). The study revealed that as more adolescents observe their peers buying condoms and talking about the importance of condoms, the more their condom use self-efficacy increases. The results of the present study are similar to the results of Abigail et al. (2013) in terms of revealing positive relationship between the variables but differ in terms of the strength of the contribution of vicarious experiences in adolescents' condom use self-efficacy. The current study found that the model predicted adolescents' condom use for 21% whereas Abigail et al. (2013) found a strong relationship in the same areas. The variation can be explained by the difference in some cultural disparities between Tanzania and South Africa with regard to condoms as part of the SRHS as well as the study population that was involved. For example, the values and norms of adolescents from South Africa on condom use are not the same as those of adolescents from Tanzania. Another possible reason might be the level of awareness, sensitization, and transparency about HIV/AIDS in Tanzania and South Africa. South Africa is ahead in terms of transparency and the political will and commitment on the issue of condom use. In South Africa, for instance, the right to sexual and reproductive health is protected in Article 27 of the national constitution, which states that everyone, including adolescents, has the right to access quality reproductive health services including condom use (Beksinska et al., 2013). These high levels of transparency in South Africa, which are advertised in the media, could be more influential with regard to adolescents' condom use in South Africa than those in Tanzania. Thus, values, norms, level of transparency, and political commitment of adolescents' condom use might affect the results of the current study as compared to Abigail et al. (2013).

The results of the current study are also similar to the results that were found from a study conducted by Babalola et al. (2018) in Northern Nigeria on a communication programme on condom use among young women. The study by Babalola revealed an increase of 3–16 percentage points in the likelihood of condom use due to exposure to condom use through messages from TV and radio ads. These results have two

implications. First, adolescents' vicarious experiences through TV/radio ads and peers significantly contribute to adolescents' self-efficacy on condom use. Second, when adolescents observe others similar to them buying condoms, they judge their own capability to buy condoms. The similarities in results between the current study and Oladeji and Ayanganna (2017) can be explained in terms of the similarities in the study population and cultural contexts between the two studies. For example, both studies were conducted on secondary school students in a similar age group (15-21 years) who might share some overall or general beliefs, perceptions, and attitudes about condom use, that reasonably affect their self-efficacy on condom use in similar ways.

On the other hand, the results of the current study, which indicated a significant influence of vicarious experiences on self-efficacy in condom use among adolescents, differed from other studies that did not reveal a significant influence of the same variables. Guilkey and Hutchinson (2011) in Bangladesh found no influence between vicarious experiences and self-efficacy condom use. The inconsistency of results may be interpreted in three ways. First, the differences in methodological approaches used, the present study was based on an exclusive questionnaire administered to students as a data collection tool, while Guilkey and Hutchinson (2011) used both questionnaires and interviews. Thus, in this study, it is probable that some respondents were intentionally misreported as being dishonest to respond to sensitive issues like a condom, which is culturally prohibited at a young age in the Tanzanian context (Mwakatobe, 2007). Second, the difference in study population between the current study and the study by Guilkey and Hutchinson (2011) can be another reason for explaining the inconsistency in findings between the two studies. The current study involved secondary school students aged 15–21, while the study by Guilkey and Hutchinson (2011) involved only women aged 10–49 years. Therefore, age differences might affect the attitudes, knowledge, and experiences on condom use which might also affect their self-efficacy in condom use. Third, in terms of cultural context, Tanzania is a non-secular country in which the adolescents may have a relatively more freedom to discuss issues of condom use with their peers, watch TV/radio ads about condom use, and thus be more likely to earn and enrich their self-efficacy in condom use through vicarious experience compared to their counterparts living in Bangladesh, a secular country. Studies have established that secular countries, including Bangladesh, have some laws and norms that restrict

adolescents' access to information on condom use through radio or TV ads, or models through peer educators' programmes, or adults (Guilkey & Hutchinson, 2011).

The results of the current study also contradict the results of the study conducted in Kyrgyzstan and Tajikistan by Habibov and Zainiddinov (2017) on the effect of radio family planning messages on the probability of condom use in post-Soviet Central Asia. The study found no significant impact of radio family planning messages on the likelihood of condom use in Kyrgyzstan (β=0.06) and Tajikistan (β=0.08). The possible reasons for such differences in findings can be attributed to different contextual factors and study populations. For example, in Central Asia, messages on the radio about condom use are discouraged due to cultural and religious factors compared to the Tanzania context, where adolescents have access to messages from TV/radio ads about condom use, which could be more likely to increase adolescents' self-efficacy in condom use. Other possible reasons may be due to the nature of respondents; for example, the study by Habibov and Zainiddinov (2017) involved only female participants, while the current study involved both boys and girls.

The study also assessed the difference in condom use among the respondents based on their sex and age. Results revealed a statistically significant difference in respondents' condom use, concerning their gender as girl adolescents it revealed higher mean scores in condom use self-efficacy than with boys' adolescents (M=2.36, SD= .69), t=3.299, df=550, *p-value*<.001). This suggests that girl's adolescent is more likely to use condom consistently than their adolescent boys. Interestingly in these results, while girls' information and knowledge about access to and ability to negotiate condom use might have been limited by socio-cultural and gender norms girls, they appear to use than their counterparts.

The results of this study also concur with the study conducted by Abigail et al. (2013) on gender, peer, and partner influences on adolescent HIV risk in rural South Africa involving 983 adolescents aged 14–17 years. The study revealed that girls' peer behaviour related to condom use was associated with condom use self-efficacy at last sex (OR = 1.79, *p* value = 0.01). The girls who associated with friends who were also using condoms were more likely to use them. This indicates that adolescent girls with friends who use condoms are more likely to use condoms than

girls with friends who do not encourage condom use. Likewise, a study conducted in Tanzania by Exavery et al. (2011) on the role of condom negotiation in condom use among women revealed that self-efficacy in condom use is a significant predictor of actual condom use among women in rural Tanzania (OR = 3.13, 95% CI 2.22-4.41). Similar results were found by Taylorukznacza et al. (2017) on the reasons for inconsistent condom use by rural South African and Kenyan high school students. The results revealed that adolescent girls reported higher condom use when they received greater social support from their peers (*p* value =.005) and had more self-efficacy in condom use than adolescent boys. This indicates that adolescent girls are more likely to raise their condom use self-efficacy when they see other girl models exhibit such behaviour but not after seeing a boy adolescent model do so. In this case, gender is the quality that matters substantially in explaining the assumed similarity. The results are also supported by Bandura, who posits that people tend to imitate those who appear most like them; the more a person observes another similar person behaving a certain way, the more likely they are to repeat that behaviour (Bandura, 1986, 1997).

The results also revealed that, the mean scores of condoms use of middle adolescents were statistically significantly higher than the mean score of late adolescents. This indicates that middle adolescents were more likely to use condoms by observing, learning, and imitating their peers and TV/radio ads than late adolescents on condom use. This result could be explained by the fact that adolescents' condom use experiences are more likely to decrease as they get older, implying that as adolescents get older, their attention and curiosity to learn and imitate condom use behaviour from others decreases. It could also imply that as they get older, they assume they know much more about condom use and thus pay less attention to learning and imitating condom use behaviour from peers, and TV/radio advertisements.

CONCLUSION AND RECOMMENDATIONS

The study showed that vicarious experiences predicted adolescents' self-efficacy condom use. Therefore, adolescents' judgments about their perceived ability to use condoms are generally influenced by the observation and imitation of their peers, and the more they watch and listen to radio and television advertisements about condom use, which is in turn associated with the comparison of themselves to others who have similar characteristics and engage in condom use. When adolescents

watch or listen to condom use and HIV test advertisements on television or radio or when observing how peers buy condoms, they believe that they could also use condom in the future. Thus, adolescents' HIV prevention and reproductive health programmes aiming to promote condom use among adolescents should focus on using peer educators' programmes and condom advertising and promotion programmes through TV and radio ads. In addition, the results of this study are expected to inform policy and programs developers, school teachers, social workers, and counsellors on the role of vicarious experiences on adolescents' condom use. The results provide information on how media, peers and adults influence on adolescents' condom use among adolescent in Tanzanian context. Moreover, this study added to the body of existing knowledge on the condom use in Tanzania, specifically on to what extent vicarious experiences influence adolescents' condom use. Lastly, the results of this served as a basis for further research on sources of self-efficacy and adolescents' condom use by adding information and understanding on how vicarious experiences in the Tanzanian context are associated with adolescents' self-efficacy in condom use.

On the other hand, the results revealed that sexual and reproductive health content and advertisements on television and radio about condom use in the form of vicarious experiences provide more information, which increases adolescents' self-efficacy in condom use. More condom use advertisements on television and radio should be given priority, aimed at improving adolescents' condom use self-efficacy. However, radio and television exposure is measured only by the frequency of watching television and listening to the radio, without any information available about programme content. The study recommends that further research should be conducted to determine the types of television and radio programmes that are particularly persuasive and potential for adolescents in relation to condom use. Also, when designing and advertising programmes aimed at improving reproductive health among adolescents, the programmes should include audio visual content in the form of observational learning instead of banners, brochures, and hand-outs.

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Factors affecting ability and willingness of community members to enrol Improved Community Health Fund in Dodoma and Iringa regions

Edward Mbanga
cathef22@gmail.com
Ministry of Health, Ministry of Health
Felician Mutasa
felician.mutasa@out.ac.tz
Deus Ngaruko
deus.ngaruko@out.ac.tz
The Open University of Tanzania
Samwel Kahamba
cathef22@gmail.com
Sokoine University of Agriculture

ABSTRACT
Financial protection has been recognised as an important element within the healthcare financing system of many low and middle-income countries. Pre-payment schemes have been advocated as a means of curbing high out of pocket expenditure and achieving universal health coverage. A number of financing reforms have been taking place, however there is a limited rigorous contextual evidence on the willingness-to-pay (WTP) for the recently Improved Community Health Fund (iCHF) in Tanzania. The study took place in district councils of Dodoma and Iringa regions. Data were collected from a household survey conducted in 2021. Contingent valuation methodology was used to elicit households' the willing to pay (WTP) for iCHF premium using the bidding game technique. In addition, the relationship between WTP and other socio-economic variables was examined using logistic regression models. Majority 88% respondents said they will repay their package after expiry considering the quality of the services provided by health insurance. The results showed a statistically significant negative relationship 0.526 ($p = 0.034$) between household aged above 55 years of age and WTP. More specifically, as age increases above 55 years, the likelihood to pay for health insurance premium decreases. We also found a positive statistically significant relationship 1.882 ($p = 0.034$) between the household with small business and WTP, which suggest the individuals with small business are in a better position to pay for iCHF premium compared to those with formal employment. It is important to

educate the households to raise awareness about the benefits of being a member of insurance scheme in both formal and informal sector. The households should be encouraged to formalize their small business, this will improve their income and enrolment into the insurance schemes. The benefit packages should be revised to fit the need of the people as WTP was also influenced by the nature of the packages.

Keywords: *Insurance, willingness to pay, insurance premium, Tanzania*

INTRODUCTION

Globally, health insurance is considered a promising means for achieving universal health-care coverage (UHC) (WHO, 2010). In particular community-based health insurance schemes are becoming increasingly recognized as a potential strategy to achieve UHC in developing countries. The UHC promotes preventive, curative, and rehabilitative health interventions at an affordable cost to achieve equity in accessing health services. Achieving UHC among other things needs an efficient and equitable financial collection from health insurance members contributing to one pool and using such contributions to provide or purchase health services, and hence the risk of paying for health services once needed is shared by all and not borne by each person in the invent of illness (Paul, *et al*., 2019).

There are various categories of health insurance in Low- and Middle-Income countries including public managed schemes such as National or Social Health insurance (NHIF) and Community Based Health Insurance (CBHI) and Private Health Insurance (PHI) schemes. Enrolment in some of these schemes is mandatory for a specific segment of the population. The PHI is a voluntary insurance mechanism based on individual risk assessment and the CBHI is a voluntary, non-profit health insurance scheme that is organized and managed at the community level (Kigume & Maluka, 2021). The prepaid health financing mechanism is adopted by many countries especially poor countries to counteract the negative effects resulting from the implementation of user fees introduced in the system of health services provision, which leads to inhibition of utilization of health care, particularly for marginalized populations, and sometimes lead to catastrophic health expenditures in turn (Woldemichael, et al., 2019).

Tanzania like any other developing countries, has established different insurance mechanisms to improve health care services among its

population. The NHIF was established in 1999 by the Parliamentary Act, CAP. 395 and started to operate in 2001 as a purchaser of health services for public sector servants paying 6 percent to the Fund; (3 percent of monthly salary deduction from employee and another 3 percent contribution from the employer) remitted to the Fund in advance before utilization of health services from either public or private health facilities (Lee *et al.,* 2018). In 2001, the government also established a Community Health Fund (CHF) by Parliamentary Act, Cap. 409 as a prepaid scheme to be managed in 184 Local Government Authorities (LGAs) to address the social protection challenges, especially in the informal sector, as a result of the introduction of a cost-sharing policy. In implementing the CHF, every LGA had a different annual contribution rate (premium) ranging from TZS 5,000 to TZS 10,000 per household of 6 members (Maluka & Bukagile, 2014). However, in recent years, the CHF has been transformed into an improved CHF (iCHF) by removing some challenges such as immobility of services which persisted in the former CHF with an annual contribution rate being increased and fixed to TZS 30,000 across all LGAs countrywide (Kigume and Maluka, 2021; Kapologwe et al*,* 2017). Despite that user fee policies have contributed towards bridging of resources gap for health facilities to a certain level, and led to some improvements in the delivery of quality services in some settings, it has caused a strong barrier to health care for many poor households that are normally excluded from formal social security systems on the other hand (Watson et al., 2016).

