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Huria Journal

Lack of Parental Gender Socialization of Children at Family Level and its Effects on Adulthood Gender Discrimination in Rwanda

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ABSTRACT

The paper discusses holistic integration of gender concepts at tender ages. This study aimed toinvestigate parents' participation in socializing children to gender equality and assess the effect of lack of parental socialization of children to gender equality. Three hundred and fifty (350) respondents were purposively selected from Kicukiro, Bugesera, Musanze, Nyanza and Nyamasheke. Data were collected through questionnaire, interviews and focus group discussion and qualitatively analyzed using content analysis. Findings revealed that there is lack of parental gender socialization of children as it is negatively perceived in Rwandan families. Gender equality is perceived by 75 % of respondents to be the cause of family conflicts and violence. Furthermore, 69% of all respondents accuse the theory of gender equality to divert females from their responsibilities which results in family dysfunctionality. In addition, 42% of respondents consider gender equality as a way of western people to disorganize developing countries. Lack of parental gender socialization of children at family level affects children's adulthood. It presents enormous and long-lasting consequences to both females and males. Respondents confirmed that there is a considerable number of females who did not attend school because fees were reserved to boys. On the other hand, male respondents confirmed that being overpowered in childhood negatively affects adulthood relationship with their wives. Socializing children to gender equality at family level from their tender ages would be one of the best strategies to eradicate Gender-Based Violence (GBV) and discrimination.

Keywords: Gender Socialization, gender perceptions, gender discrimination

INTRODUCTION

Families provide a solid foundation on how children view, analyze and interpret the world. The child development is a continuous process even if it can change with time, education and other circumstances where a child establishes new ways of thinking, solving problems, developing relationships and decision making (Bukatko& Daehler, 2012). Families are able to provide to its offspring constructive or destructive cultural values and norms, among them gender social construct is a vibrant example (Muasya and Muasya, 2020). A stable life is constructed during children's socialization and influences the rest of their lives (Halpern and Jenkins, 2016; Halim et al., 2017).This socialization process is not only what is taught as 'do or do not do this'; it is mostly what children observe, touch, sense, see, hears around. The stability of children characters took its roots in family basic initiation. It is social integration that ensures continuity and consensus of shared values in the community (Giddens &Sutton, 2017).

Socialization is a process by which children learn cultural norms and values of the society into which they are born. It is a range of practices by which the child internalizes values of social system to conform and transform from an asocial being into a fully social adult. Though development of human personality is constructed in families, they accused to nourish at tender ages discriminating ideas. Human personality requires a certain level of stability to build up social relationship and to conform to the constraint of social-cultural context. Conflicted atmosphere at home becomes a handicap to its functions and a heritage to the offspring (Haralambos and Holborn, 2018; Kollmayer et al., 2018).

The notion of gender took its roots firstly in the family. It is an environment of trust where children are socialized with gender social construct. It becomes a legacy which dictates adulthood's behaviors which may not be easily changed with time. Children's gender identities and expressions are shaped within family interactions. It is transmitted throughout generations and accepted as a reality and this situation is not yet tackled. There is lack of parental gender education at tender ages (Eliot, 2010, Halim, 2016). Gender refers to rules, norms and practices by which biological differences are culturally constructed over time and results in unequal treatment and opportunities (Ogato, 2013; Babatunde, 2015; Bayeh, 2016). Gender is recognized as natural; it is considered as an identity and an expression of roles (Newman, 2016; Kroeger et al, 2019). It is socially constructed whereby norms, values and roles are

assigned to males and females based on patriarchal principles which create differences and form two worlds of masculinity and femininity. Male and female children are expected to identify and express themselves as such throughout their lives (Gunn & MacNaughton, 2007). Once children are not socialized with the notion of gender at young age, understanding and respecting gender equality norms and values in adulthood would be reluctant. Hence, gender violence and discrimination originate from lack of parental orientation to gender equality in childhood. Gender equality is a fundamental human right and a necessary foundation for a peaceful, prosperous and sustainable nation where females and males have equal rights. Equality does not mean sameness between females and males. This understanding is engrained in children's life through socialization to gender equality and complementarity (Amato, 2012; Baker et al., 2016; Cutas & Smajdor, 2017).

After the Beijing Platform of Action in 1995, all countries have been very sensitive to the problem of gender inequalities and its effect to social capital. This consciousness resulted in the formulation of National Gender Policy to eradicate gender discrimination and all forms of inequalities (Ferrant et al., 2015). It aims at increasing awareness on gender as a development concern, integrates women in decision making, promote their education and strengthening partnerships for the advancement of gender equality (Tundi, 2015). The policy itself does not mention clearly with specific context how to socialize children with values of gender equality it only defines child protection against GBV and the role of grassroots level committees (MIGEPROF, 2010; Bayer, 2016; Ekpe et. al., 2016). The world tends to be divided into two major social groups (females and males). The relationship of these two is exploitation, domination, submission and overpower. It is a social hierarchy of power where the elite is reserved specifically to some outstanding men and to all men in comparison to women (Wilbourn& Kee, 2010; Patterson et al., 2017).

Rwanda has approved ten years ago National Gender Policy that addresses gender inequalities and focuses on programs that empower women and girls. However, the organ in charge of its implementation has not yet reached family level (MIGEPROF, 2010). The culture of gender equality is not yet at its success stories in Rwandan families. Discriminating words and actions are still sensed among all categories of ages including children. They are still adapting discriminating behaviors from parents. The early socialization of gender equality at family level

has been overlooked and this resulted in weak program at cell level to focus on program of gender equality in families as prevention to Gender-Based Violence.

Parents are not yet putting an effort to take advantage to socialize young children with values of gender equality. They are not yet active players in changing home environment of gender bias and discriminations as the ones who first inculcate cultural and social values to young children. Even though women have demonstrated power in different responsibilities at national level, it is not yet the case in families. There is still lack of parental education to gender equality. Families are tight to cultural background which has marginalized women and who in turn accepted passively (Debusscher&Ansoms, 2013, Ekpe et al., 2016). There is a gap concerning children's socialization to gender equality at early age which is a big challenge to the eradication of gender discrimination. From the highlighted gender inequalities which are still observed, there is a need of conducting a study which addresses the root causes of the issue.

The purpose of the study was to investigate the effect of lack of parental gender socialization of children at family level on adulthood gender discrimination in Rwanda. It also highlighted the necessity of socializing children with gender equality as a way of eradicating gender discrimination. The study was motivated by persistent discriminating behavior observed despite Rwanda effort made to stamp it out. The specific objectives were to investigate parents' participation in socializing children to gender equality and assess the effect of lack of parental socialization of children to gender equality.

METHODOLOGY

The study aimed at examining the effect of lack of parental children's gender socialization on adulthood gender discrimination in Rwanda. It was qualitative in its design where researchers attempted to study human action from the perspective of social actors. The primary goal of studies using this approach is to describe and understand human behaviors (Babbie and Mouton, 2010; Neuman, 2011). It intended to address the roots causes of discriminating behaviors in Rwandan communities. Primary data were collected through questionnaire, interviews and focus group discussions from three hundred and fifty (350) respondents purposively selected from Kicukiro, Bugesera,

Musanze, Nyanza and Nyamasheke Districts. The five selected Districts covered urban and rural areas. Seventy respondents were selected in each including both males and females. Purposive sampling was used to select cases that would enable researchers discover information (Saunders et al., 2019). Content analysis was used to systematically categorize, classify and summarize data (Babbie & Mouton, 2010; Kitchin &Tate, 2013). Respondents' ideas were grouped, analysed and interpreted according to themes. In representing respondents' ideas, they were given unreal names for confidentiality.

FINDINGS AND DISCUSSION

The section presents and discusses findings related to the topic under study. It highlights respondents' views about the concept of gender discrimination, social construct and beliefs about gender equality. Collected data were related to parents' participation in socializing children to gender equality and effects of lack of parental socialization of children to gender equality.

Parents' participation in socializing children to gender equality

Gender is perceived differently; people misunderstand and misinterpret it. It is perceived as a political issue that has nothing to do with everyday life in the family; a western concept which cannot fit in Africa. A considerable number of respondents (42%) negatively stereotype the concept of gender. The following misconception of gender captures parents' bias on the idea of gender equality. Sharing his point of view, Mia articulated that:

> *Gender equality is a business of western people to disorganize underdeveloped countries. White people are imposing their culture to Africans; it is a feminist concern that incites African women to rebellion to their husbands. If there are men who are teaching gender equality, it is a way of gaining bread or they are weak men dominated by their wives.*

This wrong perception of gender constitutes a barrier to gender education in families and this position has been significantly supported. Early children's education to gender cannot take place in families with such perceptions. Building strong foundation of gender equality necessitates parents' mindset change. Children's socialization to gender equality is not about telling them the ideal behavior. It is providing a good role model to imitate instead of telling them 'do or do not do this'. Children are great imitators, give them something great to imitate. It is mostly what children

observe, touch, sense, see and hear around which shape their values and beliefs. The stability of children characters took its roots in family basic initiation. It is social integration that ensures continuity and consensus of shared values in the community (Giddens &Sutton, 2017). From this family environment where parents negate the essence of gender equality, they accordingly educate their children. Sharing her experience in group, Fides expressed that: 'My *parents gave more value to my young brother and educated him. Discouraged by my parents, I did not attend school and I got married very early.'*

On the other hand, 58 % of respondents clearly understand the concept of gender but supported its contextual consideration. To them, gender refers to socially constructed relationship between men and women where societies determine what deserves to men and women, separation of work, education, resources, family authorities, and so forth. People interpret differently this discriminating family environment because it finds its good reason in societal values and norms. Amongst those who support the genuine definition of gender (58%), a good number of them are female, 67% and males are 33%. Even though they give value to gender equality, they passively accept gender discrimination. Mat explained that: '*If gender discrimination finds its good reason in societal values and norms, there is nothing we can do to change this mindset.'* They are passive consumers of discrimination. Fils emotionally pointed out that: *'It is not good to be negatively labeled in the community. There is no reason to claim about what others have accepted.' Change has to come from decision makers*. This statement got applause in group discussion. Faz strongly supported this position uttering that '*wise wives keep quiet and are submissive to social norms and values in their families to get favor from their husbands.'* Reacting to this point of view, M_2 expressed that: *'Gender discrimination is a problem but time will resolve it, there is no need to fight for gender equality.'* They understand and interpret gender discrimination as a crucial problem, but they fear and negate their role in changing the situation. Families are the foremost actors for changes even though parents have not yet realized that they are engine of positive change. Perceptions of gender do not only consider how it is defined by both females and males. It also tackles how they value each other in family decision making. Gender is accused to have brought in families a strange situation where a husband cannot take decision and inform his wife. If husbands are

looking for the best of their families, there is no need of taking a long time to discuss and have consensus. It would take more time which would be used in implementing decisions. Ziz, quoting the Bible, he alleged that *'there is an exaggeration in gender equality consideration. Created different, gender inequalities is natural, not socially constructed. Before those theories were focused on, family decisions were taken by husbands and no problem was observed.'* To support this position, Xum underlined that: '*Family decision maker is the husband not the wife.'* Zuzu accentuated that: '*the reality is that husbands own the family authority.'* The discussion was too hot because women expressed their anguish to be considered as passive in family decisions. The question on how to change the situation through children socialization to gender equality that empowers family consensus in decision making is not yet clear. Nana articulated that: *'Some of the decisions taken at home affect children and wives are powerless to change them.*' It has been proved that most of family decisions are taken by men without informing their partners. Rwandan society is still tight to its cultural background which has marginalized women and who in turn accepted passively. Fifi emphasized that: '*mostly, what husbands fear to discuss with their wives has some discrete information they do not want to disclose.'* There is a hide and seek game between partners and it does not offer to children something great to imitate and develop a sense of gender equality. Articulating his view, Kin said that: 'Wives *have good ideas; they are able to contribute to the development of the family but it is not a must to involve them in family decisions.'* Another issue which was raised by Chak n group discussion was: *'What can happen if the one who takes decision is a wife and informs her husband to adhere to the decision?'*

The question brought opposition between women and men. Men did not stand at the same point. They were in two opposing sides. One side of men (85 %) supported the fact that women have to be submissive to men's decisions. This matches with a Rwandan saying which states that 'when a family is led by a wife, it does not prosper.' In the same line, men have been socialized from their early age with cultural background of gender discrimination and this tends to remain firm in most of families which is a barrier to children's socialization with values of gender equality.

Nik stated that: '*the ideal is discussing all family issues together and come up with a common decision. Otherwise, wives should also take decision and inform their husbands as they do.'* This position was supported by 15% of men. From the two polemic stands of male

respondents, both do not reflect the real target and aim of family gender equality where parents give a safe platform to their offspring to learn from what they observe at home. On the other hand, Weno voiced that: *'family decisions have to be taken by husbands and inform their wives'* and this position was supported by the majority of female respondents (53%). Opposing this position, Yowe alleged that: '*family decisions have to be taken jointly'* and she was supported by 46% of women. Challenging the situation where a husband may take decision and inform his wife, Zetu expressed that: *'If my husband can take a decision and inform me, I am also able to do so*' and 1% of female respondents supported the position. The polemic discussion around family decision making revealed that gender equality is not yet well understood at family level which makes complex children's socialization to gender equality where family atmosphere vehiculates unequal power in family decision making.

There is a problem to initiate children to gender equality at early age. Eloy highlighted that: '*women are overloaded by housework without help from their husbands; they are there to give orders and children learn by observation. When they play at tender age, they imitate those behaviors.'* There is a saying supporting this trend which states that 'a man who treats himself as a dog can fetch water' (because fetching water in Rwandan culture has always been a role of women and children). Men could simply be finding a pretext to escape hard work in the name of culture. Fetching water in some rural areas in Rwanda is a very hard work reason why men abdicate the work to their wives. Women consideration did not change with empowerment of girls and women education, entrepreneurs, head of families and bread winners. The modern and postmodern eras still have and entertain gender discrimination (Shen-Miller et al., 2011). Religious beliefs, men selfishness, women's biological nature and passivity regarding their rights are barriers. Men's power to dominate and women's weakness to naïve submission to male's orders do not frame a safe platform for better children's education to gender equality. Passivity is understood and interpreted as a peaceful approach.

The necessity to socialize children to gender equality is not the focus in various families. Maz stated that: '*the theory of gender equality is the root*

cause of family conflicts because of none submission of women to men and lack of respect. Gender Based Violence (GBV) is the result of women's insubordination.' This statement has been supported by 75 % of respondents. In the same line, Lulu underscored that: '*If the government gives too much power to women than ever before, it is a way of inciting family divorce because two heads cannot be cooked in the same pot.'* This is a Rwandan saying that means two powers cannot be together; the subordination is compulsory. If changes that are taking place to promote gender equality are negatively considered, family initiatives may be limited to few that are active agent of changing behaviors. Jig said that: '*focusing on socializing children to gender equality in early childhood destroys calm and simplicity between girls and boys and affects their future families. As a result, any simple conflict in families leads to separation and divorce because they all have power*.' Gender equality is accused to be the root cause of family dysfunctions and divorce. The idea was emphasized by Kal who stated that: *'Gender equality is the origin of family disorder, instead of bringing complementarity, it has brought separation.'* This position was considerably supported by 69 % of respondents. Gender equality is accused to be the major cause of family dysfunction. *'If there is equality in families, it is hard to achieve consensus. One of partners should hold authoritative decision'* uttered Gaj.

Rwandan family environment is full of gender stereotypes and assumptions about gender equality. It continues to nurture gender discrimination and they have justifications. Gender equality is not yet well understood, parents have a lower level of understanding its necessity. This makes complex the application of gender equality in families. If parents themselves do not value gender equality in their families, children's socialization to gender is still far to be reached. Men are considered to be the ones who have power to change things. Discriminating women is an advantage to men; it is a weapon of domination and power. However, women have to peacefully fight for their rights instead of passively accept what is imposed to them. Thus, there is a need of sensitizing parents on the importance of mutually sharing ideas and responsibilities within families. This will help to create conducive family environment to socialize children with gender equality and eradicate gender discrimination.

Effect of lack of parental socialization of children to gender equality

Masculinity and femininity do not wait for formal education to emerge or to be taught. Children are born with physical differences and in relation with their parents; they internalize and socialize with these differences. Through social interactions and play, children set off activities and assert control over their surrounding world. They begin to explore their family environment, learn new concepts and actions (Coles et al., 2002; Alexander & Wilcox, 2012). Till this age, children are under their parents' influence. Negative early experiences of discrimination present consequences in adulthood behaviors. Regarding early children's socialization to gender at family level, Pinc pointed out that:

> *I grew up in family full of domestic violence, torture, exchange of frustrating words. I have never seen my parents together in sitting room. I considered it as normal till when I was eight years. I went to my uncle's family and I was surprised to see my uncle and his wife laughing, discussing and exchanging encouraging words. This intimidated me at the first time. I could not understand what went wrong in my family. Back home, I started to question my family environment as having a problem. This discriminating family environment has affected me and my brothers' gender identity. Educated, we are not gender sensitive and all the time my brothers consider female as not equal to them even if two of them are married. I do fight to understand what gender equality means but sometimes, I have a self-discriminating behavior.*

Quality education at early children's life leads to continued success in their future families (Lancet, 2011). Gender education should start at early age to equip children with positive thinking regarding equal rights and opportunities between males and females. If not done, negative early experience of gender discrimination has long lasting consequences in future. Self-discrimination, insensitivity to gender equality and passive submission to male were acquired in the family atmosphere. At early age, children start to discover that girls and boys are different and if these anatomical differences are not transformed into complementarities by parents and family environment, they are used as a weapon to domination and discrimination. Fofo articulated that:

> *I am the first born in a family of six girls. My parents were unhappy since the third born and ignored our presence because of a desire to have a baby boy. Sympathizing with their worries, at four years I started behaving like boys. Fighting in vain to be a boy, I was frustrated and confused. I grew up with an inferiority complex in front of males.*

Children are very active players in their life development but it is the family environment that equips them with social constructs and ways of thinking, feeling and communicating (Bukatko & Daehler, 2012; Muasya &Kahiga, 2018). If gender bias has to be eradicated, it has to take place firstly in the family to reflect deeply parents' understandings of gender equality. Parents can make more informed decisions and create opportunities to address gender inequalities and biases at family level. Wenu sharing his tender age socialization, expressed that:

> *I was born in a family of four boys, the whole village named my family to be blessed. I started mistreating girls in nursery school. Even if I received several times teachers' punishments, I felt confident because my Dad addressed ladies as weak and not intelligent. This has affected the relationship with my wife. I am still struggling to adjust my behavior.*

When parents consciously or unconsciously engage with children, they are constantly emitting delicate beliefs and values on gender. M_8's parents did not directly address discrimination to their children, but their family discussion has nourished gender discrimination to them. Physical differences are transformed into constructed weakness to make girls inferior and boys superior.

Due to cyclical gender discrimination encountered in families, Chichi expressed that '*The problem of gender discrimination has become so natural and sometimes we do not feel it*. *As children grow, the sense of self, autonomy and belongingness would pave a way of understanding the opposite sex with mutual respect. Children reflect in the community the language and behavior from parents.'* Family gender expressions affect children's way of thinking, reacting and interacting in adulthood (Bjorklund, 2012). The point was highlighted by Ian stating that: *'at young age, children play and project their future roles. The kind of role they play is grounded on what they observe in their families. A male child may play giving orders to a female child reflecting how his father gives orders to his mother.'* In the same views, Hab described that:

> *Discriminating words and behaviors are commonly observed. Females are frequently embarrassed by words and behaviors displaying that they are not like males, they cannot be equal to them, they have to be protected and secured by males. In many cases, these behaviors, words are considered to be normal and once you consider them as part of gender discrimination, mostly you are not understood, you become a problem. The language people have got from their families continues to stress them*.

Describing endured gender inequalities, Biya stated that: *'In our family, we were many ladies and two twin boys who were the last born. All of us (ladies) did not complete high school. Parents said that they are keeping school fees for boys. That is the reason why I dropped out school.'* From this chocking family experience, those privileged boys were initiated to give much value to boys than girls and during their adulthood, they are likely to do the same. To illustrate this point of view Quata highlighted that:

> *Parents who discriminate their children are paving to them a wrong path to follow in their future families. Overpowered by my dad, my sisters were doing everything for me. Once I got married, the first year I struggled to understand some of my wife's behaviour because she was very sensitive to gender equality.*

Fata fights to understand his wife's behavior was not easy as he was still viewing her using the eye glasses of his family environment where boys were seating and watching movies and giving orders to their old sisters. He said that:

> *What makes the situation worse is when women claim for their rights and raise their voice to educate their daughters as equal to boys; they are negatively labelled as masculinised. My wife had a conflict with my parents relating to how she socialized our three children to gender equality. My Dad was unhappy of the situation and started blaming* me. *'You are no more a husband. When did you decide to be feminine? You have lost your identity. You are dominated, powerless in your home. Think about it.*

Parents who understand, defend and socialize their children to gender equality are considered to be masculinised (wife) or feminized (husband). From the analysed cases, it has been observed that gender socialization is still an issue to be debated on. A good way of gender discrimination eradication should start at early age when children are still in their parents' hands for guidance and imitation.

CONCLUSION

Parents play a big role in shaping children's ways of thinking, norms and values. The way they have been socialized to gender is replicated to their children. This lack of parental socialization to gender equality at tender age constitutes a barrier to a good understanding of gender concept. Risk factors of being socialized with gender discrimination continue to be entertained in families and local communities. Approaches that are essential to ensure children's family gender socialization that may create protective factors in the environment are not utilized and less exploited. Children are raised up with potential vectors of gender discrimination such as words, behaviors, beliefs, games, initiation to home activities and all this expose them to gender bias and discrimination. During the period where children are not able to logically understand and manipulate received information, family has substantial influence on the language to use, behavior, not only using their authorities but also parents' behaviors and family environment. Parents are not yet active players in changing home environment of gender bias and discriminations as the ones who first inculcate cultural and social values to young children. There is a need of sensitizing parents and make them understand their role of empowering girls and boys equally in education that reduces and eradicates gender inequalities. Gender does not separate family responsibilities as two blocs. It focuses on human rights and respect; gives responsibility to each family member and being accountable to each other. It reinforces saying 'we' than 'I' in family unity.

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Determinants of Pension Uptake in the Informal Sector of Tanzania

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ABSTRACT
Pension is important for persons in both formal and informal sectors of the economy. In developing countries, formal sector is much covered in terms of pension compared to informal sector though people employed in the two sectors are equally in need during retirement age. This study aimed at determining the factors for pension uptake in the informal sector in Tanzania, secondary data collected by FinScope Tanzania in 2017 were used. To determine the factors for pension uptake in the informal sector, the binary multiple logistic regression model was applied. The dependent variable is pension status and the independent variables include age, gender, highest education level, income, location, and main income generating activity. Individuals working in farming and fishing, trade, service provision, and casual work are less likely to uptake pension compared to informal salaried. Likewise, females are less likely to uptake pension compared to male category in the informal sector. Individuals at age forty and above are more likely to uptake pension compared to those aged less than 20 years. Middle and the two highest quintiles of income are more likely to uptake pension compared to those in the two lowest quintiles of income. Persons in urban are more likely to have pension compared to rural residents. Pension uptake is common to individuals with above secondary education, at least middle-income quintiles, urban residents, males, and those aged forty years and above in the informal sector.

Key Words: Pension, uptake, informal sector

INTRODUCTION

The evolution of pension is based on the Bismarckian social welfare in German and it was very common for formal sector but recently following the millennium development goals, the focus is also on informal sector (Hu and Stewart, 2009). Pension is purposely for helping persons at the time when they get retired from working (Modigliani and Muralidhar, 2004). Population in countries with no universal pension schemes for old age are more likely to be affected by poverty during old age (Joust and Rattenhuber, 2018). The life-cycle theory of saving illustrates that people save at a young age for consumption at old age (Ando and Modigliani, 1963). Pensioners get rid of poverty after retirement from working to sustain their life through pension at the time their contribution to the workforce is believed to diminish.

The government of Tanzania implements all labour regulations and has developed the national security policy which is consistent with the ILO social security convention of 1952 ((ILO, 2008). Pension as a social protection is important for every individual for use during retirement age regardless of employment in either formal or informal sector (Damerau, 2015). The informal sector is broadly defined as units engaged in the production of goods or services with the main objective of generating employment and incomes to the persons involved (ILO, 1993). The informal sector in Africa employs 85.8 percent of employed persons (ILO, 2018). In Tanzania, about 4.3 million people are engaged in the informal sector as their main economic activity and considering the SMEs, most of them fall in the informal economy (FinScope Tanzania, 2013; ILO, 2017; NBS, 2015).

Therefore, in order to ensure poverty reduction during old age, uptake of pension through social security schemes is necessary for both formal and informal sectors. In Tanzania, there were five pension funds which included GEPF, LAPF, NSSF, PPF, and PSPF before the decision by the government to merge some of them (SSRA, 2019). Recently, the government has merged some of these pension funds to form two major pension funds one for public sector employees and the other for private sector employees. The PSSSF has been established officially 2018 after merging GEPF, LAPF, PPF, and PSPF for public sector employees and NSSF has been uniquely for private sector employees, informal sector employees and the self-employed (URT, 2018).

The factor which is commonly known to influence people to join pension funds in Tanzania is the compulsory scheme for formal sector. Recently from implementation of millennium development goals, even the informal sector is considered for pension uptake. According to the report by FinScope Tanzania (2017) in Tanzania, 16 percent of pensioners joined voluntarily to private pension fund and 84 percent joined as a statutory by the employer. Beside the requirement by the government requiring employers to contribute for their employees with some percents contributed from salary, other factors influencing uptake of pension in Tanzania are not known. Social protection is inadequate for the majority of workers especially in the informal sector even though the ILO framework redirects workers to get social protection (Ackson and Masabo, 2013). Pensioners in Tanzania are directly attracted by formal employment and particularly biased with serving in the government institutions as a way to secure old age pensions after retirement form employment (Ahmed and Wang, 2018; Songstad *et al*., 2012). The formal sector and the informal sector play a mutual role in providing employment to people such that neither formal nor informal sector can completely absorb the whole working population in the country. Researchers Adzawla, Baanni and Wontumi (2015) in their study point out that elderly, single, highly educated, highly depended, and high-income earners have high a probability of contributing to the pension scheme. A study by Heenkenda (2016) identified the number of dependants, income, asset index, financial literacy and social capital index as some of the factors for dropping out from the voluntary pension scheme in Sri Lanka. A study by Ingrid and Russell (2008) identify lack of information by migrants in China as a barrier to utilize social security scheme in a situation where employers are not willing to get involved with social protection through pension schemes. Factors for pension uptake have been examined for the general population that include formal sector that is under compulsory pension scheme and informal sector that depends on voluntary scheme. There is a need to understand factors that determine pension uptake in the informal sector which is not based on compulsory scheme. Therefore, this study aimed at determining factors that influence pension uptake in the informal sector in Tanzania.

METHODOLOGY

The study used secondary data collected by FinScope Tanzania in 2017. This survey collected information related to pension and other related financial inclusion variables in Tanzania for persons aged 16 years with

the sample size targeted to 10,000 persons with a response rate of 95 percent equal to 9,459 respondents. From this data, the informal sector domain analysis was utilized to suit the objectives of this study which targeted factors for pension uptake in the informal sector. From the sample collected by FinScope Tanzania, 9033 respondents belong to the informal sector after omitting those in the formal sector. Multiple binary logistic regression analysis was used to model the relationship between pension uptake and its determining factors in the country. The dependent variable, in this model, is pension uptake which is a dummy variable taking value "1" if an individual is a pensioner and "0" otherwise. Multiple binary logistic regression determines the likelihood of factors influencing a dependent variable. The independent variables identified from the review of related studies include age, gender, cluster location, the main source of income, level of education and income. Progressive out of Poverty Index (PPI) was used as a proxy variable for income. The general mathematical representation of multiple binary logistic regression model is given in equation 1. The central role of the logistic regression model is to estimate the log odds of the event in this case pension uptake. The variables X_1, X_2, ..., X_k are the independent variables which determine pension uptake expressed in a linear model.

$$\log\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

FINDINGS

The findings of this study are presented in forms of descriptive and inferential statistics. Table 1 presents the descriptive statistics of variables used in this study. Most of the respondents 63.24% and 88.53% of males and females respectively in this study had married marital status and single accounted the least 5.71% and 1.39% of males and females respectively. Most of the respondents in this study were aged forty years and above accounting 39.5% and 33.87% of males and females respectively with very few aged below 20 years accounting 10.23% and 11.74% of males and females respectively. Farming and fishing were the main sources of income for most of the respondents for both males and females. Among males, 56.96% were farmers and fishers and 54.44% of females were farmers and fishers. This is in line with statistics from the World Bank showing that agriculture which employs a large number of

people in the informal sector and in the country have a share of 65% in 2019 (World Bank, 2020).

Similarly, a study by Idris (2018) confirms that the agriculture sector employs the largest number of females. Very few depend on other economic activities as their main sources of income. Therefore, most of the listed economic activities presented were conducted by individuals in the informal sector. In this study, most of the individuals working in the informal sector completed primary level of education where males and females accounted 52.3% and 49.1% respectively. Very few had at least a university level of education with males and females accounting 1.78% and 1% respectively. Working in the informal sector does not require any educational qualification which is contrary to formal sector where the qualification in terms of education is required.

Table 1: Descriptive statistics of variables used in the study

Variables	**Frequency**	
	Male	**Female**
Cluster		
Rural	2,925(75.81%)	3,760(72.65%)
Urban	933(24.18%)	1,415(27.34%)
Total	3,858(100%)	5,175(100%)
Marital status		
Married/living together	487(63.24%)	2,910(88.53%)
Divorced/separated	77(10%)	104(3.16%)
Widowed	162(21.03%)	227(6.9%)
Single/never married	44(5.71%)	46(1.39%)
Total	770(100%)	3,287(100%)
Age		
Below 20	395(10.23%)	608(11.74%)
20-30	1,066(27.63%)	1,630(31.49%)
30-40	873(22.62%)	1,184(22.87%)
40+	1,524(39.5%)	1,753(33.87%)
Total	3,858(100%)	5,175(100%)
Main source of income		
Informal sector salaried	69(1.93%)	61(1.57%)
Farmer & fishers	2,033(56.96%)	2,102(54.44%)
Trader	59(1.65%)	127(3.28%)
Service provider	269(7.53%)	414(10.72%)

Piece work/casual labor	172(4.81%)	209(5.41%)
Welfare	950(26.61%)	931(24.11%)
Other	17(0.46%)	17(0.43%)

The general relationship between pension uptake and associated factors shows that age, PPI, highest education attained, gender, and location of the cluster are statistically influencing pension uptake in the informal sector. These variables are statistically significant at 5% level of significance as presented in Table 2.

Table 2: Determinants of pension uptake in the informal sector, general relationship

Pension dummy	**Coef.**	**Std. Err.**	**z**	**P>z**
Main income generating activity	-0.126	0.072	-1.750	0.081
Age	0.323	0.132	2.440	0.015
PPI Category	1.247	0.170	7.350	0.000
Highest Education	0.242	0.092	2.630	0.009
Gender	-0.894	0.270	-3.310	0.001
Cluster	1.130	0.294	3.840	0.000
Constant	-8.420	0.845	-9.960	0.000

Binary multiple logistic regression model was fitted to determine the factors for pension uptake in the informal sector. Table 3 presents the odds ratio from the multiple binary logistic regression model with their P-values. The odds of farmers and fishers, traders, service providers, piece worker/casual labour, welfare and dependents are 77.5%, 85.5%, 85.5%,

Total	3,569(100%)	3,861(100%)
Highest Education		
No formal education	485(12.57%)	1,108(21.41%)
Primary	2,018(52.3%)	2,541(49.1%)
Secondary	386(10%)	398(7.69%)
University or other higher	69(1.78%)	52(1%)
Other	900(23.32%)	1,076(20.79%)
Total	**3,858(100%)**	**5,175(100%)**

78.5%, 83.1%, and 88.95% lower than informal individuals who are salaried to uptake pension respectively. Individuals aged 40 and above

years old are 25.4% more likely to have pension uptake compared to those age below 20 years. The relationship is statistically significant at 5% level of significance. Individuals at the middle quintiles are 5.237 times more likely to have pension compared to those in the two lowest quintiles and the results are statistically significant at 1%. Individuals in the two highest quintiles of income are 6.849 times more likely to uptake pension compared to those in the first two quintiles of income with the results statistically significant at 5% level of significance. In this study, it was identified that persons with secondary level of education and university or above are respectively 10.505 and 55.612 times more likely to uptake a pension when compared to persons with no formal education and the findings are statistically significant at 1% and higher levels of significance. Females are 49% less likely to have a pension compared to males and persons in urban are 91.8% more likely to have pension compared to those in rural areas. These findings are statistically significant at 5% level of significance.

Table 3: Determinants of Pension Uptake in the Informal sector, Results from Logistic Regression

Independent Variables	**Odds Ratio**	**Std. Err.**	**Z**	**P>z**	**[95% Conf. Interval]**	
Source of Income [Informal Salaried]						
Farming & fishing activates	0.225***	0.123	-2.720	0.007	0.076	0.660
Trade	0.145**	0.118	-2.360	0.018	0.029	0.719
Service provision	0.146***	0.086	-3.250	0.001	0.046	0.465
Piece work/casual labor	0.215***	0.124	-2.670	0.008	0.070	0.664
Welfare	0.169***	0.091	-3.290	0.001	0.059	0.487
Dependents	0.111*	0.136	-1.800	0.072	0.010	1.222
Age group [Below 20]						
20-30	3.452	3.639	1.180	0.240	0.437	27.252
30-40	5.042	5.467	1.490	0.136	0.602	42.220
40+	9.254**	10.041	2.050	0.040	1.103	77.604
PPI Category [Two lowest quintiles]						
Middle quintiles	5.237***	2.019	4.300	0.000	2.460	11.148
Two highest quintiles	6.849**	3.088	4.270	0.000	2.831	16.571
Highest Education [No education]						
Primary	2.113	1.541	1.030	0.305	0.506	8.824
Secondary	10.505***	7.844	3.150	0.002	2.431	45.388
University or other higher	55.612***	42.953	5.200	0.000	12.239	252.704

Other	1.310	1.110	0.320	0.750	0.249	6.895
Gender [Male]						
Female	0.510**	0.147	-2.340	0.020	0.290	0.898
Cluster [Rural]						
Urban	1.918**	0.586	2.130	0.033	1.054	3.491
Constant	0.001	0.001	-5.260	0.000	0.000	0.012

*Note: ***, **, and * means statistically significant at 1%, 5%, and 10% respectively and categories in brackets are the reference categories for each categorical independent variable.*

DISCUSSION

Individuals working in farming and fishing activities are less likely to have pension uptake compared to informal salaried individuals. People and or households depending on farming and fishing as their main sources of income are concentrated in rural areas and information about pension services are not well distributed compared to those in urban where there is a possibility of receiving some salary in the same production chain (Lotto, 2018; FAO, 2003). People employed in farming and fishing industry stay for so long period of time in their field and travel to urbanized areas for very short period of time that leads to a small chance of being accessed by pension institutions for information. Pension services have a close similarity with financial services such that they are largely concentrated in urban areas leaving rural areas with limited information and access to these services (Lotto, 2018). According to Adzawla *et al*. (2015) in their study on factors influencing pension uptake in the Tamale metropolis of Ghana pointed out that traders use to contribute a large amount to pension funds on monthly basis. Casual workers get only income for daily consumption and serve little or nothing which limit them to get involved in pension uptake. The increasing casualization of labours is one of the structural problems (Pellissery and Walker, 2007). Persons in middle and the two highest quintiles of income are more likely to uptake pension compared to those in the two lowest quintiles since at least they have something to save from their income. In the informal economy, individuals have low and unstable income to pay for social security and this influence exclusion from benefiting from social security (Holmes and Scott, 2016; ILO, 2013). Most of them can afford their basic needs, are found in urban areas where financial institutions are spread and get

involved to the pension as their saving for the future. A study by Kwena and Turner (2013) identified that poor people are not financially included though they have the same needs as others in the higher levels of income. It was also concluded by Agravat and Kaplelach (2017) that higher income is positively related to pension uptake in their study.