Regardless of of such efforts taken so far, still the government is far from achieving the Universal Health Coverage (UHC) due to a small population that is currently granted with access to health services as only few people are currently under health insurance coverage. To date, out of the country population (57,637,628) (Mwakisisile & Mushi, 2020) only 8 percent is enrolled with NHIF, 5.4 percent is covered under CHF, 0.3 percent covered by SHIB (NSSSF) and 1 percent being enrolled under private health insurance companies (Kibambo, 2021). This leads to the total of 14.7 percent as country coverage. Thus, leaving approximately 85.3 percent of all Tanzania's total population out of health insurance system, implying that the country has still a long way to go in achieving universal health coverage. In this case, more people are likely to face financial barriers and fail to access health services and care when needed.
Available evidence indicates that economic factors are among the factors contributing to the poor enrolment of people into the established health insurance scheme. In this regard, scholars have raised concerns over

people's ability and willingness to pay for the health insurance packages, information, price, and quality (Bolarinwa et al., 2020; Ogundeji *et al*., 2019). However, the studies that have been conducted focusing on Community-Based Health Insurance (CBHI) indicate mixed findings. While some indicate that socio-economic status is positively associated with willingness to pay whereas the rich were found to be more willing to pay for CBHI than the poor (Haile et al., 2014), other studies indicate that the rich in rural areas were significantly less willing to pay for CBHI than the poor (Oriakhi & Onemolease, 2012; Bukola, 2013). Nevertheless, some studies indicate that there is no association between wealth and willingness to join a CBHI program (Eckhardt, et al., 2011) but point out other factors such as education level whereas those who are more educated in the rural areas were less willing to join CBHI scheme than the poor due to low-quality services offered through the schemes.

Previous studies conducted in Tanzania indicate that inadequate benefit packages have been reported to be among the reasons for low enrolment or dropout for members of health insurance (Ajuaye et al., 2019). Household enrolment decision into the health insurance scheme has been reported to be influenced by household social-economic and demographic factors, health insurance knowledge and its benefit in accessing healthcare services, individual willingness and ability to pay for annual premium amounts set by the respective insurance schemes (Macha et al., 2014). In different settings, factors such as the design of the schemes and accountability-management issues, annual premium rates, methods of premium collection, and benefits packages, have been reported to affect household enrolment to the schemes (Mladovsky et al., 2015).

Low membership enrolment and retention into the schemes have been linked to the voluntary nature of the community health insurance schemes (Kigume & Maluka, 2021). The government of Tanzania is planning to go for mandatory health insurance after revising some of the bottlenecks (such as portability of the services, enrolment points, provider-purchaser relationship) associated with the previous community health fund. Failure to enrol in healthcare insurance in developing countries is contributed by two basic aspects of poverty as pointed out by Sachs (2012). Firstly, in the low-income economy, many households do not have the means to pay for annual insurance premium, and secondly, the governments in these countries often lack adequate domestic budget revenues to ensure universal access to a basic package of health services for the poor even if the government is willing to guarantee universal access to health care.

Macha et al., (2014) conducted a study to assess the determinants of community health fund membership in Tanzania by using mixed methods analysis found that the three middle income quintiles were more likely to enrol in the CHF than the poorest and the richest. The poor rather than the poorest were more likely to join as were large families and of greater risk of illness, with disabilities or persons with chronic diseases. It was also revealed that households with elderly members or children under-five years were also more likely to enrol. In addition, poor understanding of risk pooling discouraged people from joining or renewing the scheme; and poor quality of public care services, the limited benefit package and a lack of provider choice were the main factors for low enrolment.

In Tanzania only one study has assessed community willingness and ability to pay for insurance premiums in Tanzania (Kuwawenaruwa et al., 2011). The authors used a cross-sectional household survey of 2008 and found that few households were willing and able to pay higher premium rates even with the expanded benefits package for the previous (old) community health fund in Tanzania. However, there is no up-to-date study that has assessed willingness and ability to pay for the current improved community health insurance fund in Tanzania.

METHODS

The study area

The study was conducted in Bahi, Dodoma Municipal and Mpwapwa in Dodoma region and Iringa Municipal, Kilolo and Mufindi from Iringa region in 2021. The health insurance coverage informed the selection of the two regions (Dodoma and Iringa). Dodoma region had the highest iCHF insurance coverage of 4 percent while Iringa region had the lowest iCHF coverage of about 1 percent (URT, 2021). The iCHF had been implemented in Dodoma region since 2013 while the other region started implementing iCHF in 2018.

Study design

This was a cross-section study in which a structured questionnaire was deployed to capture information on households' demographic characteristics, household iCHF membership, willingness to pay (WTP) for iCHF and household ownership of assets. Qualitative research methods were employed to capture in-depth information from iCHF beneficiaries and key informants regarding the factors influencing community members' ability and willingness to pay for iCHF.

Study population

The study population consisted of health insurance scheme beneficiaries, non-beneficiaries, health service providers, district and regional level healthcare managers. Inclusion criteria was that, any insurance member who had been enrolled in the scheme for not less than six months, household head/assistant and aged 18 and above. While for non-health insurance beneficiaries we included any household head/assistant and aged 18 and above. All who met inclusion criteria and consented to participated were included.

Sampling

This study was conducted alongside a bigger study undertaken by the Ministry of Health which specifically looked at knowledge, attitude and practices of beneficiaries, non-beneficiaries and healthcare providers on the existing insurance schemes; and factors affecting the community choice for a defined health insurance package. A multistage cluster sampling was adopted through selection of regions, districts and wards. Furthermore, a total of 10 regions were selected randomly across the geographical zones in the country (Dodoma, Dar es Salaam, Kagera, Mwanza, Kilimanjaro, Mbeya, Iringa, Ruvuma, Mtwara and Tabora). In each region three districts were also selected randomly making a total of 30 district councils (Bahi, Dodoma, Mpwapwa DC, Kigamboni MC, Ubungo MC, Kinondoni MC, Biharamulo DC, Bukoba, Karagwe DC, Ilemela DC, Magu DC, Misungwi DC, Moshi DC, Moshi MC, Rombo DC, Mbarali DC, Mbeya CC, Kyela DC, Iringa MC, Kilolo DC, Mufindi DC, Songea MC, Mbinga DC, Songea DC, Mtwara MC, Nanyumbu DC, Masasi DC, Tabora MC, Uyui DC, Nzega DC). A multistage cluster sampling approach was further used to select the wards included in the study. At the ward level a roster of all the household was obtained from the leaders, and those with and without insurance were identified. Thereafter, a random selection of the households was done and invited to take part in the study. Sample size was calculated to ensure large and enough representation of the beneficiaries. Estimated proportion of respondent with ability to pay 3,940.23 Tanzanian shilling per month to cover health insurance which was 65%; Z=1.96; value of standard normal distribution at 95% confidence level and a margin of error “e” = 2.54%; design effect of 2.0; and a non-response rate of 20%. The above statistical parameters were opted based on a factor of available resources as per recommendation in the document titled “Practical Issues in Calculating the Sample Size for Prevalence Studies” (Ogundeji, Akomolafe, Ohiri, and Butawa 2019). With the above statistical parameters, a sample size of

3,570 (n=625 beneficiaries and 2,945 non-beneficiaries) (URT, 2021). In this particular analysis, two regions (Dodoma and Iringa) were purposively selected based on iCHF enrolment. A sub-sample of 118 beneficiaries and 538 non-beneficiaries was drawn and used for analysis of the research objective in this study (Table 2).

Data collection and management

A structured questionnaire was used to collect primary data. Among the variables collected using these tools included information for assessing household social economic status (SES), knowledge on, attitude and practices towards health insurance scheme and social-demographic characteristics. The questionnaire captured information on beneficiaries and non-beneficiaries' demographic characteristics, accessibility to health services; health-seeking behaviour, household ownership of various assets and practices towards health insurance scheme. The tools were programmed into, and administered using, Android tablets using Open Data Kit (ODK). Data were stored on password-protected laptops, with restricted access to questionnaires and data by researcher only. Systematic routines were developed to check for data entry discrepancies, range, and consistency. All discrepancies were resolved by reference to the original checked data collection forms. Interview guides that were developed in English and then translated into Kiswahili were used to capture qualitative information from the iCHF beneficiaries and key informants (healthcare providers, district and regional level healthcare managers) to triangulate with the quantitative information collected. All interviews were recorded.

Data analysis

Descriptive statistics

To assess the ability to pay the households' expenditure-income ratio approach was used to estimate the ability of the respondent to pay the iCHF amount willingly We utilized a 5-10 percent health expenditure-income ratio based on evidence from developing countries considering impoverishment effects due to out-of-pocket payments when accessing healthcare services. Furthermore, a bivariate analysis (the t-test and chi-square test of association) was done to assess the level of association between the ability to pay and willingness to pay amounts. Statistical significance was examined using Pearson chi-square (for binary or categorical variables) and the Mann-Whitney U test for continuous variables.

Empirical strategy

In this study, health care access and utilization is defined as binary (1= if a household accessed healthcare services for the past three months before the survey, 0 if otherwise). Theoretical model presented in equation 1 below.

$$Y(1/0) = \alpha + \beta_{ij}X_{ij} + \cdots\cdots\cdots\cdots\cdots + e \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

A logistic model was used to assess the community's willingness and ability to pay for iCHF. Equation: empirical Model of willingness to pay for Health insurance (Model 2, 3):

$$WTP = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \beta_n X_n + \mu \ldots. (2)$$

$$WTP = \alpha + \beta_1 Age + \beta_2 Satisfaction + \beta_4 income + \cdots\cdots\cdots\cdots\cdots + \beta_n X_n + \mu \ldots. (3)$$

the dependant variable for the logit model will be binary (1= willing to pay for health insurance, 0= not willing) while α, will be the intercept; β, are coefficients of explanatory variables X (such as age, satisfaction with health insurance, household income etc); and u is the error term. computation of marginal effects on logit models will be undertaken (See Annex 3, possible exogenous variable and endogenous variables).

Qualitative data analysis

Qualitative data was analyzed using content analysis. All audio recorded in-depth interviews were transcribed within 48 hours of the interview to allow a follow-up of any issues arising from the previous interviews. The data was coded using Nvivo 12 QSR International software. Then themes and categories depending on the research questions were drawn from the dataset. The patterns from the data helped in identifying unique quotes, compiling the data and summarizing them according to the research questions. The results are presented in the narratives, descriptive and explanatory forms.

Consent and ethical approval

The permission to undertake the study was obtained from the National Institute for Medical Research (NIMR) reference number NIMR/HQ/R.8a/Vol.IX/3653. The proposal was submitted to the ethics committee of the Open University of Tanzania. Informed consents were obtained from all respondents of this study. All data have been treated as confidential and presented only in aggregate form or anonymised. No personal identifying details of any participant linked with the information provided by them.

RESULTS

Demographic and socio-economic characteristics

Table 1 presents information on the demographic and socio-economic characteristics of the study respondents in the two regions. Thirty-seven (37) percent of the respondents were aged between 26-35 years of age, followed by 36 – 45 years (27%). The most (52%) of respondent had attained primary education, 18% had not attended any formal school, while 14% reported to have attended secondary school. The most (35%) of respondents had no formal employment, 27% were doing self-businesses and 25% were farmers. Most respondents 381 (58%) reported to be married, and the proportion was high in Mpwapwa (74%) followed by those from Mufindi (63%). About 32% of respondents were categorised as poorest in the study districts. Majority (77%) of those classified as poorest were from Mpwapwa district. Only 6% respondents were classified as non-poor from Mufindi district (Table 1).