Individuals with secondary and at least university level of education are more likely to have a pension compared to those with no education. This is due to the fact that those with such levels of education are financially included, have knowledge of pension, and found in urban areas. Similar studies conducted by Agravat and Kaplelach (2017) and Muller (2001) revealed that respondents with higher education are likely to join the micro-pension scheme in Kenya which has a similar background of economic development to Tanzania. Males are more likely to have pension than females since in the country males are dominating decision at the household level and are more empowered than females and it is that reason women empowerment have been emphasized for a long period of time. A similar study conducted by researchers Agravat and Kaplelach (2017) found that demographic factors influence pension uptake among informal employees of Kenya Ports Authority. Financial inclusion in urban areas is at high level compared to rural (Lopez and Winkler, 2018) which contributes to the likelihood of urban dwellers to have the high odds of pension uptake relative to rural settings.

CONCLUSION

In this study, farmers and fishers, traders, service providers, piece worker/casual labour, welfare, dependents, and females are less likely to uptake a pension. Persons aged forty years and above, persons in the middle and two highest quintiles of income, individuals with secondary and at least university level of education, and those in urban residences are more likely to uptake pension. The government, private sector and international organizations that are stakeholders to pension coverage should cooperate so that large population of the country and the world at large is covered by pension.

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Reasons for Patronage of Traditional Bone Setting as an Alternative to Orthodox Fracture Treatment A case of Muleba District, Kagera Tanzania

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ABSTRACT

The study examined the factors for the preference of Traditional Bone Setting (TBS) in the treatment of fractures among Tanzanians. It sought to unfold other reasons for consulting TBS practitioners besides poverty, ignorance and inaccessibility to modern orthopedic services which are commonly associated with the pull factors. From the available literature, though very popular, TBS is associated with complications like malunion, non-union of the fractured bones, and limb gangrene. In order to find out why there is a paradox, the investigation was mainly done in Muleba, a district of Kagera Region where the treatment is most common according to the Institute of Traditional and Alternative Medicine, at Muhimbili University of Health and Allied Sciences. The study revealed that the therapy management groups were often more vocal than their fractured individuals in deciding the model of treatment. And, the fractured people who are financially able, formally educated and geographically closer to orthopedic services are among the adherents of TBS. Besides, the respondents unanimously expressed their dislike of orthopedic amputation, Plaster of Paris (POP), internal and external fixation let alone the length of time spent in hospital for treatment. All these have significant implications including continued use of TBS by rural and urban people for themselves and livestock. Combining X-ray reading and alternative medicine makes TBS sustainable. Thus, in future, it is suggested TBS services be integrated to orthodox treatment so as to control its negative aspects while harnessing its positive aspects.

Key Words*:* Fracture(s), Traditional Bone Setting, traditional bone setters, orthopedic, orthodox treatment

INTRODUCTION

Traditional bone setting which is a traditional mode of treating fractures is gaining a number of adherents despite the development of scientific orthodox treatment and the complications which are normally accompanied by its use. Wedam and Amoah (2017), assert that traditional bone setting is a branch of traditional medicine which is deep-rooted in many countries across the world though with slight differences in style, name and practice from one region to another. In Tanzania, the practice is common in different regions and it is known by different names. For example, it is called *kayunga magufa in Muleba, Omubhunga Magufa in Karagwe* and *bhalungi maguwha among the Sukuma.*

Literature from different scholars such as Manjunatha (2016); Dada, Yinusa and Giwa (2011) and Sina *et al*. (2014), associate the adherence of traditional bone setting with high cost of orthodox treatment, ignorance of the adherents and inaccessibility of the orthodox treatment especially in rural areas. Based on Nigerian experience, Owumi *et al*. (2013) assert that traditional bone setting as an alternative health service is a recognized and specialized form of healing which is available and accessible to all people in rural and urban areas. It is admitted by scholars that traditional bone setting as a component of traditional medicine existed long before the advent of modern or orthodox treatment (*ibid*.). The same scholars show in the literature that orthodox practitioners are against the promotion of traditional bone setting (because of being unreliable and unscientific). Despite the impediments, the treatment still thrives to the extent of having fracture patients who leave orthodox treatment for traditional bone setting. The paper attempted to establish the reasons for adherence to traditional bone setting other than cost, ignorance and inaccessibility of orthodox treatment which are mostly proclaimed as a source of such a patronage. The said reasons are not refuted altogether. However, the said reasons seem not to accommodate all adherents of traditional bone setting who come from different backgrounds such as the affluent who can cover their treatment costs and the educated who are fond of traditional bone setting despite being aware of the complications which might arise out of its uses. The study also aimed at finding out why in some cases the majority of the contemporary fracture victims start by using orthodox treatment before they resort to ending their treatment with traditional bone setting if accessibility and

inaccessibility of orthodox treatment is the major cause of the patronage of traditional bone setting.

As earlier stated, the major reasons for the patronage of traditional bone setting are mostly associated with diversion from high costs of orthodox treatment, ignorance of patients and inaccessibility of orthodox health services especially in rural areas. Dada *et al*. (2009) identified two major reasons for the patronage of traditional bone setting namely cheaper and its accessibility to many people. Khan *et al*. (2015), in their study about the practice and preference of traditional bone setting, in addition to cost and accessibility, found out another reason as being cultural beliefs. The mentioned reasons for the patronage of traditional bone setting seem not to cut across all fracture patients who in fact, come from different backgrounds. The given reasons consider the fracture victims necessarily as being economically disabled, rural dwellers and uneducated. The facts/reasons for the patronage of traditional bone setting which came out of this study, in a way contradict the traditional reasons for the same (cost, ignorance and inaccessibility of orthodox treatment) in a sense that there are fracture victims who are financially capable of covering their treatment costs; in fact some of them are beneficiaries of health insurance. It is also vividly evident that some of the adherents of traditional bone setting begin fracture treatment with orthodox treatment before going to traditional bone setting. Hence, a question arises as to whether inaccessibility to orthodox health services counts. As regards ignorance of patients who visit traditional bone setting, Manjunatha (2016) observes that education has nothing to do with people patronizing traditional bone setting since the patients who attend traditional bone setting have different educational statuses.

Patients from all education levels use traditional bone setting at different times and places. Scholars such as Oluwadia (2015) asserts that the patronage of traditional bone setting cuts across social status, educational qualifications and religious beliefs. On the same opinion, Sina *et al*. (2015) asserts that, "in spite of the complications, TBS continues to have patronage from both the highly educated and the illiterate mainly because of culture, beliefs as well as overcrowding of hospitals with traumatic cases." The popularly mentioned reasons for the preference or use of traditional bone setting are not refuted altogether, they are good and sound but not for all the fracture patients. These reasons, therefore, enhance the need for studies that will accommodate patients from all backgrounds. Basing on the literature consulted and the researcher's

experience and interest, this current study about the patronage of traditional bone setting sought to identify the reasons other than those normally proclaimed and set as the benchmark for future studies about the therapy.

METHODOLOGY

The study involved a total of 103 respondents who were receiving TBS services at the time this study was conducted, or had at one time received fracture treatment at Kazirantemwe traditional bone setting clinic in Muleba, Kagera Tanzania. Since the study was qualitative, respondents were subjected to an in-depth interview in order to extract first-hand information from them. Other few respondents were identified through the information available at the centre (the patients' register) especially their phone numbers which facilitated their encounter with the researcher.

The researcher also interviewed five (four males and one female) different traditional bone setters from different areas of Muleba, a district which was purposely selected following the report from Institute of Traditional and Alternative Medicine, at Muhimbili University of Health and Allied Sciences which showed that TBS as a new area of research in Tanzania despite the fact TBS is applicable throughout the country and that Lake Victoria region is known to have a number of prominent registered traditional bone setters, one among them resides at Kazirantemwa, Muleba and attracts many fracture victims from all over the country the factor which influenced the sampling of Kazirantemwa Traditional bone Setting Centre. Convenience sampling was utilized to capture the fracture patients as well as their relatives who were visiting TBS services at the time of collecting data for this study. The study employed interview guide in order to elicit participants' opinions and perceptions about the reasons for patronizing traditional bone setting. Interview responses were tape recorded and transcribed. Later, qualitative analysis was subjected to respondents' explanatory responses which were later summarized and categorized according to their themes. Representative reliability was enhanced by using the same tool across the study to different groups.

Data was analyzed by applying cross-sectional indexing and non-cross-sectional indexing. On one hand, cross-sectional indexing obliged the author to read the entire text (transcribed data) and create labels or codes to the related data. Non cross-sectional indexing on the other hand was

employed to tape or identify scenarios or situations in the respondents' understanding which could later add new input to the study. Data analysis was accomplished at the end by matching or aligning the emerging factors from the respondents' understanding of health seeking behavior and objectives of the study.

FINDINGS

The findings of this study were organized into sub- themes according respondents' preference and reasons for their choice of traditional bone setting as their fracture treatment and in line with the specific objective of the study which needed to examine other factors for the patronage of TBS other than the commonly mentioned reasons which are matters concerning cost, ignorance and inaccessibility of orthodox health services. The major thing in this study was to examine the influence of cost, ignorance and inaccessibility of orthodox health treatment in influencing preference of traditional bone setting.

Table 1: Social demographic characteristics of the study participants

Variable	Label	Frequency	%
Gender	Male	87	84
	Female	16	16
Total		**103**	**100**
Occupation	Civil Servants	25	42
	Peasants	20	19
	Petty traders and Boda Boda (motorcyclists)	56	54
	Dependants	02	02
Total		**103**	**100**
Health Insurance	Insured	73	70
	Not insured	30	30
Education Level	Primary school level (standard seven)	18	17
	Secondary level and certificate level professional skills	74	71
	Diploma and graduate level	08	08
	Above graduate level	03	03
Total		**103**	**100**

According to the findings, out of one hundred and three respondents, only two asserted to have opted for traditional bone setting because of having insufficient funds and thus unable to attend the orthodox treatment. Despite being forced into traditional bone setting by lack of sufficient funds they did not regret or feel disadvantaged for being treated in a traditional way because they believed in the effectiveness of the treatment. Financial problem as a as a reason for the patronage of traditional bone setting cannot be neglected even though only two out of one hundred and three participants worried about it. The fact that ignorance (in the sense of patients having low education level) as one of the motives for the preference of traditional bone setting was also examined and it was found out that all the respondents had a certain level of education in the sense that some were primary school leavers, while others had secondary school education. The findings show that 74% of the respondents (71 out of 103) had secondary level education and their number made a big portion of the sample which participated in the study by reason of having attended the traditional bone setting. Regarding inaccessibility of orthodox health services as a reason that drove many victims of fracture to attend traditional bone setting instead of orthopedic treatment, the study found out that it ought not to be neglected despite the fact that it was rarely mentioned being one of the factors. As a matter of fact, no single respondent admitted not to have attended orthodox treatment because of its inaccessibility.

In fact, almost all respondents at one time or another attended hospital treatment. Actually, they started with hospital treatment before seeking alternative treatment. Quantitatively, only two patients out of a hundred and three (103) did not go to hospital. According to them (those two), cost and distance from hospital was not a reason that influenced their choices but rather a belief in the efficacy of traditional bone setting. The above findings indicate that high cost in using orthodox treatment, inaccessible orthodox health services and ignorance among the patients are some of the factors which influence fracture patients to opt for treatment by traditional bone setting. They were, however not mentioned by the patients as their pulling factors towards TBS. They were found to be minor. The study examined other reasons for the preference of traditional bone setting and organized them into five groups.

Persistence of illness

More than half of all the respondents (sixty-nine) left the orthodox treatment due to what they considered as persistence of illness. Their fracture took too long to heal when receiving the orthodox treatment. Some stayed in bed for months or years receiving orthodox treatment which made them start looking for an alternative treatment that could hasten their healing. One patient who had resorted to traditional bone setting after having been on orthodox treatment for a long time had this to say,

> "*The need to opt or choose traditional bone setting for fracture treatment is mainly caused by persistence of illness and lack of symptomatic relief after using modern medicine for a long time"*

This reaction expresses something similar to what was said by another fracture victim explaining why he had to leave the orthodox treatment in favour of traditional bone setting, he said,

> *"I did not abscond from hospital, but I was discharged after being admitted for three months, my leg wrapped in a plaster of Paris (POP). I left the hospital still in pains in my leg and the doctors had not told me to return for a check-up after another month. I could not bear the pains, I had to look for an alternative treatment because hospital treatment had taken too long without significant relief."*

Other reasons, more or less similar to those given above, were given by several other respondents who participated in the study. All those respondents who had previously reported to hospital did not assert the preference of traditional bone setting to have been caused by inaccessibility of orthodox health facilities. More than half of all respondents (73 out of 103) had health insurance; the other 30% of the respondents (103) had no health insurance but asserted that the cost of hospital treatment was not a problem or the cause for their shift from orthodox treatment to the traditional one.

Past Fracture Experience

Another paramount reason for the preference of patronage or use of traditional bone setting to the orthodox treatment is the past fracture history of a patient himself/herself or a relative. One remarkable example of such a patient who became interested in traditional bone setting as a result of past experience of other fracture treatments is a patient aged 59 who was involved in a *boda boda* accident and had a leg broken. He attended hospital treatment for two weeks and left the hospital for traditional bone setting. When explaining the reason for his decision, he said:

> "*Back in my twenties, my uncle was involved in an accident in which his legs were terribly broken. His fractures were severe than mine and we thought he would never walk. He was brought here at this same centre. I used to bring him food for a couple of months until he fully recovered. When I got this fracture, my first thought was to come here (at the traditional bone setter), but my relatives took me for hospital treatment where I stayed for two weeks. I insisted on being traditionally treated. I am now doing fine than I was doing at the hospital".*

During the time of interview, the patient referred to above, had stayed three months at the traditional bone setting centre. His hopes of getting healed were very high and he commented:

> *"I came here from hospital in a very serious condition, both legs had fractured. Even sitting was a problem but now I can stand on my own; only that I cannot walk yet. Nevertheless, I believe soon I will be walking as my uncle did."*

Other participants had more or less the same experience. They said they opted for traditional bone setting not because they didn't trust modern medicine but because of their past experience with the traditional bone setting through other fracture victims who were treated in the same manner or their own past experience of being healed by the traditional

bone setter. More than a third (36/103) of all the participants had the same reason for choosing traditional bone setting. One fracture patient had the same experience. He had a relative who was healed by the traditional bone setter; he had gone through the same process by reporting to the hospital but later abandoned the modern treatment for traditional bone setting. After he had spent about ninety days at the traditional bone setting centre, his leg bone had already had union when it was found out that the bone had a malunion and had to be broken again so as to allow proper bone alignment. Unfortunately, the method of breaking the already united bone was very manual and crude. The patient could not tolerate such pain and he opted to have an about turn to hospital. He narrated his experience saying,

> *"I was treated by the bone setter for three months and frankly speaking, I had a relief although the leg had a mal-union. He told me to break the leg again so that it may have a proper union. The problem is that they (traditional bone setters) do not use anaesthesia. I felt I would not bare the pain, so I went back to hospital where the leg was broken again, and was treated for another five months until I got healed as you see me now"*

He admitted being very fond of traditional bone setting and wished he could have used the treatment to an end, but he was discouraged by the barbaric way of breaking the already united pieces of bone in a leg. He still insists to have a belief in the efficacy of traditional bone setting and that always fracture patients tend to make their choice of fracture treatment in favour of traditional bone setting.

Fear of Internal and External Fixation

It was found out in this study that fear of internal or external fixation was a motive behind the choice of some of the fracture patients (participants) to opt for traditional bone setting as a method of treatment for their fractures. Twelve respondents left the orthodox fracture treatment because of the fear of having iron bars internally or externally inserted to support the union of a broken bone. According to the information gathered from the orthopedic surgeon, there are several ways of treating a broken bone, and one of the common ways is medically known as Open Reduction with External Fixation.

This is a procedure which involves placing an extended device on to the injured bone after surgery whereby a surgeon places metal pins or screws above the fracture site to support and immobilize the bones while it heals. The bars used for external fixation are locally termed and *"antena"* in Swahili trying to relate them with the television antenna. Patients have a belief that iron bars fixed in their bodies would in future be harmful. They believe that they might cause cancer and referred to their relatives thought to have been acquired cancer due to having the iron bars inserted in their bodies. External fixation is also disliked because it makes a patient uncomfortable for a long time. Some of the patients claimed that they delay the healing process.

Categorization of Illnesses according to their Treatment

It was interestingly found that some patients have 'readymade' choices to some of health problems. There are health problems which are said to be healed by traditional medicine and others which can be managed by orthodox medicine. As far as fractures are concerned, some patients said that some of the accidents are not caused by normal accidents but are sent or created by people with bad eyes. In that matter, they believed not all fractures are treated in hospital, some need traditional expertise. Despite the fact that the researcher did not find any of the respondents who claimed his or her accident to be caused by people with bad eyes yet some of them still recommended some of the health problems to be treated traditionally, fractures included.

What they think about such health problems resembles what Mbiti (1969) asserts that in some cases patients employ a particular method of treatment depending on their belief about the course of an illness. The same is also observed by Owumi *et al*. (2013) who assert that there is a belief that some diseases and accidents have spiritual components that need to be tackled along with traditional treatment. For example, it was a common phenomenon among the participants of this study to say that they left the hospital after the wound accompanying the fracture had been healed. This is because some patients have a belief that traditional bone setters do much better with fractures than they do with wounds which are well managed by modern treatment. It was also found out by the study that some patients left the orthodox treatment for traditional bone setting believing that the services given by both are equal only that orthodox treatment is too demanding in terms of time and the relationship between

the patient and physician is not balanced. Despite the cost incurred, a patient is considered a subordinate. Patients and their relatives were not happy with hospital routines and timetables such as time for visitation, fixed time for taking medicine, time to rest and the like. Traditional bone setting is relatively flexible hence attractive to facture victims.