Table 1: Demographic and socio-economic characteristics of the respondents included in the analysis

Variable	Bahi	Dodoma City	Mpwapwa	Iringa MC	Kilolo	Mufindi	Total
	n=109	n=103	n=110	n=109	n=118	n=107	N(656)
Gender of head of respondents, **	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Male	59(54.1)	38(36.9)	67(60.9)	49(44.9)	52(44.1)	62(57.9)	327(49.8)
Female	50(45.9)	65(63.1)	43(39.1)	60(55.1)	66(55.9)	45(42.1)	329(50.2)
Age Categories of respondents							
< = 25, **	13(11.9)	25(24.2)	20(18.2)	12(11.0)	10(8.5)	12(11.2)	92(14.0)
26 – 35	38(34.8)	35(33.9)	39(35.5)	39(35.8)	47(39.8)	42(39.3)	240(36.6)
36 – 45	30(27.5)	21(20.4)	28(25.5)	34(31.2)	34(28.8)	29(27.1)	176(26.8)
46 – 64	23(21.1)	20(19.4)	20(18.2)	20(18.4)	22(18.6)	24(22.4)	129(19.7)
> =65	5(4.6)	2(1.9)	3(2.7)	4(2.7)	5(4.2)	0(0.0)	19(2.9)
Mean (years)[sd]	38.9[12.1]	35.8[12.0]	36.6[12.9]	38.2[11.9]	38.3[12.3]	37.3[10.2]	37.5[11.9]
Education Level of head of respondents							
No education, ***	29(26.6)	14(13.6)	40(36.4)	13(11.9)	15(12.7)	5(4.7)	116(17.7)
Primary, **	53(48.6)	41(39.8)	50(45.4)	56(51.4)	66(55.9)	77(71.9)	343(52.3)
Secondary, **	14(12.8)	24(23.3)	7(6.4)	18(16.5)	17(14.4)	12(11.2)	92(14.0)
Above secondary	13(11.9)	24(23.3)	13(11.8)	22(20.2)	20(16.9)	13(12.2)	105(16.0)
Occupation of head of respondents							
Formal employed	9(8.3)	21(20.4)	10(9.1)	18(16.5)	15(12.7)	11(10.3)	84(12.8)
Self-Business, **	20(18.4)	44(42.7)	7(6.4)	42(38.5)	38(32.2)	24(22.4)	175(26.7)
Farmer, **	33(30.3)	5(4.8)	69(62.7)	7(6.4)	20(16.9)	30(28.0)	164(25.0)
Not employed	47(43.1)	33(32.0)	24(21.8)	42(38.5)	45(38.1)	42(39.3)	233(35.5)

Variable	Bahi	Dodoma City	Mpwapwa	Iringa MC	Kilolo	Mufindi	Total
Marital status, **							
Married	65(59.6)	50(48.5)	81(73.6)	61(55.9)	57(48.3)	67(62.6)	381(58.1)
Not married	44(40.4)	53(51.5)	29(26.4)	48(44.1)	61(51.7)	40(37.4)	275(41.9)
Number of people in the respondents							
<=2	28(25.7)	38(36.9)	32(29.1)	30(27.5)	37(31.4)	27(25.2)	192(29.3)
3 – 4	41(38.5)	39(37.8)	39(35.4)	38(34.8)	35(29.7)	37(34.6)	230(35.1)
5 – 6	26(23.8)	17(16.5)	28(25.5)	28(25.7)	33(27.9)	34(31.7)	166(25.3)
>=7	13(11.9)	9(8.7)	11(10.0)	13(11.9)	13(11.0)	9(8.4)	68(10.4)
Average House Hold size [SD]	4[2.3]	3[2.4]	4[2.1]	4[2.1]	4[2.1]	4[1.9]	4[2.1]
CHF Insurance Status							
CHF insured	21(19.3)	22(21.4)	20(18.2)	19(17.4)	17(14.4)	19(17.8)	118(18.0)
Not insured	88(80.7)	81(78.6)	90(81.8)	90(82.6)	101(85.6)	88(82.2)	538(82.0)
Social Economic Status							
S1 (Poorest) , **	53(48.6)	12(11.6)	85(77.3)	4(3.7)	22(18.6)	36(33.6)	212(32.3)
S2, **	20(18.4)	13(12.6)	7(6.4)	18(16.5)	29(24.6)	41(38.3)	128(19.5)
S3, **	9(8.3)	16(15.5)	0(0.0)	18(16.5)	34(28.8)	12(11.2)	89(13.6)
S4, ***	16(14.7)	30(29.1)	4(3.6)	43(39.4)	23(19.5)	12(11.2)	128(13.6)
S5 (Non-poor), ***	11(10.1)	32(31.1)	14(12.7)	26(23.8)	10(8.5)	6(5.6)	99(15.1)

Note: *** denotes significance at 1%, ** at 5%, and * at 10% level

Ability and willingness of community members to enroll in iCHF

As shown in Table 2, majority (88%) respondents said they would repay their package after expiry considering the quality of the services provided by health insurance. Specifically, issues that are considered for renewal of the package included: health insurance package is relatively cheap (39%); full-time access to services (32%); reputation of health insurance plan (17%); and easy access to connected hospitals (6%). On the other hand, for those who didn't renew their insurance pointed out issues like, drug unavailability (14%); not satisfied with the services provided (14%) and not given answers to their complaints (7%) as the reasons for not renewing their premiums.

Table 2: Readiness to either re-enrol and not re-enrol among beneficiaries

Variable	n(%)
Considering the quality of the services provided by your health insurance, when the bundle ends up will you pay for it again	
Yes	104(88.1)
No	14(11.9)
Reasons to repay your package (n=104)	
Health insurance package is relatively cheap	41(39.4)
Reputation of health insurance plan	18(17.3)
Services available in package	33(31.7)
Choice of doctors, health facilities and other online service providers available because of a contract in the insurance scheme.	4(3.8)
Full-time access to services	25(24.0)
Access to services to me or to my family members even when I don't have money.	13(12.5)
Easy access to connected hospitals	6(5.8)
Reasons for not repaying your health insurance package (n=14)	
Unsatisfactory language of Health Insurance providers	1(7.1)
Unsatisfactory language of Healthcare providers	2(14.3)
They are not given answers to their complaints.	4(28.6)
Drug unavailability.	2(14.3)
Low Family Income	1(7.1)

Table 3 summarizes various sources of information of health insurance among beneficiaries and ex-beneficiaries. Most (52%) respondents received information from their employers. Other sources which were accessed by at least 15% of respondents included mass media channels such as magazine, radio and television; insurance agency or company; family or friends and; health facility, doctor's office, or clinic. The

majority (73.7%) of respondents reported that the sources of information on access to health insurance plans were helpful to them. Magazine, radio, or television were mentioned by the most (62%) of respondents as a recommended common source of information for health insurance to be used in the future. Other recommended sources include website, insurance agency or company; family or friends; employer; health centre, doctor's office, or clinic; public library, school, or community centre and; social networks.

Table 3: Source of information for health insurance

Variable	N=118
Sources of information about the insurance you signed up for	**n (%)**
Website	2(1.2)
Magazine, radio, or television	15(12.7)
Insurance agency or company	13(11.0)
Family or friends	22(18.6)
Employer	61(51.9)
Health facility, doctor's office, or clinic	22(18.6)
Religious or social group	8(6.8)
Public library, school, or community centre	6(5.1)
Social networks	3(2.5)
Usefulness of the sources of the information	
It Helped	87(73.7)
It helped a lot	21(17.8)
They did not help	8(6.8)
They weren't very helpful	6(5.1)
Sources of information for health insurance you can use or try to use in the future	
Website	22(18.6)
Magazine, radio, or television	73(61.9)
Insurance agency or company	43(36.4)
Family or friends	16(13.5)
Employer	31(26.3)
Health centre, doctor's office, or clinic	49(41.5)
Religious or social group	16(13.6)
Public library, school, or community centre	9(7.6)
Social networks	41(34.7)

As shown in Figure 1, majority of respondents (76%) believe that cash is the best way to pay for Health Insurance, and their opinion didn't differ between beneficiaries and non-beneficiaries. About a third of respondents (33%) recommended cash crops and 28% thought food products are the

best ways to pay for Health Insurance so that every Tanzanian can get health insurance.

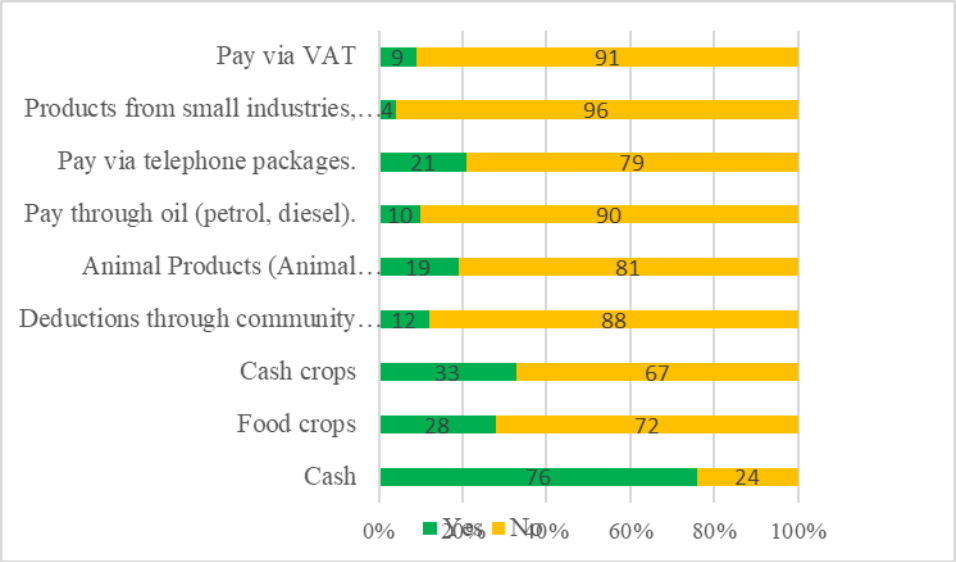

Figure 1: The best ways to pay for health insurance

Similar to questionnaire responses, qualitative interviews further examined possible ways for payment for insurance. The findings largely mirror quantitative findings however some differences were noted. While participants pay for insurance through salary deductions for public employees, individual cash payment from business or selling crops and animals, sponsorship by banks, cooperative unions and development partners, through qualitative interviews participants proposed a range of possible payment modalities to finance health insurance. First, payment through associations, for example, cooperative unions for farmers. For example, one participant commented, *"Payment through cooperative unions is a good one and it is very helpful"*. In support, the iCHF coordinator cited payment for other groups insurance, for instance, through drivers' unions for a group of more than 100 people although the requirement may be a challenge to some. This did not strongly emerge in quantitative inquiry. Secondly, cash payment through instalment system was proposed. In support of cash instalment, a participant in Dodoma commented:

> *"The best way to pay for insurance is to ensure that clients pay by instalment until the amount required to pay is reached. There could be arrangements with banks for free account where a person may be*

depositing may be 2,000/- every week until it reaches the amount required by the insurance fund".

Another respondent added:

"It would have been good if they allow small instalments. It would have been easy to manage 192,000/= instead of single payment which is a challenge considering people's income".

Third, selling livestock and crops. In addition to payment through cooperative unions, some respondents suggested direct payment by selling animals, commercial crops and food crops to cover the cost, although an emphasis was placed on the need to first educate them on the meaning and importance of insurance. For example, this was commented by a participant:

"Someone may sell groundnuts and keep 5,000/= or maize, chicken until the money reaches 30,000/= then s/he calls the enrolment officer for enrolment…this is called butter system and it is very good. It would have been nice if there was coordination between iCHF, people and potential market (buyers) …"

Fourth, payment through tax recovery from services such as petrol, phone and utilities. Tax recovery from petrol was driven by the notion that car owners have money (non-beneficiary), however, this may point to exploitation of car owners to benefit people with no cars. The preference of tax recovery from phone services was envisaged because of wider ownership even by non-beneficiaries. For example, a coordinator suggested:

"Almost every household in the community uses a mobile and in some more than one member has and uses a mobile phone every day. So, there is a huge potential for the iCHF to mobilize substantial resources from mobile phone users to cover for members' premium contributions. Mobile phone use has these days become as a basic need as people are so attached to phones to the extent that they almost cannot do without them. Mobile phone use is an opportunity to mobilize additional resources to strengthen iCHF financial base."

"when we buy phone vouchers there could be a particular VAT deducted. Also, I think it will be good if they can deduct from social services such as water, electricity and petrol".

A few participants were against cost recovery from mobile phones citing the high cost of phone services including airtime bundles; and the recovery of funds to finance insurance through mobile services would add

to the burden people are already experiencing. Furthermore, cost subsidization by the government for social groups that cannot pay for themselves such as under-five children, pregnant women and elderly.

Low family income was mentioned by 56% of respondents as the reason for individuals not willing to join health insurance schemes. Other common reasons included drug absence, no full understanding of health insurance funds and not satisfied with the services provided (Table 3).

Table 3: Reasons for not being willing to join health insurance scheme

Variable	Beneficiaries, (%)	Non-Beneficiaries, n(%)	Total, n(%)
Poor health insurance providers' language	14(11.8) *	28(5.2)	42(6.4)
Poor language from health care providers	11(9.3)	50(9.3)	61(9.3)
They are not given a response to their complaints.	19(16.1) *	59(10.9)	78(11.9)
Drug absence.	53(44.9)	272(50.6)	325(49.5)
They take long time before they get services. (maturity)	7(5.9)	26(4.8)	33(5.0)
Low Family Income	59(50.0)	307(57.1)	366(55.8)
The money to contribute for health Insurance funds to the year is too high.	11(9.3)	66(12.3)	77(11.7)
Cash payments are cheaper than paying for Health Insurance Funds.	3(2.5)	8(1.5)	11(1.6)
They have no full understanding of health insurance funds	64(54.2) ***	221(41.1)	285(43.5)
CHF/ iCHF does not have services to refer patients.	4(3.4) *	28(5.2)	32(4.9)
Some health insurance coverage cannot be used in other regions/districts	3(2.5)	31(5.7)	34(5.2)
Some health insurance coverage cannot be used in private health facilities	8(6.7) ***	33(6.1)	41(6.2)
Some health insurance coverage has not linked to pharmacist or ADDOs	4(3.4)	21(3.9)	25(3.8)
They are not satisfied with the Services provided.	27(22.9) ***	109(20.3)	136(20.7)
Peer pressure	1(1.0)	16(2.9)	17(2.6)

**P-value<0.05, **P-value<0.01 & ***P<0.001*

Effects of socio-economic status on the willingness and ability to pay

As shown in Table 5, overall, more (52.8%) non-beneficiary respondents with lowest socioeconomic status were willing to pay TZS 30,000 or 150,000 for a household with up to 6 members to cover iCHF than those (47.2%) of the same socio-economic status who were not willing to pay same amount. Further the statistics indicate that non-beneficiary respondents with lowest economic status who are willing either to pay or not to pay are more than others who belong to other categories.

Table 5: Association between SES and willingness to join iCHF

Health Insurance Package	Socio-economic status	Non – Beneficiaries	
		Willing, n (%)	Not willing, n (%)
Wiling to Join iCHF scheme	Lowest	93(52.8)	83(47.2)
	Second	42(44.2)	53(55.8)
	Middle	25(43.7)	32(56.1)
	Fourth	31(60.8)	20(39.2)
	Highest	8(30.8)	18(69.2)

Pearson chi2(4) = 8.8019 Pr = 0.066

Logistic regression on WTP

Table 5 shows the relationship between the WTP for iCHF and independent variables which were included within the logistic regression model. The results show a statistically significant negative relationship 0.526 (p = 0.034) between household aged above 55 years of age and WTP. More specifically, as age increases above 55 years, the likelihood to pay for health insurance premium decreases. We also found a positive statistically significant relationship 1.882 (p = 0.034) between the household with small business and WTP.

Table 5: Multivariate logistic regression on the WTP

Variable Odds Ratio (Confidence interval)	Univariate Analysis (656)		Multivariate Analysis (656)	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age of Respondents,				
Below 35	Reference			
35 – 44	0.913	0.625	0.937	0.749
45 – 54	1.356	0.187	1.200	0.457
Above 55	0.556	0.039	0.526	0.034
Respondents head being male	0.710	0.029		
Respondents head being married,	0.863	0.351		
Level of respondents' education				
None	Reference			
Primary	1.031	0.888		
Secondary	1.268	0.398		
college	0.728	0.240		
Respondents employment status				
Formal	Reference			
Small business	2.149	0.005	1.882	0.034
Farmer	1.181	0.540	1.199	0.584
Not employed	1.368	0.222	1.257	0.420
Household size				
Less than 3	Reference			
3-4	0.993	0.972	1.015	0.940
Above 4	1.081	0.689	1.082	0.710
Household with chronic illness	1.499	0.114	1.590	0.088
Wealth index value (proxy of income)				
S1 (Poor)	Reference			
S2, **	1.269	0.288	1.121	0.628
S3, ***	1.812	0.021	1.573	0.099
S4	1.534	0.058	1.461	0.137
S5 (Non-poor), ***	0.825	0.434	0.853	0.592
Constant				
Number of observations				656
Wald chi2(11)				27.69
Prob > chi2				0.010
Pseudo R2				0.031

Note, **P-value<0.05, **P-value<0.01 & ***P<0.001* (corresponds to the multivariate results)

Suggestions for improving health services through insurance

Unlike quantitative inquiry, participants of qualitative inquiry offered some suggestions for improving services through insurance schemes. First, improving healthcare service quality. For example, a coordinator commented:

> *"The most important thing is to improve healthcare services first…health care workers need to work in a comfortable environment and ensure there is a good relationship with the client".*

Service improvement was further envisaged through increasing availability of medications, medical supplies, medical investigations and improving client-provider relationships. One participant suggested a need to have someone stationed in all healthcare facilities to ensure that services offered by providers matches client's entitlement. However, such a move may have additional financial implications to insurance schemes. Second, strengthening collaboration and good communication between insurance schemes and service providers by improving the payment system and more involvement in solving claim related challenges. For example, the participant suggested*:*

> *"There is a need to improve the payment system by introducing a more transparent mechanism for example availing up to date price lists of drugs and other services to health facilities so that they can claim exact payments according to the actual services provided. Also, there is a need for more involvement of health facility workers in solving matters related to insurance claims".*

Collaboration and communication were further envisaged through joint meetings and forums between insurance scheme, service providers and sometime with beneficiaries. A facility in charge commented:

> *"We need good communication between health insurance schemes and healthcare facilities…there is a need for frequent meetings…. creating a tendency of meeting between healthcare workers and insurance leaders after few months to discuss contributors of deductions…I think this will erase the existing misunderstandings".*

Communication was further envisaged through healthcare providers building a tendency of sharing information to insurance schemes on the challenges encountered timely (Coordinator). Third, a need to eliminate 'business' approach to services in healthcare facilities to fuel equal treatment of clients. As one participant suggested*,*

> *"The government should eliminate the business-like approach in healthcare facilities (e.g. prioritization of cash clients) so that people receive the care they deserve".*

Improving system network in healthcare facilities. Concerns of internet network emerged as impacting verification of clients before and after offering care. A coordinator commented*:*

> *They need to improve the network because there are times when the network is down and the healthcare worker cannot offer services because the form takes too long to populate information and even the internet bundle becomes finished quickly since the network is down...that is a big challenge".*

In the case of improving service package, one participant commented:

> *"They need to improve their packages to add more services so that when the beneficiary has insurance it becomes easy to access many services in hospitals".*

DISCUSSION

The present study was the first of its kind to assess the community members' willingness and ability to pay for health insurance and its associated factors impending enrolment in Tanzania. Regarding readiness to join an insurance scheme, the findings indicate that the majority of participants (over 70-percent) appears to be ready to join health insurance. The drivers of willingness to join identified in the present study include the perception of affordability (a third of participants), ensured access to services all the time and access to services regardless of financial difficulties. Similarly, to our findings on affordability in Ethiopia premiums for insurance bids was found to influence household WTP (Negera and Abdisa, 2022). On the contrary, unaffordability of insurance, insufficient information and inadequate services were identified as the reasons for unwillingness to join. This may explain why the findings indicated that some participants required services to be improved, adequate information to be provided and affordability as are among the pre-requisites to join insurance schemes. As noted above, these issues have been widely documented as impacting uptake of insurance services in previous studies (Fadlallah et al 2018; Fenny et al 2016), requiring attention more broadly. Furthermore, WTP for health insurance is closely linked to the household income, which could be from paid employment or business (Ahmed *et al*., 2016).

This implies that efforts to universalize health insurance requires massive improvements in quality of services as well as having customized packages for rural dwellers and people of low income to attract potential members. Our findings are slightly similar to the findings of recent studies elsewhere (Ogundeji et al., 2019; Miti et al., 2020). For instance, a study conducted in Nigeria reported a willingness to pay 1.68 US per month per person with rural- urban variations making an approximate amount of 45,000/= per person per year (Ogundeji et al., 2019). All these amounts in Nigeria and Ghana are within the range cited by the participants of our study, indicating that our findings on willingness to pay may not be different from other African countries (Miti et al., 2020).

These findings further suggest that although the majority of participants demonstrate high willingness to pay, less than half are able to pay the proposed CHF/ iCHF and almost equal numbers of those who demonstrate willingness to pay are able to pay the proposed amount for UHC. Similar to willingness to pay, economic hardship (low income) was the most important issue that drove inability to pay higher amounts as well as informal occupation and less education. Some of these issues such as rural-urban variations, income and illiteracy are frequently cited as determinants of unwillingness to pay in previous studies (Al-Hanawi *et al*., 2018; Miti *et al*., 2020; Ogundeji et al., 2019). This suggests that a consideration of different premiums across residence (urban and rural), income (high and lower), education (educated and illiterate) and/or massive community sensitization may be needed for an inclusive UHC.

Health insurers, policy makers, beneficiaries and non-beneficiaries offered insights on how to improve the design and implementation of UHC. First, most recognized the challenges of existing insurance schemes including patient/community challenges such as inadequate awareness or understanding about insurance including a tendency of some clients to question whether their money will be refunded if they do not get sick during the cover period, poor understanding of insurance packages, seeking care without an insurance card due to forgetfulness or misplacement, a tendency of patients to dictate medical treatment they want to receive, buying insurance during sickness and wanting to receive care immediately against insurance guidelines, a tendency of shopping around facilities or doctors on the same day of receiving care and residence in hard to reach villages). Other challenges are related to the facility including poor quality of services characterized by unavailability

of medications, medical supplies and investigations, long waiting time, bad providers' language, prioritization of cash clients over insurance members, prolonged process of care, a necessity for referral letter in tertiary facilities, the need for approval for some services, non-preference of iCHF in some facilities, missing some services with small insurance (iCHF) and not accepting CHF/ iCHF insurance at tertiary levels, and long distance to the facility for some members and network issue.

More challenges that were pointed out are related to insurance scheme, which include package design problems such as categorization of members within public health insurance scheme and limitations of services and medications based on levels of healthcare facility not level of medical expertise. On top of that, enrolment challenges such as unfriendly infrastructure and geography to reach potential members in some districts; inadequate awareness among potential members (on the concept of insurance and packages); requirement for certain number of people for group insurance, and concerns of poor quality of care discouraging non-beneficiaries to join and contributing to defaulting, dissatisfaction with the duration of cover, network problems, delays in card processing and insurance maturity and delays in generation of control numbers for payment). As noted above, these challenges have been widely documented as impacting willingness to pay (Al-Hanawi *et al*., 2018; Miti *et al*., 2020; Ogundeji et al., 2019) and therefore uptake and implementation of health insurance schemes (Fadlallah et al 2018; Fenny et al 2016) in many countries.

The findings indicate that various factors such as low family income, inadequate knowledge on health Insurance funds were associated with individuals not joining health insurance funds. The overall mean household and individual capita income per day were respectively 19,362.15 and 6,248.59 Tanzanian shillings. Nearly three quarters of respondents expressed their readiness to join health insurance. However, too high cost or inability to afford insurance was a concern for about half of respondents and this was reflected in their willingness to pay, only 24% to 68% were willing to pay the four proposed insurance packages. Similarly, 41% to 65% of respondents indicated their ability to pay for various health packages. The ability to pay didn't differ between beneficiaries and non-beneficiaries. However, lowest level of socio-economic status, informal occupation, no schooling were the most common factors associated with not willing to pay and also ability to pay

for various UHCI packages. Therefore, there is a need to design segmented insurance packages that consider residence (rural-urban) and income groups; however, such a move should ensure equitable access to basic healthcare services to all groups in order to minimize dissatisfactions. Most insurance beneficiaries and non-beneficiaries considered the premiums expensive because of variations in income and dissatisfaction with services. There is a need to design insurance packages that consider income groups; however, such a move should ensure equitable access to basic healthcare services to minimize dissatisfactions. The findings suggest that non-beneficiaries are willing to join an insurance scheme with some willing to pay any amount. However, the prerequisites for joining/paying for insurance were sufficient education, assurance of access to medications and good services, reducing the insurance premiums and payment by instalments. We therefore suggest continued service improvement efforts as a key entry point to attracting new members. However, customized packages of less cover duration (say 3 or 6 months) may be a consideration to cater for clients desiring to pay by instalments.

CONCLUSION

Our findings show that the majority of community respondents and health service providers had inadequate knowledge, unfavourable perception and poor practice towards health insurance schemes. The households should be encouraged to formalize their small business, this will improve their income and enrolment into the insurance schemes. Based on the above evidence, we recommend that the benefit packages should be revised to fit the need of the people. Reimbursements to the facilities should be used to improve the quality of service including purchase of healthcare commodities.

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Estimation of Persistent Organic Pollutants releases and emission levels from Healthcare Waste in Mwananyamala and Temeke Regional Hospitals in Tanzania

Josephat Alexander Saria
josephat.saria@out.ac.tz
The Open University of Tanzania

ABSTRACT
This study estimated the amount of polychlorinated dibenzodioxin (PCDDs) and polychlorinated dibenzofurans (PCDFs) from healthcare wastes generated in Mwananyamala and Temeke regional hospitals located in Dar es Salaam using Standardized Toolkit for sources of persistent organic pollutant (POPs) developed by UNEP. Healthcare wastes were collected in different categories and measured for fourteen (14) consecutive days. By using a weighing scale machine, the assessment of the healthcare waste generation rate in each hospital was measured. The average amount of healthcare wastes were 67.12 Tons/year and 105.34 Tons/year at Mwananyamala and Temeke hospitals respectively. The recommended tolerable daily intake (TDI) of dioxin/furans for an adult is 1.75 x 10-10 g I-TEQ/day. The value obtained in this study (2.38 x 10-4 g 1-TEQ/day) at Mwananyamala hospital and 3.62 x 10-4 g 1-TEQ/day at Temeke is about 1.36 x 106 and 2.07 x 106 times higher than the recommended value for adults respectively. It is hereby recommended the emission of dioxin/furan from hospitals must be controlled and if possible, reduced to below the recommended limit. More detailed studies and the permanent monitoring of air quality around different healthcare facilities would be appropriate.

Keywords: *Dioxin, healthcare waste, health risks, furans, infectious, incinerator*

INTRODUCTION

Dioxins and furans are common names for toxic chemicals that are found in very small amounts in the environment, including air, water and soil. As a result of their presence in the environment, they are also present in some foods. There are 210 different dioxins and furans. All dioxins have the same basic chemical skeleton, and they all have chlorine atoms as part of their make-up. Furans are similar, but have a different skeleton.

The name dioxins are often used for the family of structurally and chemically related *polychlorinated dibenzoparadioxins (PCDDs)* and *polychlorinateddibenzofurans (PCDFs)*. Certain dioxin like polychlorinated biphenyls (PCBs) with similar toxic properties are also included under the term dioxins (Figure 1 and 2). These polychlorinated biphenyls (PCBs) are industrial made organic compound with the general formula $C_{12}H10_{-x}Cl_x$.