Belief that Traditional Bone Setting Heals Quickly

A number of patients who participated in the study said they had left the orthodox treatment because it heals very slowly as compared to traditional bone setting. The same belief is also held by the traditional bone setters themselves who claim to have a treatment mechanism which fastens the healing process of the bone which is called a "bone union". One of the traditional bone setters commented;

> *"Patients come because we make them heal quickly; our treatment is not trial and error because we only deal with the problem which is manageable with our capacity".*

Some fracture patients also agree with the traditional bone setters that traditional bone setting works very quickly on the fractured bone. For instance, a patient who had left the hospital after two weeks of fracture treatment said,

> *"I did not leave the hospital without permission, but I was discharged after I was dressed with the POP and I was not told when I should go back to hospital. I saw it as a delay; that is why I decided to go for a popular traditional bone setter in the village. I went to him because of his history in treating many people with severe injury than mine. I witnessed that many people were healed quickly than those who stayed at the hospital for the same treatment."*

Some of the patients complained to have stayed long in hospital undergoing orthodox treatment but without significant improvement on their fractures. The same patients reported to have experienced quick union of the fractured bones when they started visiting the traditional bone setters. Such people created trust of the public in traditional bone setting. It is also evidently true that traditional bone setters do not advertise their services. Their fame spreads through such witnesses of the fracture patients and their relatives.

DISCUSSION

The study findings clearly articulate that not all fracture victims who choose to be treated by traditional bone setters do so out of ignorance, inaccessibility to health orthodox services or costs of treatment. The study also revealed that some fracture victims start treatment in hospital and end up using traditional treatment. It is also true that some other fracture victims start with traditional treatment and end up in hospital. From the findings, statistics show that more males visited TBS than females. This may be mainly because of the economic activities each group engages in. For example, to be precise, more than half of all the participants of this study who were petty traders and motorcyclists and thus more prone to accidents, were men. That shows why a bigger number of men attended the traditional bone setting. The study revealed that a good number of traditional bone setter attendees were not much faced by cost implications as far as orthodox medicine is concerned, because they were insured. Seventy percent of the participants had health insurance, either directly or indirectly (being a beneficially of an insured person). Traditional bone setter adherents in this study were found to belong to a group of people who are fairly educated to a level above that of secondary school. Only 17% of the participants were primary school leavers. This implies that education plays little or no role in the selection of treatment and in this case, fractures treatment as it was reported by Baffour-awuah, Acheampong and Francis (2018) that education level plays an insignificant role in health seeking behaviour. As per researcher's findings, the health seeking behavior is greatly influenced by the 'need to recover' which in turn determines the means.

Since the 'need to recover' seems to be the drive towards seeking ways of getting better and efficient treatment, a patient is influenced by several factors before he/she selects a type of treatment or changes the type of treatment when one is dissatisfied with the treatment given. This can be well explained by an incident whereby an affluent and well-educated person who flew all the way from Muscat where he lives to Muleba, a study area, to see a traditional bone setter, after having attended treatment in the best orthopedic departments he had been to for a long time but with no positive progress. The 'need to recover' and to recover very quickly is supplemented by the 'Persistence of illness'. Once an illness persists for a long time, a patient loses patience and begins to think of looking for an

alternative treatment. Such an idea makes a patient start questioning the orthodox treatment as being the cause of his 'healing delays'. This explains why a good number of respondents who started their treatment in hospital ultimately left for traditional bone setting. The reason behind their shift was "*Nilikaa muda mrefu hopitali, ila nikaona kama sipati nafuu, ndio maana nimekuja huku"* (I stayed at the hospital for a long time without relief, that is why I came here). Something in common among them was lack of patience. The same is expressed by the orthopedic surgeon who is very upset by the exodus of fracture patients from hospitals to traditional bone setters when commenting that "they have no patience; they must know that the process of a bone union (a proper union) is not done overnight". A campaign is suggested by the researcher to the general public about fractures and their treatment so that people may be aware of the treatment process. 'Hear say' and past experience of people who had had fractures and went to traditional bone setters play a big role in influencing those who are sometimes desperate after having been in treatment in hospitals for a long time.

It has also been revealed by the study that most of the times those stories are always positive. Negative side effects of traditional bone setting such as complications associated with it are not aired out. The stories are so sweet that they attract patients to exit from orthodox treatment. It was found out in the study that only two (2) fracture victims out of one hundred and three (103) who participated in the study reported at the hospital before shifting to traditional bone setters. The phenomenon is not by accident but implies that fracture victims and their relatives consider the orthodox treatment (as far as fracture is concerned) as an emergence treatment which is useful for first aid, diagnosis and pain reliever. Having all that done they find their way to the traditional bone setters. This means nothing than the fact that the members of the public are aware of the efficiency of orthodox treatment in diagnosis of the illness. The same people have a belief that traditional bone setters heal better and quickly than the orthodox treatment does. It is also a plea of a researcher that a general public be helped to shift the "belief" from tradition bone setting to orthodox healing in order to avoid complications which are accompanied by the traditional treatment. According to Kumma *et al*. (2013), the majority believe in the importance of the role of traditional bone setting in fracture treatment despite the fact that the treatment is associated with a lot of complications which might be avoided by the orthopedic treatments. It is evident that people have incorporated their health seeking behaviour to their culture hence, made it hard to change in some of the

perspectives about treatment.

In that line, Varnum *et al*. (2017), assert that there are possible features that facilitate or impede cultural change which include things like tight against loose social norms, whether the society is relatively isolated versus frequent contacts with other cultures and the like; all may affect the degree to which culture is stable or malleable. In the case of this study, it is obvious that the employment of the traditional bone setting is a component culture and health seeking behaviour and is very stable.
This is expressed by the component of the adherents of the traditional bone setting as they come from different social backgrounds (the rich and the poor; the educated and the non-educated; rural and urban dwellers; to mention but a few). A lot of campaigns are needed to make the change possible. It was also revealed that not all fracture victims who visit the traditional bone setters get healed. Some of them go back to hospitals after facing complications when using the traditional fracture treatment. The complications include malunion which necessitates the bone to be broken again so that it may be realigned. The traditional bone setter does that manually without using anaesthesia. The researcher interviewed a few victims, two out of one hundred and three to be exact, who faced this situation and had to return to hospital from which they had earlier vacated. This implies that traditional bone setting, despite being patronized by some of the fracture victims, is not safe per se. In addition, it was found out that traditional bone setters have no prescribed fee to be paid by the patient. This is because they believe their ancestors handled them treatment for free and it should be served to others for free. However, the service is not free per se but a patient is let free to decide what to offer or what one can manage. Before treatment starts, a patient is obliged to pay a small fee which locally goes by the name *entela bishaka* which can be translated as bush clearing fee. After the treatment has been completed the patient offers another fee out of what he can afford, however small. This after treatment fee is called *entashurano* or parting fee. This makes the traditional bone setters to earn very little from the trade which in turn makes it impossible for them to develop in terms of innovations and technological advancement. In short, the trade is static. A kind of integration between traditional and orthopedic bone setting needs to be introduced in order to reduce complications which are associated with traditional bone setting.

CONCLUSION AND RECOMMENDATIONS

It has been clearly found that traditional bone setting is patronized by patients from different backgrounds in terms of education, occupation, income and residence. However, it is also evident that it is accompanied by several complications which sometimes face the users of the treatment. To avoid these complications, it is suggested that a massive campaign which aims at synthesizing about the causes and treatment of fractures be launched all over the country. Secondly, it has been observed that the Council of Traditional and Alternative Health Practitioners of Tanzania engages itself in matters of registration of traditional bone setters. This helps to identify them and know where they are but does not go further to finding out what and how they do their activities. Some trainings should be conducted with the traditional bone setters and of course other traditional healers. This will in a way avoid the complications which traditional bone setter cause to the patients unknowingly. The study gives credit on the traditional bone setters who participated in this study for their adherence to their ethical code of conduct especially, non-publicity for their activities. No poster or any advertisement was found which aimed at influencing the patients to use their services. Though the study did not go into the details of efficacy of the traditional bone setting, it is likely that in some cases, it works. And that is a reason for its patronage by people from different backgrounds.

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Plastic Packaging Materials as Possible Source of Hazardous Chemicals to Food and human health: A Review

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ABSTRACT

Plastic packaging has been implicated as a source of food packaging material (FPM) borne compounds transfer into food. These chemical migrants from packaging materials to food products are associated with human health risks. However, opinions on plastic packaging safety differ greatly and scientific agreement on product safety is still indefinable. The present review intends to explore and present the state of science about the safety of plastics, the potential for consumer exposure and discuss the major issues with respect to associated health risks safety.

Key words: Plastic packaging, chemical migrants, plastic packaging safety, health risk, consumer exposure

INTRODUCTION

Food packaging has become a modern civilization culture due to the importance and functional roles of packaging materials; as such nearly all food stuff available on market are packaged. There are numerous packaging materials but each of which provides different advantages, however, of interest in the present write up is plastic packaging materials (PPM). Plastic packages constitute the largest fraction of food packaging materials due to their flexibility, portability (light weight), inert nature, durability, versatility, their potential for diverse applications (Proshad *et al.*, 2018) and other advantages over other packaging materials. It is indicated that the number of plastics produced globally in the first decade of the present century is comparable to the total world production in the century earlier (Mathur *et al.*, 2014). According to GEF (2018) the making of plastics increased by more than twenty-fold between 1964 and 2015, with yearly output of 322 million metric tonnes (Mt), and is projected to double by 2035, and almost quadruple by 2050. By definition, plastics are polymer chains of molecules (usually made of

carbon, hydrogen, oxygen, and/or silicon) which are hooked or joined together. The raw materials for making polymers include petroleum-based products and other products, which are heated together under pre-determined conditions (Halden, 2010). Monomers are the building units of polymers and determinant of their polymeric properties. Different combinations of monomers produce plastic resins with different characteristics, such as strength or molding capability (Halden, 2010).

Plastic materials used in packaging are greatly varied in their chemical structure, offering dissimilar properties based on the processing, incorporated additives and combination with other polymers (Tatiane *et al.*, 2018). Several categories of additives, such as antioxidants, stabilizers, lubricants, anti-static, anti-blocking agents etc., have been produced to advance the performance of polymeric packaging materials (Al-Dayel *et al.*, 2012). Additive materials enrich plastics with such properties like elasticity, flexibility and resistance to breakage and transparency to light (Al-Dayel *et al.*, 2012). The addition of plasticizers, antioxidants, fillers, flare retardants, and colorings to plastic polymers imparts preferred functionalities and generates hundreds of different assortments of plastic materials of deviating properties (Halden 2010). It is also indicated that such additives like antioxidants, ultraviolet (UV) stabilizers or plasticizers (softeners) are compulsory to (i) safeguard packaging material from UV power-driven or oxidative deterioration, (ii) increase softness and (iii) enhance the general appearance or quality of the plastic package. Nonetheless, additives are non-covalently bound to the polymer and are consequently vulnerable to migration when subjected to heat or during long-term storage (Mathur *et al.*, 2014). Several contributions in the literature (Tatiane *et al.*, 2018) illustrate that there is likelihood of migration of components from the packaging to the product.

Key findings documented by FSANZ (2014) on chemical migration from packaging into food (CMPF) indicate availability of evidences on the migration of chemical into food from packaging. They concluded that unintentional leaching of certain chemicals from packaging could pose a health risk to community but there is a high degree of doubt about the exact nature of the problem. It is also reported by Mathur *et al.* (2014) that though plastic polymers are not regarded as toxic, there could be toxic residual remnant chemicals, chemical additives and decomposition products in the plastic products that can leach out since are not bound to

the plastic polymer. Halden (2010) associated human health risks with plastics monomeric building units notably bisphenol A (BPA), their additives e.g., plasticizers and a blend of the two e.g., antimicrobial polycarbonate. As such, the present review intended to examine the potential health risks associated with chemical migration into food from plastic packaging.

METHODOLOGY

The current work employed a narrative review to provide an insight on health implications that are associated with PPM under the following methodological review approach:

(a) Brief description of different types of plastic packaging including their categorization based on assigned number codes, highlighting the composition, uses and safety implication.
(b) Discussion on the monomeric building units and/ or additives (e.g. BPA, phthalates, etc.) with great potential for adverse human health risks.
(c) Explanation of the ways through which human exposure to chemicals migrating from plastic packages can occur and factors affecting their migration.
(d) Description of the underlined potential health risks due to plastic packaging chemical migrations into foods.
(e) Description of the established main observations from the revisited literature.

The data collection was achieved through searching a variety of relevant literatures from different electronic sources of scientific literature (PubMed, Google Scholar) and "grey" literature (government publications, trade body and industrial collections). Several keywords were used during search, either individually or in combinations; under which the articles were sought and finally selected. Examples of key words include plastic packaging, plasticisers, additives, chemical migration, health risks of plastic package and bisphenol A.

FINDINGS AND DISCUSSION

Types of Plastic Packaging

Plastics can be divided into two major categories namely (i) thermoset or thermosetting plastic and (ii) thermoplastics.

(i) Thermoset or Thermosetting Plastics

Thermoset are materials which stay in a stable solid state after being cured once. Polymers inside the material cross-link in the course of curing process to make an unbreakable, irreversible bond. This implies that thermosets won't melt even when exposed to exceedingly high temperatures **(**ROMEORIM, undated**).** Thermoset are valuable due to their hardness, strength and durability. They are used mostly for aircraft parts, auto parts, tires and constructions applications (Halden, 2010). Additional uses include adhesives, inks, and coatings (Halden, 2010). Examples include silicone, epoxy, phenolic and polyurethane. In addition, some materials such as polyester can occur in both thermoplastic and thermoset versions **(**ROMEORIM, undated).

(ii) Thermoplastics

A thermoplastic is any plastic material which melts into a soft, flexible form beyond a certain temperature and hardens upon cooling. In contrast to thermoset, thermoplastics can be re-melted and re-shaped several times **(**ROMEORIM, undated)**.** Thermoplastic molecules are held together by weak bonds, making plastics soften upon heating and return to their original form at room temperature (Halden, 2010). They can be easily moulded, shaped and extruded into films, fibers, packaging and products such as milk jugs, floor coverings, credit cards, and carpet fibers (Freudenrich, 2007; Halden, 2010). Examples include polypropylene (PP), polyethylene (PE), and polyvinyl chloride (PVC) (Freudenrich, 2007).

Classification of Plastics based on Number Code

Plastics are categorized in seven main categories based on the classification system established by the Society of the Plastic Industry (SPI) namely SPI or number code. The SPI code ranges from 1 – 7 and

the SPI code on each plastic product is commonly molded into the bottom (Yadav, undated). However, from personal observation sometimes the SPI code is placed on the label of the plastic packaging. The description of each of this category is given below.

Polyethylene Terephthalate (PET) – Type 1

Polyethylene terephthalate is usually abbreviated PET. It is the most common thermoplastic polymer resin of the polyester clan (Mepex Consult AS, 2017). An alternative abbreviation PETE originates from Polyethylene Terephthalate Ethylene (Schuler, 2008). PET is biodegradable and semi-crystalline. PET is a clear tough plastic with good gas and moisture barrier properties and in some instances, there is little need for additional barriers (Mepex Consult AS, 2017). It exhibits some exceptional characteristics superior to other types such as distinctive appearance, food grade i.e., non-toxic, chemical resistance, good creep resistance, impact resistance, unbreakable and recyclability. PET is frequently used in making disposable containers or bottles for liquids, soft drinks and foods such as water, various types of juice, butter, salad dressing, vegetable oil, mouthwash, detergents, cleaner, cosmetics, etc. (Schuler, 2008; Proshad *et al.,* 2018), jars and tubs, thermoformed trays and bags and snack wrappers because it is strong, heat resistant and resistant to gases and acidic foods (Mathur *et al.*, 2014) and it is manufactured for single use only (Proshad *et al.*, 2018). It can be either transparent or opaque (Mathur *et al.,* 2014).

High-Density Polyethylene (HDPE) – Type 2

Polyethylene is the most used plastic in the world. HDPE is a harder plastic with a higher melting point than low density polyethylene (LDPE) (Freudenrich, 2007), (see Type 4) and it is stiff and strong (Mathur *et al.*, 2014). It is made from petroleum product, giving rise to a heat-resistant plastic (Proshad *et al.,* 2018). It has a clear and even surface and has some good barrier characteristics; nonetheless it is not a good barrier to oxygen. However, if enriched with polyamide (nylon) – (PA) or other additives, HDPE becomes a good barrier against gases. It is similarly durable against shocks and heat (Mepex Consult AS, 2017).

According to Proshad *et al.* (2018) HDPE does not contain harmful BPA or phthalates and is presumed to have no identified health risk for food use. Compared to PET, HDPE made container is regarded safer for food

and drink (Proshad *et al.,* 2018). HDPE is used in making opaque plastic milk, juice and water bottles and jugs, bottles for bleach, detergent (household cleaner containers) and shampoo, some plastic bags (Schuler, 2008), cereal box liners and several other types of bottles and tubs (Mepex Consult AS, 2017). Furthermore, HDPE is used in making toys, various types of plastic grocery, rubbish and retail bags (Mathur *et al.,* 2014; Proshad *et al.,* 2018). Nevertheless, HDPE is heat sensitive as it melts at a relatively low temperature (Mathur *et al.,* 2014).

Polyvinyl Chloride (PVC or V) – Type 3

PVC is a thermoplastic that is made by polymerization of vinyl chloride (Freudenrich, 2007). It's however, fragile as such it requires additives and stabilizers to make it useable (Freudenrich, 2007; Schuler, 2008). Usually, phthalates or adipates are used as plasticizers to make PVC flexible and mouldable (Mathur *et al.,* 2014). However, phthalates are harmful to human upon exposure. Plasticized PVC pipes contain phthalates and many other toxic chemical substances including BPA, lead, dioxin and cadmium (Proshad *et al.,* 2018). While plasticizers are added for softening and creating flexibility, lead is often added for strength. These toxic additives contribute to pollution and human exposure (Schuler, 2008). PVC are used for making containers for fruit juice and cooking oil (Proshad *et al.,* 2018), peanut butter containers, cling wrap, and bottles for plastic squeeze, detergent and window cleaners (Schuler, 2008), making pipes and plumbing (Freudenrich, 2007), as well as commercial-grade cling films for over-wrap of trays in supermarkets and filled rolls at delicatessens (Mathur *et al.* 2014).