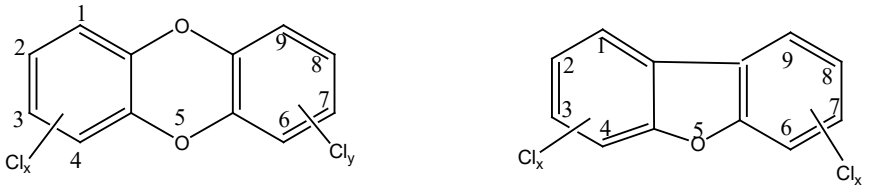

Fig. 1 General Structures of PCDDs (left) and PCDFs (right)

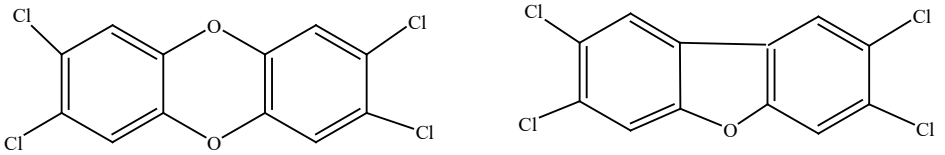

Fig. 2: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (left) and 2,3,7,8-tetrachlorobenzofuran (right)

Among these PCBs, the compound 2,3,7,8-Tetrachlorodibenzo-p-dioxin referred as dioxin is the most toxic synthetic compound known (Harnly *et al.,* 2000) and chlorinated dibenzofurans (PCDF) which is tricyclic ethers having up to eight chlorine atoms attached at carbon atoms 1 to 4 and 6 to 9 (Fiedler, 1998). These chemical compounds may be created during burning of forests or household trash; medical waste, chlorine bleaching of pulp and paper; or manufacturing or processing of certain types of chemicals, such as pesticides (Zhang, *et al.,* 2015).

There has been great concern about dioxins-polychlorinated dibenzo dioxins (PCDDs), polychlorinated dibenzo furans (PCDFs), and polychlorinated biphenyls (PCBs) causing contamination in the environment because the adverse effects of these chemicals on human health have been known for many years (Shibamoto *et al.,* 2007). According to ATSDR (1998), it has been estimated that about 40% of 2,3,7,8-TCDD in the air can be found in vapor phase. However, the sunlight can break down these 2,3,7,8-TCDD into a very small portion of the CDDs which later deposited on land or water. In this study

dioxins/furans refers to all polychlorinated dibenzo-p-dioxins and dibenzofurans considered toxic, namely, the 17 congeners chlorinated in the 2,3,7 and 8 positions.

According to Fiedler *et al.,* (2000) the main source of dioxins and furans in the health sector is combustion of healthcare waste and combustion related processes (open burning, different kinds of incineration, gasification, rotary kiln furnaces, plasma pyrolysis, etc). According to Dopico and Gomez (2015), the PCDD/PCDF are emitted unintentionally with about 75% being discharged to waste and only about 25% emitted to air. Air emissions are dominated by residential combustion in small combustion installations and open burning of waste like healthcare waste (UNEP, 2011).

The health effects associated with human exposure to dioxins and furans include skin disorders such as chloracne, immune system impairments, endocrine disorders, reproductive problems, and developing nervous system and certain types of cancer (Ma *et al.,* 2020). An occupational health study has shown the carcinogenic nature of these chemicals, confirmed in 96.5% effect in exposed workers (Dopico and Gomez, 2015). Dioxins and Furans can also affect humans and animals through skin contact or ingestion of fatty food and breathing contaminated air. The health problems associated with these toxic chemicals include cancers, immune problems and skin disease.

The biggest source of dioxins and furans in developed countries is the large-scale burning of municipal and medical waste. The healthcare waste can be categorized to be non-infectious waste or infectious (waste from patients with infections like swabs, bandages and disposable medical devices), sharps (needles and syringes), pathological waste (human tissues, organs or fluids, body parts and contaminated animal carcasses), pharmaceutical (expired, unused and contaminated drugs and vaccines including cytotoxic waste, hazardous chemical waste, radioactive waste, and general (non-risk) waste. Other major sources of dioxins and furans can be burning of household waste, especially plastics, fuel burning wood burning, if the wood has been chemically treated (UNEP, 2011).

In Tanzania different scholars (Manyele and Anicetus, 2006; Anicetus *et al.,* 2020) indicated management of healthcare waste is poor hence can be a major source of dioxins and furans. There is poor segregation of waste

in acceptable categories and hazardous wastes are mixed with general waste during incineration (Kagonji and Manyele, 2016). Also, majority of the healthcare facilities has no specific sites for medical wastes disposal, the disposal methods is not safe (wastes are burnt in open areas due to unavailability of working incinerators (Figure 1a & b).

Most of the existing incinerators are not equipped with Air Pollution Control (APC) systems. The cost involved in procuring and running APC equipment discourages its use (Manyele and Anicetus, 2006). As a result, lots of noxious organic and inorganic pollutants are released in the flue gas.

Figure 1a: Broken burning structure

Figure 1b: Open burning space

Under the Stockholm Convention in which Tanzania is a member signed in 2001 and was adopted and ratified it on 30 April 2004 on Persistent Organic Pollutants requires parties to adopt measures that reduce sources of these chemicals (IPEN, 2018). Tanzania developed its National Implementation Plan (NIP) in 2006 (URT, 2006), in compliance with this requirement. However, no known further steps have been taken, particularly at community level. It is known that the main source of dioxins and furans in the health sector is combustion of healthcare waste and combustion-related processes open burning, which is common combustion method used by healthcare facilities in Tanzania.

The objective of this study was to estimate amount of persistent organic compounds (Dioxins and Furans) released in a year in two different

hospitals of Dar es Salaam City (Temeke and Mwananyamala) from different categories of healthcare waste generated from these hospitals. Results of this study hopefully inform replication at other potential hotspot areas the country.

METHODOLOGY

The study area

The study was conducted in the city of Dar es Salaam assessing healthcare waste generation rate and its management system in two hospitals: Mwananyamala District Hospital and Temeke Regional Referral Hospital.

Study design

Observational checklist and weighting scale were used to assess the healthcare waste generated in each hospital. A cross-sectional study was conducted by weighing of healthcare waste for 14 consecutive days in two hospitals. Weighing of healthcare waste was done over two shifts. During the night shift healthcare waste was weighed in the morning, likewise, all the waste generated during the day was weighed in the evening and recorded before the end of days shift. A walk-through inspection in all hospitals was done by the investigator in order to identify what type of waste generated in relation to the working section.

Data collection procedures

To determine the weight of waste generated, the WHO guideline was followed (WHO, 2014). Each hospital was provided with 25 kg storage container with appropriate bin liners. The number of containers provided for each hospital depended on the number of functional units. All containers were well labeled as per Healthcare waste guidelines (URT, 2017).

Field investigators placed designated bin-liners in each Healthcare waste (HCW) generation unit at the start of a shift and collected the liners at the end of the shift, replacing it with a new one to continue the exercise. Waste generated were segregated and stored in appropriate color coded containers with appropriate polyethylene bag liners as per Tanzania Healthcare Waste Management (HCWM) guidelines (URT, 2017).

Frequent follow up on segregation practices as well as measurement of HCW was done by assigned supervisor in each hospital. All safety

precautions including Infection Prevention and Control (IPC) were followed by both healthcare practitioners and investigators (HCW handlers).

The UNEP's standardized toolkit for dioxin estimation

The Toolkit (UNEP, 2013) focuses on activities under direct anthropogenic activity. Generally, an air release of POPs (PCDD/PCDF) is of concern at the local level especially in healthcare centers. It is usually an issue of workplace design, occupational exposure/worker hygiene and provision of suitable protective clothes–eventually including filter masks-to potentially exposed workers.

At both hospitals they have diesel burner operated incinerator with combustion design of Horizontal Double Chamber with capacity of 100 kg/h and maximum temperature 721ºC and 150 kg/h and maximum temperature 841ºC for Mwananyamala and Temeke regional referral hospitals respectively (Figure 2). The waste is inserted into two small openings of a bore hole that is paved, and then put on fire to burn.

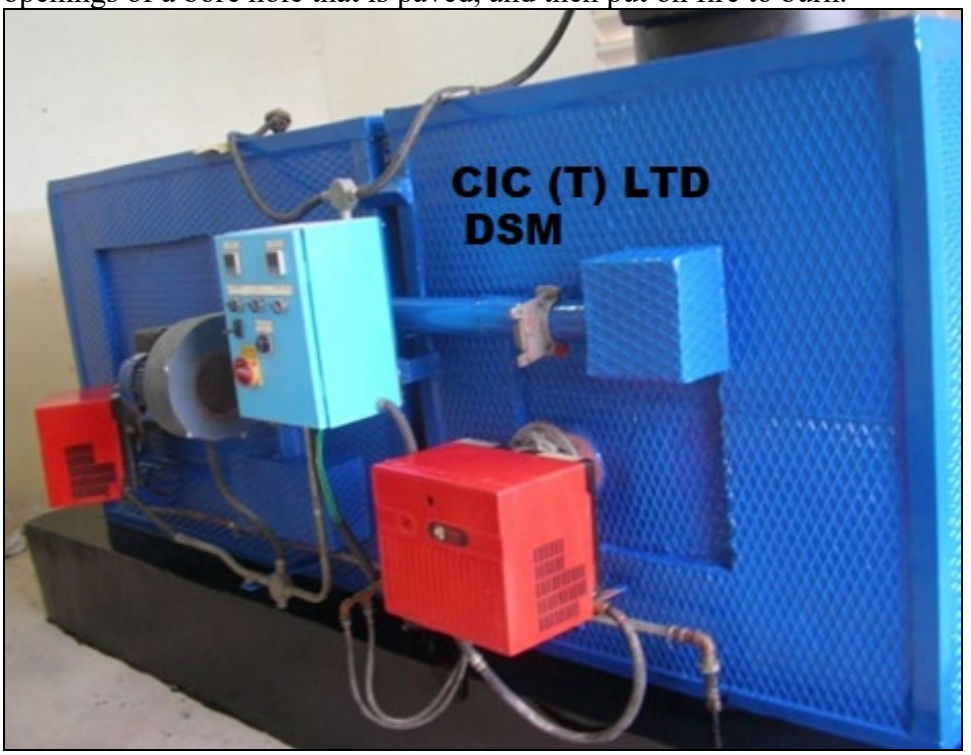

Figure 2: High-Tech incinerator at Temeke Referral Regional Hospital

According to Baharun *et al.,* (2005) in order for the combustion efficient of incinerator to be 99.99% the temperature must be ≥1100°C. Batterman, (2004), in his study has indicated, in most cases the residue of incinerator (bottom ash) collected ranged between 20 - 90 kg/day which is about 5.41% of the total waste incinerated per day, indicating that 95.59% must be converted into gaseous by-products including toxic gases like SO_2, CO, O_2, NOx, HCl and recently Hg is regularly conducted at modern incinerators, as well as metals like Hg, As and POPs. Incinerators produce dioxins (polychlorinated dibenzo-para-dioxins or PCDDs) and furans (polychlorinated dibenzofurans or PCDFs) as a result of the combustion of chlorine-containing wastes, e.g., polyvinyl chloride and other plastics (WHO 1999,2001).

Categories of hospital healthcare waste

Infectious waste: These includes the waste contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples), cultures and stocks of infectious agents from laboratory work (e.g. waste from autopsies and infected animals from laboratories), or waste from patients with infections (these are like used bandages, swabs and disposable medical devices) (WHO, 2022).

Non-infectious waste: These are waste that doesn't pose a health risk to human beings. These includes packaging materials such as cardboard, office paper, leftover food, cans etc. Sharps this is medical term for devices with sharp points or edges that can puncture or cut skin. Example of sharps is needles, syringes, lancets (finger stick), auto injector; infusion tubing sets (Munir *et al.,* 2014).

Plastics: These refers to, rubbers and polymer composite based materials used in hospital. Sharps waste are all disposable scalpels, hypodermic needles and blades, contaminated glass and certain plastics, and guide wires used in surgery (WHO/UNICEF, 2015). Sharps waste contains items that can cause cuts or puncture wounds to healthcare workers. Whether sharps are infected or not, are considered highly dangerous and potentially infectious waste, due to their puncture or cutting property (Matee and Manyele, 2016).

There are different types of plastic present in healthcare waste in form of different disposable products (example plastic bottles), packaging plastic bags and plastic medical instruments (Blessy *et al.,* 2021). Also PVC is

one of the plastic materials in the medical devices (Chia *et al.,* 2020). In most of the healthcare centers the used plastics are either disposed in landfills or inadequately incinerated hence increases the release of POP (Baruah *et al.,* 2018).

RESULTS AND DISCUSSION

Amount of healthcare wastes generated

The average infectious waste generated at Mwananyamala hospital ranged from 42.4 – 1.7.8 kg/day with an average of 65.4 kg/day (Figure 3).

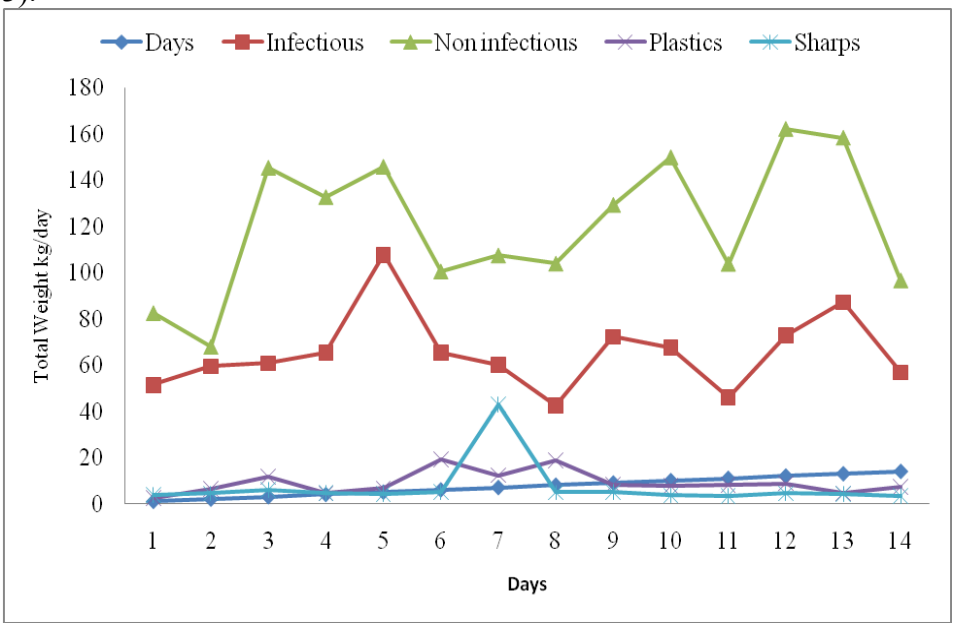

Figure 3: Weight of healthcare waste at mwananyamala hospital for 14 days

At Temeke hospital ranged between 1.3.4-214.5 kg/day with an average of 98.0 kg/day (Figure 4). These values correspond with values detected earlier at Mwananyamala hospital with 84.1 ± 29.0 kg/day (Honest, *et al.,* 2020), but lower than values obtained earlier from Amana Hospital recorded 649 kg/day (Kagonji and Manyele, 2011).

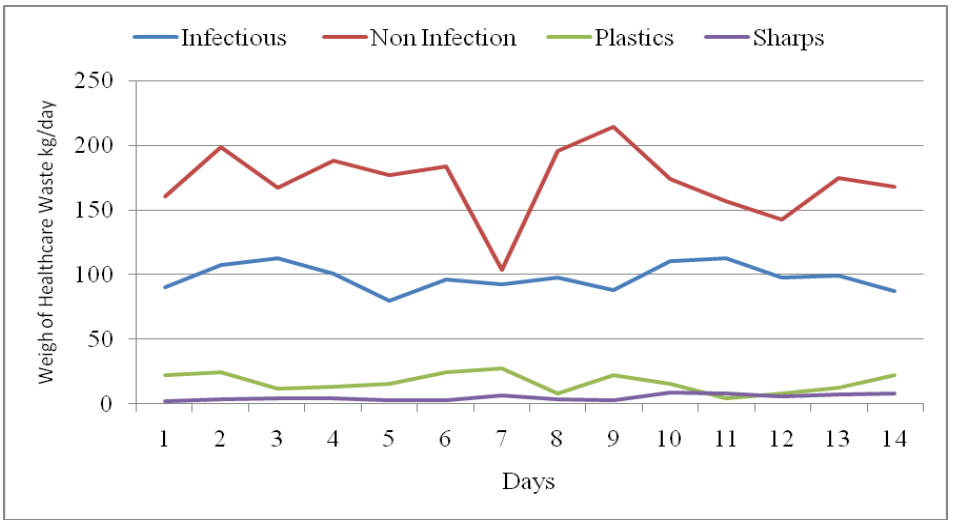

Figure 4 weight of healthcare waste at temeke hospital for 14 days

The amount of non-infectious wastes at Mwananyamala Hospital ranged from 67.9 to 162.2 kg/day average of 120.5 kg/day (Figure 2), at Temeke hospital ranged from 103.4 to 214.5 kg/day with average of 171.7 kg/day (Figure 3). These values are lower than value determined earlier in Dar es Salaam city with an average of 739 kg/day (Kagonji and Manyele, 2011).

The amount of plastics ranged from 2.5 to 18.9 kg/day average of 9.2 kg/day at Mwananyamala Hospital and it 4.6% of the total waste collected. At Temeke hospital the weight of plastics ranged between 4.5 and 27.7 kg/day with average of 16.9 kg/day, which is 5.8% of the total waste collected. These values are lower than the values determined earlier (McGain *et al.,* 2009) of about 30% of entire waste collected.

Results from figure 2 indicated the weight of sharps at Mwananyamala hospital ranged from 3.2 to 5.9 kg/day with an average of 4.4kg/day which is 2.2% of the entire waste collected. At Temeke hospital (Figure 3) the weight of sharps ranged from 2.2 to 8.9 kg/day with an average of 5.2 kg/day which is 1.8% of the total weight collected. These values are lower than the value detected in Dar es Salaam city earlier (Manyele *et al.,* 2011), who detected about 24.41 kg/day.

Estimation of dioxin and furans levels

The estimation of dioxin/furan was based on the materials subjected to incineration. Incineration has been the main method for disposing of the

wide range of combustible materials that constitute healthcare waste, because it can significantly reduce the volume of waste material and it can destroy organic matter (Weir, 2002). In this study, the weight of non-infectious waste material was not considered in estimation of dioxin/furan as this type of waste is taken to municipal dump.

The estimation of the annual releases for POPs is calculated based on the UNEP's Standardized Toolkit (2013). The emission of each source group such that:

$$POP_{Year} = [(EF_{Air} xAR) + (EF_{\text{Re}sidue} xAR)] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Eq i)}$$

Where:

POPs/Y = PCDD/PCDF released/year in µg□□□□□Q/Year

□□□□Q/Year = International Toxic Equivalent

AR = Waste Processed (Tons/Year)

EF_{air} = Emission Factor in air (µg □□□□Q/Tons of waste processed). The EF_{air} Standard is 3000 µg I-TEQ/Tons of waste processed (Zhang *et al.,* 2019)

$EF_{Residue}$ = Emission Factor in residue (Fly or bottom ash) (µg□□□□Q/Tons of waste processed). (The $EF_{Residue}$ Standard is 20 µg I-TEQ/Tons of waste processed) (Batterman, 2004).

The average waste incinerated in a year from Temeke Hospital is 43.8 Tons/year while at Mwananyamala is 28.8 Tons/year (Table 2). These values are extremely lower than one determines in Taiwan (Cheng *et al.,* 2009), where the total amount of medical waste was estimated to 526.3 Tons/year. The lower the volume of waste generated was not surprising because in these hospitals there is an installation of bio-digesters in which most of placentas, human tissues and food remains are now considered as raw materials (Honest *et al.,* 2020). The volume of healthcare waste generated in both hospitals is also lower than one generated in Ghara (Oduro-Kwarteng *et al.,* 2021) estimated to be about 69 Tons/year.

Table 2: Estimation levels of dioxin and furans from the measured healthcare waste

	Mwananyamala Hospital			Temeke Hospital		
Categories	Infectious	Plastics	Sharps	Infectious	Plastics	Sharps
Average kg/day	65.4	9.2	4.4	98.0	16.9	5.2
Total kg/day	79.0			120.1		
Total kg/year	28,835			43,836.5		
Ton/year	28.8			43.8		
Air (µg I-TEQ / year)	8.7×10^4			1.3×10^5		
Residue (µg I-TEQ/ year)	5.8×10^2			8.8×10^2		
Total (µg I-TEQ / year)	8.7×10^4			1.32×10^5		
Total (g I-TEQ / year)	8.7×10^{-2}			1.32×10^{-1}		
Total (g I-TEQ / day)	2.38×10^{-4}			3.62×10^{-4}		

Total dioxin/furan released at Mwananyamala hospital from 0.087 g I-TEQ/year) while at Temeke hospital is 0.132 g I-TEQ / year). These values are lower than values determined earlier in hospital at Ethiopia (Akele and Tarekegn, 2017), where results were 9.57 g I-TEQ/year of dioxin/furan released. In another study elsewhere, the quantity was 56.172 g I-TEQ/year released due to medical waste incineration (Ritter *et al.,* 1995).

According to FAO/WHO (2001), the tolerable daily intake (TDI) of dioxin/furans for an adult is 1.75×10^{-10} g I-TEQ/day. The value obtained in this study (2.38×10^{-4} g 1-TEQ/day) at Mwananyamala hospital and 3.62×10^{-4} g 1-TEQ/day at Temeke is about 1.36×10^6 and 2.07×10^6 times higher than the recommended value for adults respectively.
Su-Saharan African countries are high health risk due to high level emissions of dioxin/furans from poor performing incinerators. Golder (1999) in his report indicated the highest concentration of toxic effluents can be found very close to the incinerator (within 100 m). To most of developing countries, Tanzania is not exceptional, patients, staff and healthcare visitors are at adversely health risk because most of hospital departments are within that range from incinerators, burning structures or open burning space.

CONCLUSION AND RECOMMENDATION

The Stockholm Convention on Persistent Organic Pollutants states that each party to the convention should reduce emissions of unintentional POPs at their source, or if possible, eliminate the emission of PCDD/PCDFs. The present study focused on the estimation of POPs in selected hospitals of Tanzania.

In this study, the average waste generated from Temeke Hospital is 105 Tons/year while at Mwananyamala is 67.1 Tons/year. These waste lead to releases of POPs of about 5.56 $X10^{-4}$ g I-TEQ/day and 8.71 g I-TEQ / day at Mwananyamala and Temeke hospitals respectively. The tolerable daily intake (TDI) of dioxin/furans for an adult is 1.75 x 10^{-10} g I-TEQ/day, while to children is 2.74 x 10-12 g I-TEQ/day.

The results show that people are at adversely health risk due to exposure of dioxins/furans from incinerated healthcare materials at these hospitals. The best practices are like adoption of best available technology for healthcare disposal services such as incinerators with flue gas management, increasing public and stakeholders' awareness, participation and capacitating the responsible government organizations. Emission of dioxin/furan from hospitals must be controlled and, if possible, reduced below the limit recommended level. More detailed studies and the permanent monitoring of air quality around different healthcare facilities would be appropriate.

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Internal Audit Attributes on the Performance of Projects in Local Government Authorities in Tanzania

Amani Patrick Mbogella
Corresponding Author: mbogellaamani@gmail.com
Alex Kira
Email: alexkira10@gmail.com
Sarah Ngomuo
Email: sngomuo@yahoo.com
University of Dodoma

ABSTRACT
This study examined the attributes of internal audit on the performance of the projects in Local Government Authorities in Tanzania, in the way projects are operated and managed, based on the prevailed internal control systems. The role of internal audit is to ensure the entity provide independent assurance towards risk management, governance and internal controls of the entity. In Tanzania the Performance of projects are inadequate regardless of massive investments done by the Government. Internal control systems are not strong enough to ensure the performance of projects is compounded at paramount. Hence internal control systems should be addressed to cater the inadequate performance of projects in Local Government. Through examination of the attributes of internal audit work and performance of projects in Local Government authorities in Tanzania, the study revealed that internal audit had positive influence on performance of projects. This implied that a unit change in internal audit will increase project performance by the rate of 0.168. Therefore, the study showed that there is a significant direct relationship of internal audit and the performance of the projects in Local Government Authorities. Quantitative data, likert scale, multiple linear regression model was used under the study. Likert scales from questionnaires were used whereby data was analyzed by using SPSS V.26 software. This software packages have features that accommodate variables under the study and they are user –friendly. The study concluded that a great use of value-added strategies (rather than consecutive strategies) in audit results to greater performance of the projects implemented into various Local Government Authorities in Tanzania.

Keywords: *Internal Audit, Internal control systems, project performance, Value added Strategies, Local Government Authorities, Tanzania*

INTRODUCTION

The origin of internal audit can be traced back to the Mesopotamian Civilization around 4000-3500 B.C (Ambatia, 2018). Record keeping systems were formally introduced by various business firms and the governments. They were concerned with incorrect accounting of receipts and payments made and taxes being collected at that time (Bravo, Brown, & Jack, 2018). Other states which developed a system of checks and counterchecks to prevent errors and fraudulent actions at that period of time include, Babylonia, Greece, the Roman Empire and the Italy.

Over a century the role of the internal auditor has been recognized as a special role within organizations that provided important support to the organization. The importance of this support has been growing over the century. In particular internal audit is considered to encompass the audit of both operational activities as well as purely financial activities. Internal auditors continued to play a role in a number of organizations even after the introduction of compulsory external auditors in the first half of the 20th century (Folkers, Vartle, & Risnen, 2018). Following the stock market collapse of 1929 in the USA the role of the external auditor was expanded. During this period, the quality of audit generally, and internal audit specifically, came under increased scrutiny.

Internal Control systems are processes designed and affected by those charged with governance, management, and other personnel to provide reasonable assurance about the achievement of an entity's objectives with regard to reliability of the financial reporting, effectiveness and efficiency of operations and compliance with applicable laws and regulations (Makundi, 2019) The Committee of Sponsoring Organizations of the Tread way Commission (Pagrustev, 2019). Framework looks at internal control as a process, affected by an entity's board of directors, management and other personnel, designed to provide "reasonable assurance" regarding the achievement of objectives in the following categories: Effectiveness and efficiency of operations, reliability of financial reporting, compliance with applicable laws and regulations while, proper internal control systems will always lead to improved financial performance, the reporting process and also give rise to reliable

reports which enhances the accountability function of management of an entity (Rajhan, 2017) .Therefore internal control is a mechanism that ensure safe custody of all LGAs assets and avoid misuse or misappropriation of assets and detect and safeguard public fund resources against probable frauds. Internal control systems are policies and procedures undertaken by the organization to ensure objectives of the organization are achieved. Therefore, internal audit play a great role to ensure compliance of internal control systems are adhered to achieve performance of the projects.

Project performance is measured by the value for money (Shadrack, 2020). It can be assessed using criteria of economy, efficiency and effectiveness (Wiley & Zabihollah, 2019). Economy is the acquisition of project resources in the right quantity, of the right quality, at the right time and place at the lowest possible of the project cost. Efficiency is the utilization of project human, financial and other project resources and the optimum relationship between the output of goods, services or other results and the resources used to produce them. Effectiveness is the performance in relation to achievement of the project objectives, operational goals and other intended effects of the project being implemented. Project assessment in terms of value for money provides important information to assess the management in decision making of the implementation of the projects (Edger, 2020).