Low Density Polyethylene (LDPE) – Type 4

LDPE is a thermoplastic made from the monomer ethylene. It is the most common polymer in plastics. In LDPE, the polymer strands are interlinked and loosely organized, so it is soft and flexible (Freudenrich, 2007). It is a 'heat-resistant' polymer, which can be both clear and opaque (Proshad *et al.,* 2018). It is used in making grocery store bags, zip-lock bags, most plastic wraps, bottles (Schuler, 2008), films of various sorts (including domestic/ household cling film) (Mathur *et al.,* 2014), disposable gloves, garbage bags (Freudenrich, 2007), freezer bags, juices

and milk cartons (Proshad *et al.,* 2018), bread bags, flexible lids and squeezable food bottles (Mathur *et al.,* 2014). It is presumed that LDPE do not contain any harmful components and are therefore safe for food and beverages uses (Proshad *et al.,* 2018).

Polypropylene (PP) – Type 5

Polypropylene is a type of plastic polymer, which is prepared from propylene monomers (Freudenrich, 2007). PP is usually harder, strong, hydrophobic, more heat resistant, denser and more transparent than polyethylene (Mathur *et al*., 2014; Proshad *et al.,* 2018) and has a high melting point (Mepex Consult AS, 2017). The different forms of polypropylene have dissimilar melting points and hardness (Freudenrich, 2007). PP has low oxygen barrier quality and is thus frequently used in packaging that does not need a specific oxygen barrier (Mepex Consult AS, 2017). It is typically used for packing yogurt, beverage, ketchup, medicine (Proshad *et al.,* 2018), soup, syrup containers, straws and for making baby bottles (Schuler, 2008), car trim, battery cases, bottles, tubes, filaments and bags (Freudenrich, 2017) microwavable packaging and sauce and salad dressing bottles (Mathur *et al.*, 2014). It is a good material for storing acids, bases and other solvents (Mepex Consult AS, 2017). Like LDPE, PP containers are considered safe since no harmful substances are found in food or water and beverages from PP plastic (Proshad *et al.,* 2018).

Polystyrene (PS) - Type 6

Polystyrene is made of styrene molecules (Freudenrich, 2007). According to Proshad *et al.* (2018) styrene is very risky for health. The International Agency for Research on Cancer (IARC) has acknowledged that styrene is human carcinogen (Proshad *et al.* 2018). PS is used in several applications, though its use is declining. It is used for production of containers such as pots, clamshells, bottles, lids, food trays and opaque disposable cutleries. PS is regularly found in compact disc cases, egg cartons, meat trays, carry-out containers, and disposable plates, bowls and cups (Mepex Consult AS, 2017; Schuler, 2008). It is also extensively used in producing packaging and insulating materials (Proshad *et al*., 2018). PP can make hard impact-resistant plastics for cabinets (for computer monitors and TVs), furniture, glasses and utensils. Once polystyrene is heated and air blown through the mixture, stryfoam is formed, which is used in making styrofoam based items (Schuler, 2008). Styrofoam is lightweight, moldable and an excellent insulator

(Freudenrich, 2007) that has a good stability for heat, though it is not flame retardant (Mepex Consult AS, 2017).

Polycarbonate (PC) – Type 7

With exception of the types already mentioned, all the remaining plastics are labelled as Type 7 plastics. Polycarbonate container is made of BPA, which can leach out into beverage or food stored in them. Owing to the BPA's health risk reflected in multiple studies, the use of type 7 or polycarbonate plastic materials has of late declined greatly (Proshad *et al.,* 2018). Polycarbonate is essentially used for packaging consumer goods (Proshad *et al.,* 2018). It is clear, durable and heat resistant and normally used as a replacement for glass in objects like refillable water bottles, sterilisable baby bottles (Mathur *et al.,* 2014), "sippy" cups, baby food jars, plastic dinnerware and clear plastic cutlery (Schuler, 2008). PC is also at times used in epoxy-based lacquers on the inner part of food and drink cans to inhibit the contents reacting with the metal of the can (Mathur *et al.*, 2014). The assigned number codes are used internationally as described in Table 1. The code number provides a guide to consumers and recyclers to identify and verify each plastic product (Yadav, undated).

Table 1: Different types of plastics and their classification

SPI Code	Name and Abbreviation	Density	Properties	Usage area
	Polyethylene terephthalate (PET)	1.34 – 1.39	• Clear & smooth surface • Barrier against air & water • Durable against shocks & heat	Widely used for drink & detergent bottles bottles, but also as packaging for other products including trays & cups
	High Density Polyethylene (HDPE)	0.91 – 0.94	• Rigid & tough materials • Good properties in terms of solvents • Stretchable	Widely used for bottles, also for chemical products. Heavily used in building materials & in car parts

	Polyvinylchloride (PVC)	1.16 – 1.30	• Resistant against fats and oils • Very strong material	Mainly used within construction for pipes, flooring, but also for garden furniture, shower curtains & toys. Found in rigid & soft products
	Low Density Polyethylene (LDPE)	0.90 – 0.92	• Soft, flexible, waxy surface, scratches easily, translucent	Garbage bags, squeeze bottles, black irrigation tube, silage & much films, rubbish bins, shrink wrap, food packaging
	Poly propylene (PP)	0.90 – 0.92	• Good container for acids, alkalis & solvents • A strong material with high melting point	Moulded products for buildings & cars. Flexible and rigid packaging products, straws, lunch boxes, compost bins
	Polystyrene (PS)	1.04 – 1.09	• Good protection against liquids that have a short life time • Rigid & foam shaped • Poor transporter of heat • Low melting temperature	Other used for food packaging and for drinks e.g., water cups, safety helmets, brittle toys
	Acrylonitrile butadiene styrene, (ABS) Polyamide (PA) Polymethyl methacrylate	Other plastic[181] types and laminates 1.13 – 1.15	• A range of different types of plastics with varying properties	Products that are based on other types of plastic or a combination of plastics, for instance laminated plastics used for packaging

Source: **(**Schuler, 2008; Plastic New Zealand, 2009; Grigore, 2017)

Safer Choices of Plastics for Food and Beverage

According to Schuler (2008) and Proshad *et al.* (2018) safer plastics for food and beverage include PETE (Type 1), HDPE (Type 2), LDPE (Type 4) and PP (Type 5), whereas plastics to be avoided include PVC (Type 3), PS (Type 6) and PC (Type 7). This implies that the basic knowledge about plastic classification based on SPI or number code is important to the consumers from the food safety perspective.

Monomeric with Potential Health Risks

As indicated earlier, plastics play a great role in almost every phase of food production and preparation. Food is processed on plastic equipment, and packed and dispatched in plastic containers or plastic-lined boxes and cans. Similarly, at household level, foods are stored in and leftovers reheated in plastic containers (Mathur *et al.,* 2014) whose building slabs are monomers. It is accepted that plastic polymers on their own are non-toxic since are unreactive and their big size restricts transport through biological membranes (Mathur *et al.,* 2014). According to Proshad *et al.* (2018) human health risks due to plastics can originate from their monomeric building units (e.g., Bisphenol A), their additives (e.g., phthalates) or from a combination of the two (e.g., antimicrobial polycarbonate). Among the numerous toxic materials generated by plastics, constituents and additives of principal concern are Bisphenol A (BPA) and phthalates which is the focus of the present review.

Bisphenol A (BPA)

As presented before, BPA is among the Food Contact Materials (FCMs), implying that it is used in the preparation of plastics for the production of materials that have direct interaction with food (Konieczna *et al.,* 2015). It is a building block of polycarbonate plastics and a common additive of PVC (Halden, 2010). In the course of polymerization, BPA tends to leave some unbound monomers, which can be released from packages into food and drinks over time. When plastics degrade, they can release BPA through normal use and/ or due to high temperature and exposure to alkaline or acidic solutions foods and beverage products (Halden, 2010; Lee *et al.,* 2016). Repeated washing of packages similarly accelerates leaching (Halden, 2010). Food and drinks stored in such containers

including the ubiquitous clear water bottles can have a trace amount of BPA (Proshad *et al.,* 2018). According to Lee *et al.* (2016) the daily human intake of BPA is ~ 1 µg/kg/bw.

Phthalates

Phthalates is an assemblage of organic lipophilic chemicals fundamentally used as plasticizers. Phthalate plasticizers (PAE's) are defined as benzene-di-carboxylic acid esters with dissimilar degrees of toxic results particularly endocrine disrupting changes (Saad *et al.,* 2015). Phthalates are extensively used as plasticizers in PVC products. Phthalates are non-covalently bonded with PVC; thus, they are free to migrate and are released into the surroundings by direct release, evaporation, migration, leakage and abrasion (Lee *et al.,* 2016). As a result, phthalates are capable of transferring into food, drink, skin, and the environment. The daily human intake is ~ 0.1-2 µg/kg/bw (Lee *et al.,* 2016).

Chemicals Migrating from Plastic Packages

People may be exposed to Food Package Material (FPM) migrating chemicals e.g., phthalates and others (Table 2) through different routes such as ingestion, inhalation, and absorption through the skin, that is, dermal exposure (Saad *et al.,* 2015) or parenteral administration (Mathur *et al.,* 2014). Both dermal exposure and inhalation are normal to short chain phthalates such as dimethyl and diethyl phthalates (DMP and DEP) owing to the day-to-day usage of soap, shampoo, conditioner and other personal care products. Oral exposure is largely due to consumption of phthalate-contaminated food with the long chain phthalates like di-ethylhexyl and di-*n*-octyl phthalates (DEHP and DOP).

However, human exposure to phthalate esters mostly arises through dietary intake, particularly plastic packaged foods owing to the weak covalent bond between phthalates and their parent materials (polymer) which cause release and bioaccumulation of phthalate esters into the packaged foods (Saad *et al.,* 2015). Direct interaction with food for primary packaging has been recognized as the major way in which chemical migration occurs. The migration of additives or contaminants from polymeric food packaging to food could be through three different, but inter-related, phases namely (i) diffusion within the polymer, (ii) solvation (association) at the polymer food interface, and (ii) dispersion

into bulk food. The migration has been demonstrated to increase with increasing food fat content and storage temperature (Al-Dayel *et al.*, 2012). Table 2 presents substances likely to migrate from food packaging materials to food.

Table 2: Overview of substances migrating from FPM

Type	Class of substance	Substance	FPM/ Use
IAS	Plastic monomers	Vinyl chloride	PVC
		Acrylamide	Polyacrylamide
		caprolactam	Polyamide
		6-aminohexanoic acid	polyamides
		p-hydroxybenzoic acid	Polyesters
		2-hydroxy-6-naphthoic acid	Polyesters
	Metals	Aluminum	Aluminum foil
	Plastifiers, monomers etc.		Plastic polymers, coated aluminum cans, coated paper / cardboard
	Dyes		Paper / cardboard
	Antioxidants		Plastic polymers
	Plastifiers	Bisphenol A, phthalates	Plastic polymers
	Photo-initiators	2-isopropylthioxanthone	Paper / cardboard
	Water / fat repellents	Perfluorinated acids etc.	Paper / cardboard
NIAS	Mineral oils	MOSH / MOAH	Recycled paper / cardboard

Source: Schrenk, D (2014); IAS - Intentionally Added Substances, NIAS - No-intentionally Added Substances (NIAS)

Factors affecting Chemical Migration into Food

The migration of chemicals from packaging materials into food and drink is a complex phenomenon that is influenced by several factors (Almeida *et al.*, 2018). The size of migrating chemical is among the determining factors. Chemical molecules or ions with small or less than 1000 Daltons are likely to leach into food (FSANZ, 2014). Ever since the non-

polymeric compounds mostly are of low molecular weight and are either delicately bound or not bound completely to the polymeric macro-molecules, they or their degradation products, can be detached from the plastic product to other contact media e.g., food, water and beverages (Mathur *et al.*, 2014).

The incompleteness of the polymerization process enables BPA monomer residues to migrate into food in the course of storage and processing at high temperatures in bottles or other containers (Almeida *et al.*, 2018). Chemical composition of food also affects the migration rate of the contaminants. For example, polarity and functional properties of the food packaging material like crystallinity and permeability may alter the migration of the additive or plasticizer into the food. Furthermore, the amount of fat in the food is vital in determining the rate of migration since most packaging chemicals are lipophilic (that is, dissolve readily in fat); thus, can freely migrate into fat foods at superior rates and levels (FSANZ, 2014). Chemical migration is also influenced by product filling conditions, storage environments, shelf life and food product: pack ratio. Impairment to the food product packaging might potentially lead to greater chemical migration through alterations in ambient oxygen, moisture, light and temperature (FSANZ, 2014). Almeida *et al.* (2018) further highlights other influencing factors to include the specific interaction between packaging material and food (direct or indirect contact), interaction time (since the concentration of the migratory chemical element in food is directly proportional to the square root of the interaction time), temperature during contact (higher temperatures appear to be associated with a higher migration rate due to increased diffusion rate), type of packaging / food contact material (finer packages are associated with higher migration rates) and the nature and amount of the compound migrating into food and drink (Almeida *et al*., 2018). The transfer of BPA from food contact materials to food is amplified by heating, contact with alkaline or acidic substances, excessive use, and exposure to microwaves (Almeida *et al.*, 2018). Chemical migration from a variety of plastic packages into food products have been demonstrated by several researchers (Zugravu and Cilincă, 2009; Tatiane *et al.*, 2018). This generally implies that though other factors can hardly be controlled, others can be controlled to minimize the rate of chemical migration and hence human exposure through ingestion.

Potential Health Risks due BPA and Phthalates Migration to Food

The functional role of food and beverage packaging as a source of pollutants has caused many concerns due to their extensive use. These pollutants originate from Food Packaging Material (FPM) constituents (monomers and other raw materials, additives, residues) which migrate from the packaging into the food (Al-Dayel *et al.,* 2012). It has also been indicated that some additives comprise of heavy metals (lead, cobalt, nickel, copper, etc.), highly toxic phthalates (Dibutyl phtalate or DBP) and other non-intentionally added substances (Lahimer *et al.,* 2013). However, the ingredients on which most health concerns have been placed to are BPA, which is applied in tough polycarbonate products and epoxy resins which line tin cans and a group of plastic softeners termed phthalates (Mathur *et al.,* 2014). Their health risks to human have attracted many investigations which have led to the accumulation of literatures in connection with human exposure to these compounds.

Bisphenol A (BPA)

BPA is regarded an endocrine disruptor and there is a relationship between exposure to BPA and the appearance of adverse health effects (Almeida *et al.,* 2018), such as cancer, infertility, diabetes, and obesity, among others. BPA has been shown to interact with estrogen receptors and act as agonist or antagonist through endocrine receptor (ER) dependent signaling pathways due to its phenolic structure. Lee *et al.* (2016) have also documented that BPA displays hormone like properties which might interrupt endocrine system function, obesity, cancer, heart disease, neurological effects, reproductive and sexual development deviation.

According to Warner and Flaws (2018) more hormones in the body can be interrupted by imitators in addition to estrogen. For instance, BPA can bind to androgen, estrogen, thyroid, estrogen-related, and peroxisome proliferator-activated receptors. More evidences have been documented by the European Parliament (2019) which implicates BPA to interact with a good number of nuclear receptors, including oestrogen receptors. Even though the intensity of the binding of BPA with the oestrogen receptor is

much weaker than that of natural (endogenous) oestrogen, this multiplicity of the receptors (some binding to BPA with strong affinity) and indicating pathways that may be activated or influenced by BPA could describe the great number of biological and health parameters likely to be influenced by BPA at very low doses. According to Konieczna *et al.* (2015), BPA play a role in the development of several endocrine disorders including female and male infertility, precocious puberty, hormone dependent tumours such as breast and prostate cancer and several metabolic disorders including polycystic ovary syndrome (PCOS). Elevated levels of urinary BPA concentration were correlated with a decreased number of sperm in the ejaculate, as well as its decreased motility and viability.

Studies experimented in men with prostate cancer revealed a much higher concentration of BPA in the urine of those patients in comparison with the control group (Konieczna *et al.*, 2015). Furthermore, BPA has been associated with obesity. Results from animal studies have been correlated with prenatal exposure to endocrine disrupting chemicals, BPA inclusive, and the incidences of obesity, impaired glucose tolerance and lipid metabolism in mice. Mice subjected to 10 mg BPA/kg body weight per day had greater concentrations of plasma triglycerides, and elevated body weight in four months of age as compared to the control group (Konieczna *et al.*, 2015). The relationship between obesity and plasma triglyceride concentrations has been demonstrated elsewhere (Després *et al.*, 1989). Their results documented significantly higher plasma levels of very low-density lipoprotein triglyceride (VLDL-TG), low density lipoprotein-cholesterol (LDL-CHOL), LDL-TG, LDL-apolipoprotein (apo) B and reduced high density lipoprotein-cholesterol (HDL-CHOL) levels in obese women compared to non-obese controls. As per Almeida *et al.* (2018), BPA being lipophilic, it can accumulate in adipose tissue which could also explain the levels of plasma triglycerides. According to Kelly *et al.* (2015) since BPA can be detoxified by the body and does not normally accumulate, it is debatable whether or not its serum concentrations can be high enough to affect the normal estrogen related functions. However, Calafat *et al.* (2005) in evaluating urinary concentration of BPA reported the detection of BPA in 95% of the samples studied at concentrations ≥0.1 μg/L urine; the geometric mean and median concentrations were 1.33 μg/L (1.36 μg/g creatinine) and 1.28 μg/L (1.32 μg/g creatinine), respectively; the 95th percentile concentration was 5.18 μg/L (7.95 μg/gcreatinine). On the other hand, Teeguarden *at al.* (2013) demonstrated the convergence of robust methods for measuring or

calculating BPA serum concentration from several published research outcomes.