Value for money has become more prominent on the project development due to recent sensitivity of the communities being driven by the project performance criteria rather than the extent the project spending, as how much is spend sometimes overshadows the more fundamental question of what the funds achieve (Dzefangh, 2019). Value for money is often used as a framework for assessing cost effectiveness across the public sector, particularly on the implementation of various projects. Furthermore, value for money may be measured through, the degree of utilization of project funds; the degree of timely completion of the projects and the degree of usage of completed projects (Akerlof, 2019). Moreover, once the projects are not completed timely, it revealed that service delivery to the intended community is also delayed, hence value for money is not obtained. Contrary to that, the projects may be completed but not put in use, as result the intended project objectives may not be met and thus the value for money may not be achieved. Under this study, criteria for project performance is based on value for money of the implemented projects as

this factor measures the efficient, effectiveness and economy of the projects being implemented.

Value added strategies are ways or audit procedures in which internal auditor applies in which will add value towards the audit works. Rules and regulations may be complied by the projects but still could not obtain value for money, value added strategies confined with value for money for the projects. Hence performance of the projects is aligned with the value for money and compliance of the implemented projects.

LGAs may be newly established (aging below ten years) or may be old established (aging more than ten years). Obviously old LGAs consist more infrastructure and effective internal audit compared to newly established LGAs. Furthermore, LGAs may be of two in nature as according to its location, LGA may be in urban or at rural area. Urban LGAs consist better infrastructure and more effective internal audit compared to rural LGAs in Tanzania context. This study considered both environment in analyzing the information obtained from the respondents.
In Europe, audit practice were found in Ancient, Rome, through hearing, verifications were made for financial records, so as to prevent fraudulent activities (Edna, 2021).The role of hearing the records being kept gave rise to the term 'audit' originated from latin ''auditus or audire'', which means ''hearing''. These hearing played an important role at that time, since most of people could not read and write. Auditors were selected by the community upon recognizing fraud and errors (Mansell, 2018). At the beginning of 13th Century, auditors started to be appointed for the sake of verification of receipts and payments upon various states/cities such as Pisa, Kazakhstan (Gomez, 2019). During the 16th to 18th Centuries, the scope of audit expanded to consist the transactions of a business-oriented society. The focus still remained on fraud prevention and detection through verification of transaction with supporting source documentation (Hills, 2019).

In United Kingdom (UK) and United States of America (USA), from 1930s, onwards, the Securities and Exchange Commission (SEC) required firms to provide the audited financial statements if they wanted to be registered at Stock Exchange Market (Bale, 2020). As businesses expanded and become more complex around the World, the management ability to monitor its operations were limited, hence the role of internal

audit increased (Blackwell & Rebitzer, 2017). Various states/firms started employing internal auditors to perform audit functions.

In Tanzania context, to understand the attributes of internal audit on the performance of projects in Local Government is to know how projects are operated and managed, to know the internal control systems of the implemented projects, to know the performance of the projects. The crucial role of internal auditors in the projects implementation is to protect the interests of the management (Ditoeng, 2020). The project internal auditors should ensure the project objectives are met through monitoring and evaluation of the project's implementation. Therefore, the project internal controls should be appropriate. In additional the internal auditor has a role of provision of consultancy service towards the project management and also to ensure project compliance are adhered. For example, the internal auditor may recommend the action to be taken to prevent frauds towards the implementation of the projects, this may be done through making the risk assessment of the projects; internal auditor may also recommend the action to be taken for an officer who found manipulating the figures of financial statements of the projects.

The government of Tanzania undergone various LGAs projects reforms since 1993 to date but still its objective not achieved as desired (Razia, 2019). Various studies have been done on internal control and its impact on projects performance but still does not provide the sufficient practical information particularly in Tanzania context. Each LGAs have internal audit unit, the same legal systems, financial guidelines and international approved accounting standards to comply with. However, with the same systems LGAs are issued different projects audit reports from Controller and Auditor General. As results there is incidence of inadequate project performance and deteriorating service delivery.

Internal audit as part of internal control systems, under this study specific investigate the best approaches which should be used by the internal auditor to improve the project performance unlike the consecutive approaches and undesired audit approaches which is currently used by the internal auditors.

Hence the objective of this study is to conclude, if there is a significant direct relationship of internal audit and the performance of the projects. The findings show that internal audit had a greater influence towards

performance of projects. Through internal audit, risk of the projects may be mitigated, frauds may be prevented and also detected and hence improves the performance of the projects.

A theory is a "set of interrelated concepts, definitions, and propositions that present a systematic view of events or situations by specifying relations among variables, in order to explain and predict the events or situations" (Zikmund, 2017). Theoretical under the study is concerned primarily with theories or hypotheses rather than practical application. There are several theoretical approaches which can be used to outline internal audit attributes on the Performance of Projects in Local Government Authorities in Tanzania, to select the predictors to the models, and to justify the functional form between these predictors. In this review, the study employed agency and stakeholder theories.

Berle and Means (1932) found the research on agency theory in the early 19th Century. Thea et al., 2017). Among earlier authors of agency theory are Ghauri and GrØnhaug (2019), Geemiz (2021), who surveyed and captured the different facets of the agency literature due to its wide popularity.

Agency theory helps in implementing the various governance mechanisms to control the agent's action in the jointly held corporation (Gilbert & Brown, 2017). This theory is very pragmatic and popular. However the theory have various limitations as criticized by many authors (Thomson, 2017). The theory assumes a contractual agreement between the principal and agent for a limited or unlimited future period, where the future is uncertain. The theory assumes that contracting can eliminate the agency problem, but practically it faces many hindrances like information asymmetry, rationality, fraud and transaction cost. Shareholders' interest in the projects is only to maximize their return, but their role is limited in the projects. The roles of owners of the projects are only limited to monitor the project managers meanwhile their further role is not clearly defined. The theory considers the managers as opportunistic and ignores the competence of the project managers. Regardless of its weaknesses but still the theory hold water as the theory has been widely used in literature to investigate the information asymmetry between principals (shareholders) and agent (management).
Agency theory is relevant to the study as it gives an idea about how LGAs operations should be managed. Managers of LGAs are trusted towards the

public resources. The role of internal audit is to provide assurance to the public who are the owners of the public resources on the management of project resources by LGAs management.

Stakeholder theory was originally detailed by Goddard and Mkasiwa (2016). ‘‘A Stakeholder Approach’’. The theory identifies and models the groups which are stakeholders of organization. It is a theory of organizational management and business ethics that addresses morals and values in managing an organization. In the traditional view of the project, the shareholder view, the shareholders or stockholders are the owners of the project, and the organization has a binding fiduciary duty to put their needs first, to increase value for them. Stakeholder theory argues that there are other parties involved, including employees, customers, suppliers, communities, political groups, trade associations, and trade unions.

Political philosopher criticized stakeholder theory for assuming that the interests of the various stakeholders can be, at best, compromised or balanced against each other (Cooper & Schindler, 2019). He argues that this is a product of its emphasis on negotiation as the chief mode of dialogue for dealing with conflicts between stakeholder interests. He recommends conversation instead and this leads him to defend what he calls a 'patriotic' conception of the corporation as an alternative to that associated with stakeholder theory.

Stakeholder theory is relevant to this study as it gives an idea about how LGAs should really work and cooperate with stake holders of the projects being implemented. It states that for any project to be successful it has to create value for customers, suppliers, employees, communities and financiers, shareholders, banks and other people who are part and parcel for the project implemented by LGAs.

RESEARCH METHODOLOGY

Research design

This study adopted survey research design in which a researcher administered a survey to a sampled population to describe the attitudes, opinions, behavior or characteristics of the population.

Study population

The population consist all employees of the selected LGAs who are responsible for projects implementation. According to the council's report (2021/22) staffs who are responsible for project implementation are about 1,002.

Sample size

The sample has been derived from a sample frame of 1002 staffs from the selected LGAs. The proportional sampling has been used due to the fact that the target population is greater than 1,000 items/ respondents. Thus, upon the five LGAs selected, a sample of 278 staff has been selected from the population of 1,002 based on simple random sample size determination formula below:

$$\mathbf{n} = \frac{\frac{Z^2_{\alpha/2}P(1-P)}{e^2}}{1+\frac{Z^2_{\alpha/2}P(1-P)}{Ne^2}} = \frac{\frac{1.96^2 \times 0.5(1-0.5)}{0.05^2}}{1+\frac{1.96^2 \times 0.5(1-0.5)}{1002 \times 0.05^2}} = 277.69 \text{ approximately to } 278$$

Thus, the level of confidence which placed 95% which provide us Z Value of 1.96 per the normal table. Where Z is the critical value that is 1.96 and e is the margin of error 5% which is 0.05, p is the probability proportional which is 0.5, N is the population and n is the sample size. Proportional sampling is used when the population is large.

Data collection methods and tools

Primary and secondary data were employed in this study. Semi structured interview, focused group discussions and surveyed questionnaire methods were used for collection of primary data.

Secondary data also were used in this study, written or printed materials was obtained particularly from the financial statements of projects from selected LGAs (Dodoma CC, Ilala MC, Iringa MC, Singida DC and Chamwino DC). Five LGAs have been selected by using a purposeful sampling method. The selection was based on the poorly and better performance of Local Government Authorities on the projects' implementation. The selection was also based on the LGAs whose financial statements were withdrawn by the CAG for several years due to irregularities and mismanagement of the projects' funds (CAG reports 2013/2014-2018/2019). The researcher mainly used financial statements and internal audit reports of projects for the consecutive five years

(2013/14-2018/19) in seeking the extent upon which, projects fund is utilized in the normal course of business.

Data analysis

Quantitative data, likert scale, multiple linear regression model used under the study. Likert scale from questionnaires were used whereby data was analyzed using SPSS V. 26 software. Moreover, in case of likert scale of 1-5 stages was used. The scale was divided into I, Strong Dissatisfied, 2 Dissatisfied 3, Neutral, 4 Satisfied and 5 Strong Satisfied. Thereafter, the interpretations of the findings of the likert scale was done. Meanwhile, for qualitative data, Narrative analysis for data from the Key informant interview were used for data analysis.

Estimation of model

Multiple linear regression model

Multiple linear regression model was employed under the study. The aim of the model is to obtain a model which best predicts the chance of an outcome variable (let say y) as a function of explanatory variables (let say x's). The main variables under the study includes the resources on monitoring and evaluation of projects, the working relationship of internal auditor and assurance providers of the projects, the independence of internal auditors on the implementation of the projects and the implementation of the internal audit recommendations on projects. The main purpose was to test a model by using inductive approach.

Attributes of internal audit on the performance of projects in LGAs.

Multiple regression analysis was done; the internal audit index was obtained by adding each item in internal audit to obtain the total index which is continuous variable as shown below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Where by Y= project performance score or index X_1=Nature of local government authorities this is categorical variable 1 if urban, X_2=Age of local government authorities this is dummy variable 1 if age is above 10 years and X_3= Internal audit score or index (the resources on monitoring and evaluation of projects, the working relationship of internal auditor and assurance providers of the projects, the independence of internal auditors on the implementation of the projects and the implementation of the internal audit recommendations on projects)

The findings on internal audit on the performance of projects in LGAs were analyzed on the resources on monitoring and evaluation of projects, the working relationship of internal auditor and assurance providers of the projects, the independence of internal auditors on the implementation of the projects and the implementation of the internal audit recommendations on projects.

Reliability

Cronbach's alpha was used to measure the consistence of variables under the study. (Worley, 2018) stated that Cronbach's alpha is an appropriate measure of variance attributable to the subjects and variance attributable to the interaction of subjects and items. Hence Cronbach's alpha was used as a measure of internal reliability. In terms of the specific testing of reliability, the following scores were obtained by testing of Cronbach's alpha as indicated in the **Table 1.**

Table 1: Reliability statistics

Variable	Cronbach's Alpha	Number of Items
Internal Audit Attributes	0.701	14

The values in Table 1, indicate that, Internal Audit attributes α=0.701; is sufficient confirmation of the data reliability for the independent variables as supported by Zikmund et al. (2010) that a Cronbach's alpha of 0.60 as a minimum level is acceptable.

The issue of reliability was ensured by the researcher through pre-testing of tools, parallel form reliability and using the internal reliability methods such as cronbach's alpha. The researcher also used semi-structured interview to different categories of the project staff.

Validity

Factor analysis was used by the researcher during the pilot study, in order to test the validity of the study items. Factor analysis enabled the researcher to make decisions on whether the items under the study explain the dependent variable. In this study, validity shows whether the findings clearly show the internal audit attributes on the performance of the projects in LGAs. Variables under the study and the results had a factor loading above 0.5. Cooper and Schindler (2019) stated that a loading

factor which is 0.4 and above is considered acceptable. This statement also was agued by William and Babin (2020) in their studies.

RESULTS AND DISCUSSION

Regression analysis on internal audit and project performance

The jarquebera test of normality employed to the error term of the model in order to assess whether the error term was pure random (normal distributed). Given H_0andH_1, at 5% level of significance. The rule is to reject H_0 if the p-value is less 0.05. The outcome are shown in the **Table 2.**

Table 2: Table of normality assumption

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)adj	chi2(2)	Prob>chi2
Residual	275	0.4194	0.2503	1.99	0.3701

Table 2 indicates that jarquebera testing the error term was normally distributed since the p-value was greater than 0.05 at the 5% level of significance. Therefore, this implies that the error term was pure random. Hence the assumption of regression was taken into consideration on the test of normality.

Factor analysis was done for 14 items and all 14 items were retained for further analysis as they had factor analysis of 0.5 and above.