They reported that characteristic serum BPA concentrations are in orders of magnitude lower than levels quantifiable by modern analytical techniques and below concentrations desired to occupy more than 0.0009% of Type II Estrogen Binding Sites, GPR30, ERα or ERβ receptors. Their results illustrated inadequate or no potential for estrogenicity in humans which in turn poses questions to reports of quantifiable BPA in human serum. Moreover, according to FSANZ (2014) migration of chemical from packaging to food are characteristically too little to cause acute adverse health effects. But, repeated dietary exposure to migrating chemicals over a long period could results to chronic exposure (FSANZ, 2014). It can thus be presumed that regardless of the low levels of migrating contaminants, the total exposure and health risks will depend on their overall accumulation overtime and toxicity level. Such accumulations of chemicals have been demonstrated in earlier studies (Almeida *et al.*, 2018). Moreover, according to Warner and Flaws (2018) the prototype of "the dose makes the poison" does not apply to BPA, phthalates, and other endocrine disrupting chemicals. The unique properties of BPA and phthalates, including low-dose effects, non-monotonic dose response curves (NMDRCs), and rapid metabolism, break up traditional principles of toxicology. On the other hand, FSANZ (2014) reported that allegations about a causal relation between BPA and a variety of public health effects are unproven. However, as reported by the European Parliament (2019) several studies have recorded effects of BPA at doses believed safe by regulatory thresholds operative in the EU.

Cases in point include the hypothalamic and hippocampal outcomes on gene transcription in rats, *in vitro* work on mouse and human pancreas demonstrating environmentally applicable levels (exposures in the 1-20 μg/kg body weight/day range) to modify insulin signals and other organ systems. Furthermore, according to Gerona *et al.* (2020), CLARITY data (i.e. data extracted from the Clarity database which is a large subset of data that comes from the PennChart (Epic) application) offer proof of significant adverse effects at the lowest dose studied (2·5 μg/kg per day), far lower than the lowermost discovered adverse effect level (5000 μg/kg per day) applied to establish the tolerable daily intake for BPA. Nevertheless, based on the hypothesis that human exposure to BPA is

negligible, the US Food and Drug Administration (FDA) has not taken into account the adverse low dose effects in CLARITY data and many other studies (Gerona *et al*., 2020). These data suggest disagreements in threshold value which could even undermine the exposure toxicity. It is well appreciated that knowledge about the amount of BPA that go into the human body is vital for risk assessment. Nevertheless, quick metabolism of orally ingested BPA means accurate evaluation in humans needs not only measurement of BPA but also of its major conjugated metabolites (the primary metabolite, BPA glucuronide, and secondary metabolite, BPA sulfate) which are however excreted in urine. As such (Gerona *et al.,* 2020) biomonitoring of urine over time offers the best understanding to human exposure to BPA. Differences in BPA measurement techniques have also been associated with discrepancies in BPA threshold value. According to Gerona *et al.* (2020) indirect techniques used in BPA exposure estimation underestimates actual human levels of BPA. The evidence established from the comparative analysis of urine samples using both indirect and direct methods demonstrated that the geometric mean established using indirect method was nearly 19 times lower than the direct method.

These inconsistence in BPA estimation and difficulties in its direct health effects characterization in human is due to BPA great changeability in the body over time (European Parliament, 2019), owing to a short half-life. Furthermore, the inconsistence could be linked with repeated exposures during the course of the day and dependence on a single bio-specimen collected in each subject, which is a design used so far in most epidemiological cohorts. They indicated that (European Parliament, 2019) this strong time-based variability will, on average, lead to a strong under-estimation of the slope of dose-response functions and a reduction in the ability of studies to demonstrate any effect of the compound. This observation suggests that even though direct methods can provide an estimation that could be more or less reflective of the actual exposure this could certainly be achieved if several bi-specimen are sampled over time for estimation of the mean exposure. Fisher *et al.* (2015) on the other hand reported low reproducibility and sensitivity of BPA and all phthalate metabolites all the way through pregnancy and into the postpartum period but much higher replicability within a day. The time of a day when the urine was amassed was a significant predictor of specific gravity adjusted exposure levels. This led to the conclusion that, if the intention is in average exposures across gestation, maternal/fetal exposure, approximation may be more accurate if multiple measurements, gathered

across the course of the entire pregnancy, rather than a single spot measure, are implemented. Available data indicate that estimates of human exposure have been based nearly fully on data from indirect methods, which implies underestimation of human exposure to BPA and proposes higher exposure than has been presumed formerly.

These different standings in threshold value suggest the need for extra studies to reconcile the differences. However, apart from the demonstrated disagreements among researchers in the currently available literature particularly with respect to the dose–effect relationship and threshold value of the migrating chemicals, overwhelming evidence still illustrate adverse effects associated with BPA and phthalates. Evidences of chemical migration are undisputable and the limits set by the EU have been demonstrated to be attained. Fasano *et al.* (2012) assessed the migration of BPA and phthalates (DMP, DBP, BBP, DEHP, OP, NP, and DEHA) from a variety of common food packaging and correlated their levels with the limits developed by the EU and compared the migration potential of plasticizers and additives from plastic wine tops at an incubation temperature of 40°C (Extreme Conditions) and ultrasonic extraction. The results indicated comparable levels of phthalates (NP, OP, BPA and DEHA) with EU maximum levels, all samples displayed chemical migration lower than specific migration limit (SML) and overall migration limit (OML) established (Reg 10/2011). Plastic wine tops exhibited the uppermost level of migration even though wine tops are not in contact with the wine but in the headspace of the bottle on the other hand, available reports indicate the potential role of BPA in the pathogenesis of breast cancer (Konieczna *et al.*, 2015) which could be among the factors that contribute to the development of prostate cancer as well. Evidence from animal studies documented by European Parliament (2019) strongly suggest effects of BPA on fat weight/obesity, metabolic disorders leading to type-2 diabetes, neuro development and behaviour such as hyperactivity, reproductive processes and memory performance.

Presently, BPA is prohibited from food contact materials intended for children under three years old in the EU but not for food contact materials in general (European Parliament, 2019). BPA is also linked with breast and prostate cancer due to its tumor enhancing properties (European Parliament, 2019). Determination of systemic levels of BPA in patients with type 2 diabetes mellitus (T2DM) was done (Soundararajan *et al.*,

2019) and compared to individuals with normal glucose tolerance ($n = 30$ each) signifies the European Parliament (2019) report on diabetes. Their results demonstrated significantly higher serum levels of BPA in patients with T2DM compared to control individuals and established a significant association of elevated BPA levels with cellular senescence, pro-inflammation, poor glycemic control, insulin resistance, and shortened telomeres (chromosome ends) in patients with T2DM. Such evidences suggest the role of BPA in the development of T2DM. In another investigation in which Comparative Toxicogenomics Database (CTD) was used (Hassan *et al.,* 2020), it was revealed that BPA has 1932 interactions with genes/proteins and few often used phthalates (DEHP, MEHP, DBP, BBP, and MBP) indicated 484 gene/protein interactions. Analogous toxicogenomics and adversative effects of BPA and phthalates on human healthiness are associated with their 89 common interacting genes / proteins (Hassan *et al.,* 2020). Such genes interactions are likely to affect the genetic pattern which provides evidence of the contaminant effects. The effects of BPA exposure in inducing abnormal DNA methylation of specific genes related to childhood asthma is also reported (Yang *et al.,* 2020).

The result showed that MAPK1 protein methylation was minor in children with asthma than in children without asthma. Mediation analysis proposed that MAPK1 methylation works as a mediation variable between BPA exposure and asthma. In view of the results, it was concluded that the mechanism of BPA exposure on childhood asthma could, therefore, be through the alteration of MAPK1 methylation. A more or less similar study (Miura *et al.,* 2019) examined the relationship of prenatal BPA exposure with genome-wide DNA methylation modifications in cord blood in 277 mother-child pairs. It was witnessed that a big share of BPA-associated differentially methylated CpGs was characterized with a decrease in epigenetic methylation in DNA (hypo-methylation) among all new-born (91%) and female infants (98%), as opposed to an increase in epigenetic methylation in DNA (88%) among males (hyper-methylation). They also found 27 and 16 CpGs with a False Discovery Rate (FDR) < 0.05 in the analytical study for both male and female, respectively. They concluded that epigenome-wide analysis of cord blood DNA methylation proposes potential sex specific epigenome reactions to BPA exposure (Miura *et al.,* 2019). This implies that similar exposure may have different outcomes based on an individual's sex. According to Almeida *et al.* (2018) age, gender, liver function, and physiological status are other factors that influence BPA metabolism.

Associations of urinary BPA levels (exposure) with sperm parameters including sperm movement characteristics among fertile men have been recognized (Honglei *et al.,* 2018). The available data indicate that exposure to BPA would reduce both sperm concentration and sperm swing characteristics [amplitude of lateral head (ALH) and mean angular displacement (MAD)], and raise sperm velocity ratios [linearity (LIN), straightness (STR) and wobbler (WOB)], which might facilitate additional effects on impaired male fertility.

Weakened spermatogenesis and sperm movement could illuminate some light on male subfertility resulting from exposure to BPA. The adverse effects of BPA on spermatogenesis have been associated with its interaction with Sertoli cells (somatic cell of the testis) and block the meiotic progression of germ cells (Honglei *et al.,* 2018). It is further documented that BPA can interact with steroid receptors, reduce steroidogenic enzymes, and generate reactive oxygen species (ROS), which might affect spermatogenesis. Rodent studies of both low- and high-dose BPA exposure have reported declines of sperm count and testosterone concentration, damage of sperm motility and sperm DNA impairment (Honglei *et al.,* 2018). The observation suggests the effect in spermatogenesis can occur at a wide range of BPA exposure doses. Earlier animal studies (NRDC, 2008) have also associated BPA with reproductive deformities such as lower sperm counts, hormonal changes, enlarged prostate glands, anomalies in the number of chromosomes in eggs, and pre-cancerous alterations in the breast and prostate. It has likewise been linked with obesity and insulin resistance, an ailment that usually precedes the development of diabetes. Similarly, it is documented that BPA offers a good illustration of complex receptor interactions (Cwiek-Ludwicka and Ludwicki, 2014). This is demonstrated by *in vitro* studies which show it to be both an oestrogenic receptor agonist and an androgenic receptor antagonist. In vivo studies also observed lots of different responses signifying a potential endocrine effect that was nonetheless expressed above its threshold value, that is, 5 mg/kg body weight (bw) per day. Toxicological studies on BPA permitted the No Observed Adverse Effect Level (NOAEL) to be established as 5 mg/kg bw/day, and as a result a Tolerably Daily Intake (TDI) level established to be 0.05 mg/kg bw/day (Cwiek-Ludwicka and Ludwicki, 2014).

An earlier review (Posnack, 2014) based on in vitro, in vivo and epidemiological studies indicate adverse effects of BPA on cardiac function, the cardiac electrical conduction effect being concentration-dependent. However, according to Warner and Flaws (2018) the prototype of "the dose makes the poison" does not apply to BPA, phthalates, and other endocrine disrupting chemicals. Data from mammalian model (Posnack, 2014) demonstrated modification in cardiac structure and function in mice. Other observations included sex-specific variances after BPA exposure, comprising of concentric remodelling (male), raised systolic and diastolic blood pressure (female) and altered calcium handling protein expression (male & female). These documented results generally indicate that while other adverse effects are sex linked others are sex independent. Epidemiological results indicate association between higher BPA urine levels and intensified risk of coronary artery disease, hypertension, carotid atherosclerosis, angina (inflammatory infection of the throat) and myocardial infarction (heart attack), and declined heart rate inconsistency. Higher BPA urinary levels have also been associated with LDL and HDL cholesterol levels, and the echogenicity of vascular plaques. Experimental data also advocate that BPA can affect a diversity of endocrine signaling pathways, taking account of those mediated by oestrogens, androgens, progestins, and thyroid hormone (Gerona *et al*., 2020). Exposure during pregnancy has been associated with changes in a wide array of developing tissues, with corresponding postnatal effects on behaviour, fertility, growth, metabolism and cancer risk.

Phthalates

Though the epigenetic effects of phthalates have not been entirely clarified, but gathering evidence proposes that they may be connected with adverse health effects, some of which may be heritable (Bowman and Choudhury, 2016). Phthalate migration into a variety of milk product have been illustrated and the levels of migration established. Saad *et al.* (2015) examined. the migration of the six most common phthalates of di-ethyl phthalate (DEP), di-methyl phthalate (DMP), benzylbrobyl phthalate (BBP), di-brobyl phthalate (DBP), di-ethylhexyl phthalate (DEHP) and dsi-n-octylphthalate (DOP) in samples of pasteurized milk, fermented milk "Rayeb" and Domuatti cheese packaged in plastic bottles and containers. Nonetheless, the results indicated that none of the 6 phthalates of DMP, DEP, DBP, BBP, DEHP and DOP were detected in any sample of milk, Rayeb and Domuatti cheese examined during the first

month of production in both bottle and container sizes. Similarly, none of the four phthalates namely DMP, DEP, DBP and/ or BBP were discovered in the three examined products up to the last month of expiry. Only 2 and 3, each out of 24 and 2 out of 18 samples of milk, Rayeb and Domuatti cheese, respectively displayed low levels of contamination with DEHP or DOP. The determined residues of DEHP or DOP phthalates ranged from 30 - 88 ng/ml. It is shown that adverse health risks among consumers depend on the type, nature and levels of chemical contamination which indicates consumer exposure. This could explain the variation in migration phenomenon of the six phthalates. The results further indicate that the total concentration of the contaminant (e.g., phthalate in this case) might not be reflective of the toxicity since not all types of phthalate might contribute to the contamination and hence toxicity.

Available data indicates that phthalates, which exist in more than 10 congeners in business and uncountable metabolites, can similarly interact with multiple hormone systems. Endocrine disrupting action might or might not be receptor driven and might be agonistic, antagonistic, or a mixture of both (Warner and Flaws, 2018). Even though the clinical consequence of phthalate exposure has been tough to assess with epidemiologic studies, the evidence that physiological variations occur due to exposure to phthalates is increasing and points toward the need for more examination at a molecular, specifically epigenetic level (Bowman and Choudhury, 2016). Phthalates, as is the case with BPA, are normally believed to disrupt endocrine function and badly affect sex and thyroid hormones, reproduction, and neuro development. Several in-vitro and in-vivo investigations have revealed that phthalates have functions analogous to the thyroid hormone and the capacity to bind thyroid receptors and, consequently, affect thyroid homeostasis (Kuo *et al.*, 2015). In a study of the relationship of phthalates exposure with thyroid function in pregnant women and their newborns (Kuo *et al.,* 2015) observed that the greater the urinary mono-benzyl phthalate (MBzP) level in pregnant mothers, the lesser the Thyroid Stimulating Hormone (TSH) level in cord blood serum. It was concluded that maternal urinary MBzP may affect TSH activity in newborns. The modification of thyroid homeostasis by certain phthalates in the initial life, which is a critical period for neurodevelopment, is a pressing concern. Among the phthalates, dibutyl phthalate (DBP) and bis(2-ethylhexyl) phthalate (DEHP) have a common mode of action, but different active metabolites

(monobutyl phthalate (MBP) versus mono-(2-ethylhexyl) phthalate (MEHP)) and are thought to have the biggest effect on development of metabolic disorders (Baralić *et al.,* 2020). Examination of the association between phthalate exposure and central precocious puberty (CPP) in girls (Jung *et al.,* 2019) demonstrated no significant difference in the five urinary phthalate levels between the CPP and pubertal control groups.

Furthermore, phthalate metabolites were significantly lesser in the CPP group than in the pre-pubertal control group. Earlier studies also reported conflicting results on CPP and phthalate concentration. Whereas Chen *et al.* (2013) indicated significantly higher levels of seven urinary phthalates [(1) MMP, (2) mono-ethyl phthalate (MEP), (3) MBP, (4) mono-benzyl phthalate (MBzP),and (5) MEHP; and two oxidized metabolites:(6) mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP) and (7) mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP)] in the CPP group than in pre-pubertal controls, Lomenick *et al.* (2010) revealed no difference in nine urinary phthalates [DBP (Di-n-butyl phthalate), DEHP (Di-(2-ethylhexyl) phthalate), MBP (Mono-n-butyl phthalate), MBzP (Monobenzyl phthalate), MCPP (Mono-3-carboxypropyl phthalate), MECPP (Mono (2-ethyl-5-carboxypentyl) phthalate), MEHP (Mono (2-ethylhexyl) phthalate), MEHPP (Mono (2-ethyl-5-hydroxyhexyl) phthalate), MEOHP (Mono (2-ethyl-5-oxohexyl) phthalate)] between girls with CPP and pre-pubertal controls, proposing that phthalate exposure is not linked with CPP. Several studies (as reviewed by Posnack, 2014) have similarly documented toxic effects of Di-(2-ethylhexyl) phthalate (DEHP) and its byproducts based on in vitro, in vivo and epidemiological studies.

The documented toxicity includes cardiac toxicity leading to termination of contractile function in chick embryonic cardiomyocytes, reduction in systolic and diastolic blood pressures in male offspring after in utero exposure to DEHP and a rise in blood pressure in rat offspring after maternal exposure to DEHP. Epidemiology data on the other hand indicated a direct relationship between elevated urinary phthalate levels and both increased blood pressure in adolescent population and increased coronary risk in the elderly people. Posnack (2014) also documented significant relationship between elevated MEHP (Mono (2-ethylhexyl) phthalate) urinary levels and Low Density Lipolipid (LDL) cholesterol levels and the echogenicity of vascular plaques, but not blood pressure. Echogenicity of vascular plaques is an indicator of lipid infiltration and a foreteller of future cardiovascular demise.

Synergistic Effects of Phthalates and Bisphenol A

Though several studies which have been conducted so far are based on single endocrine disrupting chemical (EDC), that is, (phthalate or BPA) recent data conflicts such documented observation on the basis of combined effects. Baralić *et al.* (2020) compared the subacute toxic effects of low doses of single compounds (bis (2 –ethylhexyl) phthalate (DEHP), di-butyl phthalate (DBP), and bisphenol A (BPA)) with the effects of their mixture through different biochemical, hormonal, and hematological parameters in-vitro using rats. It was observed that a blend of low doses of DEHP, DBP and BPA caused significant alterations in body weight gain, water and food consumption, thyroid hormone and testosterone levels, lipid profile, liver-related biochemical parameters, and the glucose level as opposed to single substance doses on compared parameters. It was concluded that more noticeable effects witnessed at certain parameters with mixture exposure are due to the elevated total exposure amount, suggestive of the dose addition.

The results of the study challenge the results of toxicity studies of single chemicals and further contribute to the understanding of the health effects triggered by exposure to chemical mixtures. The results imply that exposure effects estimated based on single endocrine disrupting chemical (EDC) might have underestimated the overall effects of its blend. Reproductive toxicity of phthalates and BPA was examined (Baralić *et al.*, 2020) in binary and multicomponent blends, commonly targeting male reproductive tract disorders, mostly after the perinatal exposure. It was shown that prenatal exposure to the blend of DBP and DEHP changes fetal testosterone production and insl3 gene manifestation in a manner that resulted in cumulative dose-additive escalations in reproductive tract malformations (Baralić *et al.*, 2020). Manikkam *et al.* (2013) also examined the effect of mixed EDCs bisphenol-A (BPA) and phthalates [bis (2-ethylhexyl) phthalate (DEHP) and di-butyl phthalate (DBP)] at two dissimilar doses in promoting epigenetic transgenerational inheritance of adult-onset disease and associated DNA methylation epimutations in sperm. The results showed significant increases in the prevalence of total disease / abnormalities in F1 and F3 generation male and female animals from plastics lineages. Pubertal anomalies, testis disease, obesity, and ovarian disease (primary ovarian inadequacy and polycystic ovaries) were increased in the F3 generation animals. Prostate and kidney disease were only witnessed in the direct fatally exposed F1

generation plastic lineage animals. Examination of the plastics lineage F3 generation sperm epigenome earlier identified 197 differential DNA methylation regions (DMR) in gene promoters, termed epimutations. The results show that a blend of plastic derived compounds, BPA and phthalates, can boost epigenetic transgenerational inheritance of adult-onset disease. The sperm DMR provide potential epigenetic biomarkers for transgenerational disease and/or ancestral environmental exposures.

This observation further justifies the need for consideration of the synergistic effect of the plastic derived EDCs in particular BPA and phthalate. Another study (Pednekar *et al.,* 2018) evaluated the exposure of BPA and phthalates in plasma samples of fertile and infertile women. BPA and four phthalate monoester metabolites [namely mono-benzyl phthalate (MBzP), mono-methyl phthalate (MMP), mono-2-ethylhexyl phthalate (MEHP) and mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP)] were quantified in human plasma. BPA was evident in 77% of plasma samples of infertile women and 29% of fertile women. All the four phthalate metabolites were identified in plasma samples of both fertile and infertile women. The infertile women indicated significantly higher plasma levels of MBzP, BPA and MEHHP as compared to fertile women.

The concentrations of MMP and MEHP did not vary significantly between the two groups. The results generally suggest the likely association of BPA, MBzP and MEHHP with infertility implying their combined infertility effect. Furthermore, the observation implies that some phthalates (MMP and MEHP) have insignificant effects on women infertility. This could on the other hand suggest that the total concentration of a particular plastic monomer (phthalate in this case) might not be indicative of the reflective dose effect for a particular health risk.

CONCLUSION

Available literature provides evidences which demonstrate that chemical migration from plastics packaging is an unquestionable reality. Though several chemicals are migrating from plastic packages, however, the chemicals of great health concerns are BPA and phthalates. There is accumulated evidence of the human health risks associated with BPA and phthalate leakage into packaged food with dietary intake being the major

root for human exposure. The health effects due to migrating chemicals is demonstrated to be through their interactivity with multiple hormone systems, implying a wider range of effects that can occur depending on the number of affected hormonal receptors. Although disagreements among researchers are still demonstrated in available literature particularly with respect to the dose-effect relationship and the threshold value of the migrating chemicals, however, overwhelming evidence still illustrate several adverse effects associated with BPA and phthalates which can hardly be undermined. Such effects include adverse effects on spermatogenesis, obesity, type two diabetes mellitus, raised systolic and diastolic blood pressure (female) and altered calcium handling protein expression (male & female), coronary artery disease, hypertension, carotid atherosclerosis, cancer risks, angina etc. Even though several studies have been done for a single chemical (BPA or phthalates) the comparative results indicate a cumulative dose-additive amplification when a mixture of the two is examined which implies the need for further reexamination of the synergistic effect of the plastic derived EDCs in particular BPA and phthalate.

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Gender Discrimination in Politics: A Critical Review of Liberalism

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ABSTRACT
Liberal political theory assumes that the separation of the public from the private sphere is natural and therefore woman's subordination to man is inherent. The backdrop of this dichotomy appears to reinforce gender stereotyping since it constructs woman to reflect an apolitical nature of a subject in a political system. Man's behaviour, on the other hand, is portrayed as the standard political behaviour against which a woman is supposed to measure. Viewed from the perspective of the dichotomy, politics is reduced to "man" and hence its masculinisation. Camouflaging its exclusionary tendencies, liberal theory purports to employ "universal"- neutral static language which is "sexual-blind" such as "individual", "citizen", "worker", "equality", and "representation". Liberalism therefore makes universal rationality the essence of humanity and the basis of its epistemology and politics. This article examines the core of liberalism as one of the sources of gender discrimination in politics.

Keywords: Liberalism, gender, discrimination, politics, masculinization, rationality

INTRODUCTION

Political theories are not neutral and natural. They were formulated to reflect the socio-economic and political context of a given space and time. The theories are therefore infused with the experiences, perspectives, understandings and assumptions of their creators about human nature and relationships. By the same token, the language that is imbedded within the body of these theories reflects the context within which they originate. In the Western and colonial societies, for example, the creators of the language, norms, laws, and practices of the dominant culture and ideology were white, economically privileged, formally educated, able-bodied, heterosexual (or at least not openly homosexual or bisexual) men. Men

with power created the dominant cultural discourses - languages, symbols, disciplines and institutions that control political, legal, economic, social, scientific and organizational practices governing a gendered society (Bender 1990). Arguably, women were inevitably excluded from the studies designed to produce knowledge of the dominant discourses, theories and practices. It is through this exclusionary process that the language of political theories carries with it the fallacy of gender stereotyping by constructing woman as apolitical subject of the political system. In this article, the liberal philosophy and theories are critically examined. Toward that grand objective, the public/private paradigm and its underpinning social contract (consent) theory form the core of this discussion. The intention is to revisit and destabilize the fallacy of gender stereotyping as imbedded in the language of political theory. The main argument of this article is that political theories and classical studies have been at the centre stage of perpetuating gender stereotyping with the effects of rendering women incompetent political beings and hence their exclusion from participating in political affairs.

METHODOLOGY

This is a literature review-based article. It employs mainly secondary materials particularly classical and contemporary works on liberalism. The materials are critically reviewed using three thematic areas namely gender stereotyping, rationality, and universality. The purpose is to delineate exclusionary tendencies of liberalism based on gender. This approach is useful in so far as it interrogates the controversial facets of liberalism on its inclusivity and exclusivity along a gendered perspective.

FINDINGS AND DISCUSSION

Gender Stereotyping in Politics

Theorizing politics is a discourse which has yet to be closed. With the publication of the Aristotle's *The Politics*, in which various constitutions are studied to establish the best method of a government, the debate on what constitutes "the political" began. The central questions in the discourse revolve around two definitional issues: the scope and nature of politics as well as who should participate in politics and why. In examining this discourse, two frames of references are considered here for the sake of space. The first frame is called institutionalist perspective. This views politics as confined to the state and its related institutions.

Politics, in this sense, comprises of public and formal affairs of the government.

Putting this point in perspective, Nnoli (1986) posits that an action of the bishop can be differentiated from that by a president in that the president's order is authoritative since it has the back-up of the sanctioning power of the state. With coercive forces such as police, army, prison and courts, the president is fully vested with powers that can be used to implement his or her decisions. In contrast, the bishop, without these supportive instruments is unable to effectively sanction his or her followers. This view seems to carry the problem of academic reductionism. For one thing, if the same activities, such as elections, conflicts, and decision-making take place within the church, schools, trade unions and so forth, can't one argue that these are church politics, school politics, union politics respectively? To define politics strictly around the affairs of the state is to fail to appreciate other spaces and forms of politics. This view restricts the meaning of politics to the old fashion of the Westphalia Treaty of 1648 that recognised state as a sovereign entity with the right to exercise power in a hierarchical order. In contrast, the instrumentalist perspective views politics as an exercise of power game. It is argued that when "X" influences "Y" so that the latter accomplishes the wishes of the former which without that influence nothing would have happened, power is assumed to have been exercised (French and Raven, 1959).

This definition is broader in the sense that it views power to transcend the state to other non-state actors. It allows one to appreciate politics at both micro and macro level organisations. One omission in this definition is that it does not state who should own and exercise that power against who. It also assumes that power is static and exercised in one direction. Power, in this way, seems to be a means to an end an end in itself. To put it differently, power as we shall see later, is seen to be confined to the public sphere, the sphere of man. If that is the correct interpretation as given by the public/private paradigm, one is supposed to see power flowing from men to women in their private sphere. In a way, men are the ones who possess power and exercise the same over women. From these derivations, politics is inherently infused with patriarchal assumptions of power that control knowledge – reasoning and rationality. In the Estonian System theory, political system is arranged in terms of 'demand-political system-supply' logic (Easton, 1965). It assumes that the system operates in response to the demands from the environment i.e., citizens. These

should have the capacity to demand from the state: activities and services since the government through a social contract (formed during election) promised to deliver them in exchange for votes and support, mainly through compulsory taxation. To be sure, politics being a formal activity in the public sphere automatically excludes women to play their role. Thus, one may put that the premise on which politics and its discipline – political science is founded, is essentially a male domain. And therefore, all theories, research and studies derived from politics are biased to favour men. Pateman (1989) aptly argues that the power of men over women "is excluded from scrutiny and deemed irrelevant to political life and democracy by the patriarchal construction of the categories within which political theorists work".

Attesting to this view Lovenduski (1981) posits that the dominant conception of political studies excludes women "largely because women usually do not dispose of public power, belong to political elites or hold influential positions in government institutions". As it can be deduced from these authors, Pateman primarily criticises the institutional focus of liberal political theory while Lovenduski questions the instrumentalist view of positivist political science. Indeed, both the institutional and instrumental conceptions of politics focus on the public sphere of decision making. It is from this backdrop that Pateman (1989) proceeds to claim, "both women's exclusion from the public world and the manner of our inclusion have escaped from the notice of political theory". The instrumental and institutional views of politics are criticised to be restrictive and biased. The feminist assertion that "the personal is political" destabilized the previous definitions of politics. Phillips (1998) went further to say that "politics" was subjected to such devastating criticism that it threatened to dissolve as a distinct category of analysis. From the above observations, it can be noted that the definition of politics is intertwined with gender stereotyping. In that sense, the relationships between men and women are shaped by using "constructs" which mask world's reality about the nature of man and woman (Archer and Lloyd, 2002). From the work of social psychologists, a stereotype is employed to connote a set of beliefs typical to personal attributes of a group of people. Koch (2000) argues that, though "stereotype" was once considered a pejorative term, the cognitive approach in social psychology now regards it in a more neutral manner, viewing it as a heuristic employed to decide whether a target possesses a particular attribute.

Thus, gender stereotypes are mere social and cultural constructs. They are essentially rooted in the historically socialized roles that have encompassed the lives of men and women. To that extent, they constitute beliefs people hold about members of the categories man and woman. Existing in a bipolar axis, these stereotypes provide mainly three assumptions: that women and men are fundamentally different; that men are superior to women and that men are logical and rational, the attributes which women seem to lack. From the outset, stereotypes are basically of two types. The first type is named belief stereotypes. These refer to the ideologies and policy preferences that are ascribed to men and women, and the second one is called trait stereotypes which concern with personal qualities that are inferred about men and women (Fox and Oxley, 2003). In line with this view, Archer and Lloyd (2002) for example point out that in the Judaeo-Christian tradition, God created woman as the helpmate of man but not his equal. This divine view seems to take woman's subordination to man as the natural order of the day. It is not uncommon to find that in most teachings of other major religions, woman occupies this inferior status. Sabbah (1984) puts that, "Muslim culture has built-in ideological blindness to economic dimension of women, who are ordinarily perceived, conceived and defined as exclusively sexual objects." One peculiar element about stereotype is generalization. Women are clustered and lumped together as if they form a homogeneous social category. Almond and Verba (1963) study on civic competence is exemplary to bring this point home.

In this study, women are generalized as incompetent political beings. They dislike politics and would not participate in that game. Meena (2001) seems to concur with Almond and Verba when she observed those people who never follow politics in Tanzania to be women who accounted for 61 percent against men who comprised 39 percent. The simple reason advanced for this difference is that most women live in rural areas and particularly those who did not attend the formal schooling. One of the omissions in Meena's analysis is to fail to question the nature of that education. If the theories, discourses, as well as practices of education are infused with gender stereotyping, it is no wonder that such education will perpetuate the gender gap between men and women. In this context, education is in itself insufficient to correct the past gender imbalances.

Rationality in Liberalism

The emergence of liberal political theory is associated with the rise of capitalism in Western Europe around 17th Century. The theory is essentially grounded on the conception of human beings as rational agents. Rationality has three distinct elements: firstly, the mental capacity; secondly, as a property of individuals rather than of groups; and thirdly, as a capacity that is possessed in approximately equal measure at least by all men (Jaggar, 1983). Like any other political theory, in developing its vision of the good society, liberal political theory incorporates some assumptions about the nature of men and women. To be sure, the liberal conception of the good society naturally is the one that advocates the basic liberal values of protecting the dignity of each individual and promote individual autonomy and self-fulfilment. This means that individuals should enjoy maximum freedom that is not impeded by others. Paradoxically, impediment is a likely permanent human condition.

Liberal theorists therefore devise a state as a social institution that will protect each individual's right to a fair maximum autonomy and self-fulfilment. They are however, very cautious of the potential dangers of a state to abuse its role as a custodian of protection of liberty. Hence, they limit the legitimate state intervention in the life of individuals. This limitation resulted into what is commonly referred to as the public and private spheres. The public/private paradigm contends that society is broadly divided into two spheres i.e. the public and private spheres. The public sphere according to this paradigm is characterized by power, wealth, rule, rationality, career and reasoning. In contrast, the private sphere is predominated by domestic activities as well as child bearing (Arneil, 2001). It should be noted right from the outset that, political theory and the classical studies are accused to have a share in reinforcing and widening this dichotomy. They construct woman to reflect the apolitical nature of a subject in a political system. Man's behaviour, on the other hand, is always taken as the standard political behaviour against which a woman is supposed to measure herself. The dichotomy thus reduces politics to "man". By so doing, politics is being masculinised. Nikolas (1987) reaffirms this view in a more explicit way:

> *The division between public and private is traced back in political and social philosophy at least as far as Aristotle's distinction between polis and oikos and up to the natural rights theories of John Locke. However, in the eighteenth and nineteenth centuries*

> *the distinction is reposed in terms of the division between home and market. It is given a philosophical foundation in the liberal political philosophy of J. S. Mill and his followers, with the opposition between the realm of legitimate public regulation and the realm of freedom from intrusion, personal autonomy and private choice. Writers point to the particular associations in these texts between the public sphere - the world of work, the market, individualism, competition, politics and the state - and men, and the corollary association of women with the private, domestic, intimate, altruistic and humanitarian world of the home.*

Stevens claims that, "The traditional division confined women largely to the domestic sphere and to the reproduction and nurture of children as their primary role, while generally affording a much greater share of both power and resources to men. However, this division is being undermined...In particular, modern market-driven capitalism tends to treat everyone alike, whether as a factor of production (a worker) or a consumer" (Stevens, 2007). This position asserts that capitalism is fair to everyone, something which is not true. It ignores critical questions like ownership of the major means of production and factors of production. Gatens (1992) posits that "Liberal feminists conceive the problem of women's confinement to the private sphere as central to their low socio-political status. Equality, wealthy and opportunity are located in the public sphere. Hence the issue of providing women with access to power becomes the issue of providing them with equal access to the public sphere. The state is obliged to provide women with the same opportunities it provides for men." Nonetheless, the question as to what constitutes a state is side skipped. In *A Vindication of the Rights of Women (1792),* Mary Wollstonecraft argued forcefully that women had the potential of full rationality and as a result were as capable as men of complete moral responsibility. She specifically argued that:

> *Men and women must be educated, in great degree, by the opinions and manners of the society that they live in. In every age there has been a stream of popular opinion that has all carried before it, and given a family character, as it were, to the century. It may then fairly be inferred, that, till society be differently constituted, much cannot be expected from education. It is, however, sufficient for my present purpose to assert, that, whatever effect circumstances have on the abilities, every being may become virtuous by the exercise of its own reason; for if but*

> *one being was created with vicious inclinations, that is positively bad, what can save us from atheism? Or if we worship a God, is not that God a devil?*

The above quotation is instructive to the solution of women's invisibility in the private sphere. It shows that the problem lays in the whole issue of "rationality" which seems to be deficient in women. Mary thinks that education is the only way to strengthen women. In his *The Subjection of Man (1869)*, John Stuart Mill dismisses the natural difference on rationality between men and women. He contends that if men had ever been found in a society without women, or women without men, or if there had been a society of men and women in which the women were not under the control of men, something might have been positively known about the mental and moral differences which may be inherent in the nature of each. And therefore, what is now called as the nature of women is eminently artificial thing – the result of forced oppression in some directions, unnatural stimulation in others. Mill's view sharply contradicts John Locke's social contract theory that the separation between the public and private spheres is natural and therefore for woman to be subordinate to man is inherent. In the Sexual Contract, Pateman (1988) vehemently criticizes the "social contract theory" and reduces it to "sexual contract":

> *The logic of contract as exhibited in 'surrogate' motherhood shows very starkly how the extension of the standing on 'individual' to women can reinforce and transform patriarchy as well as challenge patriarchal institutions. To extend to women the masculine conception of the individual as owner, and the conception of freedom as the capacity to do what you will with your own, is to sweep away any intrinsic relation between the female and owner, her body and reproductive capacities. She stands to her property in exactly the same external relation as the male owner stands to his labour power or sperm; there is nothing distinctive about womanhood.*

The point to be noted here is that sex matters and there is no legitimate way to avoid referring to it. The social contract theorists want us to believe that such contract is entered between and among individuals. It is the contract of freedom and is done under individuals' consent. Pateman claims that to view a contract in that perspective is to ignore the existence of both sexes in bodily form. And therefore, one is able to advance

women's interests if and only if he or she first and foremost appreciates the sexual differences.