The overall of the findings on internal audit attributes on performance of projects in LGAs indicate that 15.1% of the respondents strongly disagreed and 64.7% disagreed that internal audit is adequately towards the performance of projects in LGAs, meanwhile 9.4% of respondent agreed that internal audit is adequately towards the performance of projects in LGAs.

Regression analysis was also done, the analysis of variance showed that the model used significantly at ($P < 0.001$, $F=12.789$ and degree of freedom (DF) = 274), account for the joint variation of independent variables with the dependent variables. This implies that the age of the Council where projects are implemented and nature of the Council where projects are implemented has significant combined effect on the project performance.

Internal audit statistically significance (p-value<0.01) and had positive influence on performance of project. This implied that a unit change in internal audit will increase project performance by the rate of 0.168.

Nature of Local government authorities was statistically significance (p-value<0.01) and had positive influence on performance of project. This implies that projects implemented at urban Councils exceed projects implemented in rural Councils by the rate of 2.446 in project performance.

Age statistically significance (p-value<0.05) and had positive influence on performance of project with regression coefficient 1.697. This implied that projects implemented at Councils with more than ten years exceed with projects implemented at Councils with less than ten years in project performance by the rate of 1.697.

Partial correlation used to explore the relationship between internal Audit (as measured by the internal Audit score) and project performance (measured by the project performance score), while controlling for age of the Council where projects are implemented and nature of Councils. Preliminary analyses were performed to ensure no violation of the assumption of normality. There was a weak, positive, partial correlation between internal Audit and project performance, controlling for age of Councils where projects are implemented and nature of Councils where projects are implemented, (*r*=2.446*, n =274, p=0.001).* As presented in the table 41, the coefficient of determination R square is 0.123 and R is 0.350 at 0.05 significance level. The coefficient of determination indicates that 12.3 % of the variation on project performance is explained by independents variables included in the model (Age, nature of Local Government authorities and internal Audit).

Table 3: Partial correlation between internal audit and project performance

Control Variables			Internal Audit		Project Performance
Age & Nature of LGAs	Internal Audit	Correlation	1		0.214
		Significance (2-tailed)	.		0
		df	0		274
	Project Performance	Correlation	0.214		1
		Significance (2-tailed)	0	.	
		df	274		0
R	.350				
R Square	0.123				
Adjusted R Square	0.113				
Std. Error of the Estimate	5.50591				

** Significant at 0.01(2- tailed)

Regression analysis on internal audit versus the performance of projects in LGAs

The analysis of variance in Table 4 show that the model used significantly at ($P < 0.001$, $F=12.789$ and degree of freedom (DF) = 274), account for the joint variation of independent variables with the dependent variables. This implies that the age of the project, nature of the project and Internal Audit has significant combined effect on the project performance.

Table 4: Analysis of variance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1163.09	3	387.697	12.789	.000b
Residual	8306.31	274	30.315		
Total	**9469.399**	**277**			

Multiple linear regressions were further used to assess effect of age, internal audit and Nature of LGAs on project performance. The result in Table 4 show the fitted model:

$$\textbf{Performance} = \beta_0 + \beta_0\, Age + \beta_1\, \textbf{Internal Audit} + \beta_2\, \textbf{Nature of LGAs}$$

.

The following independent variables were statistically significant influence project performance.

Internal audit statistically significance (p-value<0.01) and had positive influence on performance of project. This implies that a unit change in internal audit will increase project performance by the rate of 0.168.

Nature of Local Government authorities was statistically significance (p-value<0.01) and had positive influence on performance of project. This implies projects implemented into urban Councils exceed projects implemented into rural Councils by the rate of 2.446 in project performance.

Age statistically significance (p-value<0.05) had positive influence on performance of project with regression coefficient 1.697. This implies that projects implemented into Councils with more ten years exceed projects implemented into rural Councils with less than ten years in project performance by the rate of 1.697.

Even when age, Nature of Local government authorities and internal audit are non-existence, project performance is still positive at 15.408 indicating that there are other drivers of project performance as shown in Table 5.

Table 5: Regression output of internal audit and project performance

Variable	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	15.408	1.638		9.406	0.000
Age	1.697	0.773	0.142	2.195	0.029
Nature of LGAs	2.446	0.804	0.197	3.044	0.003
Internal Audit	0.168	0.045	0.212	3.733	0.000

Note -Nature was dummy variable 1 if urban and 0 if is rural also the age was dummy variable 1 if is above ten years and 0 if below ten years.

RESULTS AND DISCUSSION

Resources on monitoring and evaluation of projects

The findings on resources on monitoring and evaluation of projects sought to investigate if the internal auditors have adequate resources to monitor and evaluate risks of the projects. The results indicate that, 41.7% of the respondents strongly disagreed and 20.9% of the respondents disagreed that internal auditors have adequate resources to monitor and evaluate risks of the projects. While 0.7% of the respondents strongly agreed and 14% of the respondents agreed meanwhile, 22.7% of the respondents were neutral as shown in the **Table 6:**

Table 6: Resources on monitoring and evaluation of projects

Likert scale	Number of respondents	Percentage
Strong disagree	124	41.7
Disagree	62	20.9
Neutral	68	22.7
Strong agree	2	0.7
Agree	42	14
Total	**298**	**100**

Therefore, the results showed that the internal auditors have inadequate resources to monitor and evaluate the risks of the projects.

These findings are supported by a male interviewee found at the field:

> *''Projects are not closely monitored and evaluated by the internal auditors as they are mostly operated at remote areas where our internal auditors have no reliable transport for monitoring and evaluation of the implemented projects''*

Another female interviewee stated that:

> *''Monitoring and evaluation of the projects is a hard task, monitoring should be committed to our projects, we have inadequate audit staff on monitoring and evaluation of all the projects in time, this affects the performance of the implemented projects.''*

This finding is also supported by CAG, (2020) and Sari et al. (2017) as it was found out that, most of the projects are not audited timely by the internal audit unit due to inadequate resources which adversely affect the performance of projects.

Working relationship of internal auditor and the assurance providers of the projects

The findings on internal auditors' work sought to investigate if the internal auditors work in coordination with other assurance providers, to make sure that the audit committee receives all the assurance they need to form an opinion on how well the projects are managed. The results indicated that 34.5% of the respondents strongly disagreed and 21.2% of the respondents disagreed that the internal auditors work in coordination with other assurance providers to make sure that the audit committee receives all the assurance they need to form an opinion on how well the organization is managing the projects. While 3.2% of the respondents strongly agreed and 20.1% of the respondents agreed meanwhile, 20.9% of the respondents were neutral as shown in the Table 7:

Table 7: Working relationship of internal auditor and the assurance providers of the projects

Likert scale	Number of respondents	Percentage
Strong disagree	103	34.5
Disagree	63	21.2
Neutral	62	20.9
Strong agree	10	3.2
Agree	60	20.1
Total	**298**	**100**

Therefore, the results indicated that, the internal auditor do not work in coordination with other assurance providers to make sure that the audit committee receives all the assurance they need to form an opinion on how well projects are managed.

This statement was also supported by a female interviewee found at field who said that:

> *''There is inadequate relationship of internal auditors and assurance providers. Internal auditors of the projects are working under close environment, this hinders the performance of audit committee upon addressing the challenges of implemented projects''.*

Another female interviewee stated that:

> *''Project audit committees are not effective at all since internal auditors who are the secretariat of audit committee are far from assurance providers as result project assurance providers are not adding value on the project implementation.''*

The results were also supported by Arthuur (2018) and Moeller (2011), in their studies as they showed that external users (assurance providers) of the projects are not well cooperated with the internal audit unit.

Independence of internal auditors on the implementation of projects

The findings on the independence of internal auditors on the implementation of the projects, here sought to investigate if there is specific written provision from the Accounting Officer providing the internal auditor an unrestricted access to all records, including assets and liabilities and specific for the projects. The results indicated that, 24.5% of the respondents strongly disagreed and 25.5% of the respondents disagreed that there is specific written provision from Accounting Officer providing the internal auditor an unrestricted access to all records, assets etc. specific for the audited projects. While 3.6% of the respondents strongly agreed and 22.7% of the respondents agreed meanwhile 23.7% of the respondents were neutral as shown in the Table 8:

Table 8: Independence of internal auditors on projects

Likert scale	Number of respondents	Percentage
Strong disagree	73	24.5
Disagree	76	25.5
Neutral	71	23.7
Strong agree	11	3.6
Agree	67	22.7
Total	**298**	**100**

The findings indicate that there is inadequate specific written provision from Accounting Officer providing the internal auditor an unrestricted access to all records, including assets and liabilities specific for the projects.

This statement was also supported by a male interviewee found at field who said that:

> *''Internal auditors do not have written document from the Accounting Officer on unrestricted access to all records of the projects. Internal auditors only use experiences on obtaining the project documents for audit purpose''.*

Another male interviewee stated that:

> *''We have demanded formal written document on the unrestricted access for the implemented projects from the Accounting officer without success.*

We usually beg documents from the project coordinators for auditing, this enable us to be inferior on implementing our audit task.''

These findings were also supported by Fadzil, Haron, and Jantan (2018) as showed that projects in LGAs are not audited with regard to project memorandum of understanding, project guidelines and Public Finance Act (2001) and its regulations (Revised 2005) together with Procurement Act of 2011 and its regulations of 2013.

Implementation of internal audit recommendations on projects

The findings on internal audit findings and recommendations sought to investigate if the findings and recommendations of the internal audit unit are taken seriously by the project management and the audit committee. Results indicated that, 31.3% of the respondents strongly disagreed and 25.9% of the respondents disagreed that, the findings and recommendations of the internal audit unit are taken seriously by the project management and the audit committee. While 10.8% of the respondents strongly agreed and 11.5% of the respondents agreed meanwhile 20.5% of the respondents were neutral as shown in the Table 9:

Table 9: Implementation of internal audit recommendations on projects

Likert scale	Number of respondents	Percentage
Strong disagree	93	31.3
Disagree	77	25.9
Neutral	61	20.5
Strong agree	32	10.8
Agree	35	11.5
Total	**298**	**100**

Hence, results indicate that the findings and recommendations of the internal audit unit are not taken seriously by the project management.

The above findings were also supported by one male interviewee who said that

''It is about fifteen years since I was employed in this project but, I have never heard that the internal auditor has reported any incidence of frauds in this project, meanwhile the external auditors yearly report the red flags of frauds and give the recommendation on how to minimize the projects' risks on fraud. We are not sure of the capacity of the project internal auditors regarding the detection and prevention of frauds ''

Another female interviewee stated that:

> *''Recommendations raised by the internal auditors are not fully implemented by the project management, this mostly discourages the internal auditors as results on accumulations of unimplemented audit recommendation each year.''*

These findings are also supported by Hammersley (2017), as found out that, internal audit for the project is not effective as most of recommendations raised by the internal auditors are not seriously implemented by the project management.

CONCLUSION AND RECOMMENDATIONS

The following recommendations were derived from the findings, results and conclusions of the study. The management of projects should use mixed elements of internal control systems that matches with the project performance. Project managers and coordinators should fully be involved on the establishments of internal control systems. Furthermore, internal audit should be effective upon monitoring and evaluation of projects, preventing and detection of fraud towards the projects and internal auditor should be independent in reporting the performance of the projects.

Moreover, as part of internal controls, the project implementers should ensure that expenditures are correctly made from respective budget lines and prior approval should be sought in case of additional requirements. Project implementers also should ensure that expenditure is made from allowable activities according to the project/program agreements in order to avoid ineligible expenditure as the project implementers are required to utilize funds according to prevailing project guidelines, likewise the project implementers should exert more efforts on contract management.
Project management should also ensure that their projects have strong internal controls. All project controls should be monitored and evaluated on regular basis by internal audit, so as to provide the management with assurance on the adequacy and effectiveness of mitigation controls that management has put in place which finally will enable improvement of the performance of the projects.

this study contributes to the body of knowledge both in methodology, theory and practice. In order to derive more valuable and broader conclusions, the methodology adopted in this study involved administering structured questionnaires across a wide range of projects in

LGAs, in order to increase the generalizability of the results. Lack or inadequate of internal control systems, results to poor project performance among LGAs, this study is of scholarly interest as it has further un-covered factors that lead to poor performance of the projects. This is likewise true for the testing of possible relation between internal control systems and project performance.

In the context of aspiring to bring out supplemental factors that enhance internal control systems, recent studies ignored the controlling effect of the nature of LGAs and age of LGAs on project performance. This research gap has been addressed through administering structured questionnaires at the individual level over and above quantitative analysis.

This study has made important contributions to the internal audit and project performance. This study confirms existing literature in terms of the positive influence of internal audit and project performance. Scholarly research has clearly examined the link between internal audit and project performance. In Nigeria, Munine (2019), found out that internal audit has an impact towards the performance of the projects. Sari et al. (2017) found the quality of internal control systems that has a positive effect upon the project performance. However, Kinyua (2016), found inadequate concentrating on internal control environment and internal audits in LGAs projects. Hence, the importance of internal audit is paramount in erasing project fraud and hence, improves the performance in local government projects.

The study found that the role of internal audit is paramount for the project performance. The current internal audit strategy is too limited and does not cover all dimensions of project control system in terms of scope and its mechanism. The internal auditors practically use conservative strategies in which auditing is based on the project compliance, strategies used does not adequately add value towards the project performance. Hence the study suggests that both internal audit strategies (Conservative and value-added strategies) should be used on project assessment by the internal audit. This also provides an immediate suggestion for reforms of audit regulatory frameworks in prioritizing internal audit unit in LGAs and promoting the public accountability towards project implementation.

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