The Pretence of Universality

The first pillar of pretence is citizenship. Citizenship is a precondition to participate in public politics (Stevens, 2007). Being a citizen means having formal civil and political rights. As we argued elsewhere in this article, citizenship is inextricably tied to the public as opposed to the private sphere. Here the public comprises of both the state and civil society and the private is defined institutionally as the relations and activities of domestic life (Squires, 1999). It was John Locke who proposed the relation between men and women along the public and private spheres. According to him, the state of nature forced individuals to fear death and therefore the need to form a social contract.

That means a contract that is based on consent, and the one that would protect all against all. Interestingly, Locke's state of nature shows that prior to the consent men were already dominant in their families. He argued that a wife's subjection to her husband had a foundation in nature. This implies that women were excluded from the status of being "individual" which is basic to consent theory. The argument which is always advanced by feminists is that if a wife's subjection to her husband has a "natural" foundation, she cannot at the same time be "naturally" free and equal individual. This means that citizenship is a natural property of man in his public sphere. Supporting this view, Pateman (1989) argues that "citizenship has been made in the male image". The artificial inclusion of women as citizen works differently from the original inclusion of men. Pateman (1980) furthers that:

> *Consent is central to liberal democracy, because it is essential to maintain individual freedom and equality; but it is a problem for liberal democracy, because individual freedom and equality is also a pre-condition for the practice of consent. The identification of enforced submission with consent in rape is a stark example of the wider failure in liberal democratic theory and practice to distinguish free commitment and agreement by equals from domination, subordination, and inequality.*

The above quotation suggests that citizenship is an ideological euphemism of liberalism founded on a false consent. Using that "consent" men are able to enjoy freedom and equality while women are subjected to men's domination. And therefore, men are considered to be citizens, the fact which allows them to participate fully in politics. The second pillar of pretence is equality. This means, treating all human beings equally. In *the Subjection of Woman*, Mills advocated "a principle of perfect equality, admitting no power or privilege on the one side, nor disability on the other" (Mill, 1985). But it has to be stated that equality in liberalism is equality of opportunity as opposed to outcome. As Stevens (2007) maintains, "women's access to full social citizenship requires formal equality of opportunity on a basis of equal treatment".

The author fails to state clearly how that state of affairs can be achieved. To be emphasized here, though in risk of repetition, is that the development of capitalism was the driving force in separating the public from the private sphere. In a way, it was capitalism which accorded men a sense of citizenship and the associated bourgeois rights in their public sphere. Paradoxically, liberalism does not seek fundamental changes of the system to ensure equal treatment instead it advocates for equal opportunity without dismantling the unequal system of capitalism. Einhorn (2005) thus argues that "The neo-liberal market paradigm empowers the male economic actor as the citizen with the capacity to exchange contracts in the market-place. Without social entitlements, for example to adequate and affordable childcare, in a context where women are still seen as primarily responsible for looking after children, they do not have an equal capacity to access the public spheres of either the market or the polity". Stevens (2007) posits that women's economic position, status and power in the societies of OECD (Organization for Economic Co-operation and Development) countries at the start of twenty-first century fail to measure up to that of men. This observation is instructive insofar as it places men to be the standard measure of women demands to access the public sphere and equality. This shortly suggests women should be like men, or pretend to be so.

Phillips (1992) submits that "the male body has been the reference point in all our phallocratic discourse, and discussions of even sexual equality continue to privilege his body. Women can say they want to be treated the same – but this means being treated as if they were men; or they can demand laws that are specific to their needs- but this means being

compensated for their lesser abilities or role". It is along this line of reasoning, Gatens (1992) argues that equality in this context can involve only the abstract opportunity to become equal to men. It is the male body, and its historical and culturally determined powers and capacities, that is taken as the norm or the standard of the liberal "individual" or citizen. The third pillar of pretence is representation. Historically women have been excluded from participation in the formal institutions of politics. As we argued elsewhere, the reason to this phenomenon is found in the artificial separation between the public and private spheres which denies women to be citizen. Stevens (2007) puts:

> *Men in western societies acquired a substantial body of civil rights- rights to justice and to own property- before the achievement of political rights. The right of all men to participate fully in the political life of the state, an aspiration of the revolutionaries of the late eighteen century, was acquired only gradually as autocratic and absolute rule was replaced by liberal democratic systems. However, for women the position has largely been reversed. Civil as well as political rights have had to be fought for and the acquisition of political rights has often been seen not only as an end in itself but an essential means of securing equality in other spheres of rights.*

Women are under-represented in the formal institutions of political and economic life. According to IPU (2019) the worldwide average women representation in the parliaments is only 24%. One of the simple advanced reason is that women are less interested in politics than men. In Great Britain, for example, the government's Central Statistical Office report on women states that "women are not particularly interested in politics" (Stephenson quoted in Squires, 1999).

This position was supported by a government survey which showed that only 7 per cent of women claimed to be "very interested" in politics, and a MORI poll to accompany the 75th anniversary of women's rights showed that 76 per cent of women were not involved in any form of party-political activity (Squires ibid.: 196). If representation connotes representation of interests, beliefs, constituencies and identities, how are women included in the formal politics? If male dominates the public sphere how can they really represent women? Through the mythology of the "affirmative action" women continue to suffer male domination. The centrality of that action is to effect inclusion of the marginalised groups

into the major decision-making organs, employment, and education. Brest and Oshige (1995) define an affirmative action as a program initiated to seek remedy of the significant underrepresentation of members of certain racial, ethnic or other groups through measures that take group membership or identity into account. This definition emphasizes on two things. The first one is the question to cure exclusion by inclusion and the second is the issue of who should benefit out of the program, which is the group that has suffered exclusion and not the third party or an individual member. However, critics of affirmative action pose one fundamental question: Is affirmative action inherently preferential, discriminatory, and thus inconsistent with the constitution's guarantee of equal protection? (Collier, 1995). Collier responds this question in affirmative. Consistent with this view, Farber (1994) sees affirmative action as the reverse discrimination.

To them if the constitution stipulates the equality of opportunity and avoids in any way to mention any sort of discrimination, that alone is sufficient to protect every individual. Writing on the American political system, Jeffrey (1997) puts that "No matter how hard politicians run from it, this issue is not going away. The Declaration of Independence, for example, does not say that because of past discrimination some are more equal than others. It does not say that for some pursuit of happiness needs to be constrained because of past privileges; no, it insists, boldly, that here in America, we are all equal under the law". While this argument is convincing, it is narrow and too legalistic. For one thing, it misses out to raise important questions like who enacted that Declaration and for whose interests. It is ridiculous to argue emphatically that all people are equal before the law without looking deeper into those laws themselves. One may raise questions, for example, were women in the process of enacting that Declaration? How are their concerns taken into account? The fact that women in America won the voting franchise around 1920s raises doubt on the fairness of the laws themselves. Writing on the parliaments of the advanced industrial democracies, Caul (1999) argues that women participate little in the national decision-making process which not only limits diversity but also contradicts one of the central tenets of representative democracy. It is along this line of reasoning that Brown (2001) submits that, "No process could adequately address gender interests without taking into account female representation within formal political institutions. Higher levels of women's representation can empower women as a result of both the creation of more equitable

opportunities for women to participate in politics and the greater concern with gender interests that female policy-makers are supposed to have".

The fourth pillar of pretence is the use of gender-neutral language. Liberalism always strives to avoid any mention of sex. It, therefore, makes use of "universal", neutral and static terms such as "individuals", "citizen", and "worker". But this "gender-neutral abstraction" camouflage the male dominance. Phillips (1992) argues that "Human identity is sexually differentiated, and exists in a bodily form. Those who seek to deny the body, who deal only in the abstraction of 'the individual' or 'the citizen', who think it should not make any difference whether these individuals are women or men, will be writing in one sex alone as their standard. Women can be encompassed on an equality with men only if sexual difference is first of all acknowledged". While I share Phillips' language argument, I do not agree on the fact that women will attain equality once they become like men. It should be acknowledged that language is a product of society and it must carry with it the culture, norms, and practices of time and space. Swila (2004) submits that:

> *Language is a product of social conventions in that linguistic structures, their meanings and uses are shared by the entire community; the individual's freedom in her or his linguistic choices only has meaning within these conventions. Language is a crucial aspect of culture: it expresses cultural values and preoccupations and transmits these new generations. Gendered relations found in other social aspects are necessarily present and enacted in language as well. Therefore, by examining language, we are able to reconstitute the values and beliefs of a community through time. Language is dynamic and evolves to reflect changes in the society it serves; if more positive and equal gender relations are created, they will be reflected in language.*

The above quoted paragraph shows clearly that language is not neutral. In political studies, the field of international relations is for example perceived to be a man's game. With very few exceptions, men are the government leaders, diplomats, and high-ranking international military and civil servants. Ferris (2004) maintains that sexual language is used to mobilize male soldiers, foster their camaraderie, and inspire them to assert their masculinity. She observes that US and allied pilots in the Gulf War were shown pornographic films as part of their pre-aid preparations.

CONCLUSION

This article notes that the language of political theory is infused with gender stereotyping. Supported by capitalism and the consent theory, liberalism locates women in the private sphere. In masking its exclusion tendencies, liberalism purports to employ neutral vocabularies such as "citizen", "individual", "worker", "representation", "equality", and "freedom." Macdonell (1986) submits that liberalism subscribes to the idea of individuality and sameness. That is, on the one hand, we are all free to do what we please; and, on the other hand, we all speak the same language, hold the same values and know the same truths unless, that is, we are aberrant and abnormal. This is indeed fallacious. Young (1997) argues that the paradox of individualism and sameness underlies liberalism's notion that there exists a universal standard of rationality that forms the core essence common to all "normal" people. Those who act against such standard do so because they are in the first-place irrational in their lives. And therefore, liberalism makes this notion of universal rationality as the essence of humanity, the basis of its epistemology and politics, which valorise rational objectivity and its supported embodiment of scientific inquiry and institutions of government.

To de-construct the political theory and the task of engendering is still a challenge amid centuries of women's movements. One is either to look for theories of identity and subjectivity that will find women's vocabulary in the contemporary political theory. This would mean reversing the situation by seeking women's domination. Secondly, is to reconstruct the theories to be neutral and this entails confirming the status quo. Finally, is to seek rights as men are treated which would imply that the male political behaviour is the standard and desirable one for women to aspire. The current choice is to unpack the language of political theories so as to iron out gender bias. In liberal societies, this should see the fundamental change of the capitalist system which supports the public/private dichotomy and its associated consequences.

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A Rule-based Approach for Resolving Cybercrime in Financial Institutions: The Tanzania case

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ABSTRACT

It is widely accepted that technology is an agent of change in the society. However, the current rate of change in technology, particularly ICT, mobile and ATM machines, leaves room for it to be exploited and be used for things it was not meant for. The paper aims at examining the challenges to electronic banking and initiatives taken to address cyber-crimes among financial institutions in Tanzania. Using the data gathered based on employed comparative analysis methods from our studies and research undertaken by researchers, we examine in detail, technical factors that are continually shaping the landscape of cybercrime and its impact on financial Institutions. Picking a leaf on how to deal with challenges brought by information and communication technology-induced innovations in the banking sector a Platform for Organization Security Threat Analytic and Management (POSTAM) approach to address the cyber security problems in Tanzania was re-introduced. The data model approach was used to analyze collected data stored from the survey to test the security prototype developed.

Key Word: Cybercrime; model; legislation; cyber-attacks; security

INTRODUCTION

The security study literature has shown that system's users are the weak link for security breaches (Anagement, 2010) and therefore hackers use this loop hole to break the system for their personal gain or otherwise. Despite the user being a weak link, the advancement in computer technology also produces a huge amount of data i.e., information overload compared to the organizational ability to manipulate in order to extract potential useful information for informed decision-making (Mbowe et al 2014) and (Mijatov et al, 2013). According to (Mbowe et al 2014) the security awareness and maturity level for selected organizations in Tanzania are not satisfactory in many aspects.

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Electronic banking In Tanzania (or e-banking) has grown largely different from previouslyyears of an overwhelming response in its applicability and reception. Apart from the banks, other financial institutions have also adopted new methods of electronic financial transactions. The adoption of the Automated Teller Machines (ATMs) by various banks and financial institutions and mobile banking by various communication companies such as Tigo, Vodacom and Airtel have encouraged the adoption of habits for deposits and quick transfers of money or payments via electronic payment services (Kato, 2019). The adoption of electronic banking by (CRDB, 2020) (NMB, 2020) (DCB, 2020) Exim Bank and (NBC 2020) for example, confirms the development of electronic banking in the country.

It was noted that, the top management (e.g., directors, managers, supervisors or executive officers exercising the organization's powers) considers information security management as a technical issue rather than a business issue, in which there exists little or no close eye from top management to oversee information security compliance. The poor realization of information security as a corporate governance responsibility has promoted the deadly sins of information security management (Vagias, 2006). As a result, it causes the security management imbalances among internal stakeholders due to inadequate security sense and commitment across the organization structure. In this context, security management imbalance is the phenomenon of uncoordinated efforts among top management and security managers in protecting an organization's infrastructure and data and hence with the new era of computing ubiquitous resulting in lots of cyber-attacks. The definition of "cyber-crime", in the Tanzanian context, varies across the industry as it covers a wide scope of overlapping crime committed with the aid of growing technology. These crimes are classified according to how majority of the people involved make use of the internet and technologies to exchange ideas, keep in touch with family and friends, buying and selling products (including online transactions, M-Pesa) and accessing online services. Cybercrime in Tanzania is mainly committed by two groups of people. Namely, those who perform the act without the knowledge that what they are doing is wrong and those who know what

they are doing but are determined to perform the act in order to distract the country's equilibrium through different angles; from destabilizing peace in a country through misuse of social media and other communication media to stealing money through online transactions.

Tanzania has a high rate of cybercrime and hate speech as highlighted in Mtanzania Newspaper, (Mtanzania, 2013) "There is fear of high rate of individuals who made use of the internet to threaten national security (Tanzania) due to misuse of the blogs and social media along with mobile phones to spread hate speech among communities in Tanzania and the number of cyber criminals worldwide has now increased." In the past, there were a few cases where criminals made use of technology to tamper with ATM machines in Tanzania. Nowadays the act is growing faster and the fear among ATM users has increased due to the fact that each day cyber criminals are coming up with new techniques to steal money from ATMs. People were shocked and surprised when the opposition leader spokesman for the Ministry of Communication, Science and Technology announced that the country has lost 892.18 billion Tanzanian Shillings in Cyber-crimes according to the official reports of the police (http://www.tech360magaz.com). Some sophisticated criminals have been stealing money from the Banks directly; 250 million was reported in Mwananchi Newspaper (Mwananchi, 2012), as being stolen from Uchumi Commercial Bank through the ATM's in Moshi region in Tanzania. Cybercrime has become a global threat which needs an urgent attention at national, regional and international level.

"Cyber criminals are always ahead of us," this fact was backed up by the deputy minister for Home Affair's speech by then on opening conference which took place in Tanzania (http://www.thecitizen.co.tz) "Many people are ignorant of cyber-crimes while our police force has low capacity," he said in Arusha where IT specialists, lawyers, police officers and others from the East African region had a meeting to devise ways to tackle the problem. He added that currently there were more than 300 cybercrime cases which are being investigated by the police in Tanzania but admitted the exercise was slow because the police and other agencies were ill-equipped and not conversant with such crimes. The wave of hacking underscores the financial industry's battle to thwart cybercrime and comes as consumers and banks are reeling from several high-profile data breaches at retailers that have exposed millions of credit cards and debit cards to potential fraud. The statistically presentations from the

research carried out presents the general trend of cyber-attacks within the past six years from different regions in Tanzania (Figure 1).

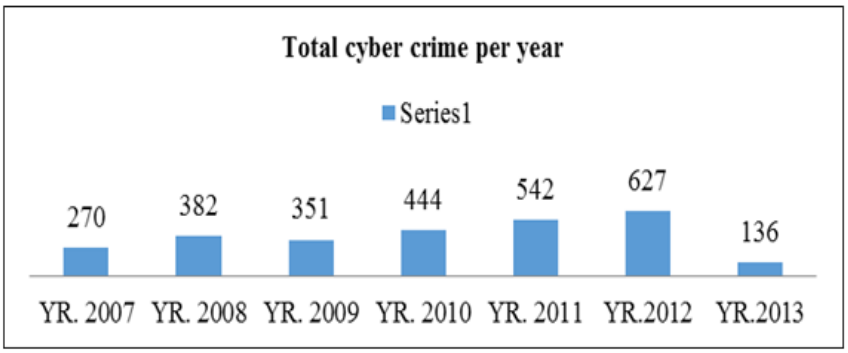


Fig. 1. Cyber crime annual statistics cumulative by 2013. (Source: Tanzanian Cyber Crime Unit 2013)

Criminal Stealing Techniques

From January to April 9, 2015, the number of attacks on debit cards used at ATMs reached the highest level for that period in at least 20 years, according to FICO, a credit-scoring and analytics firm. The company tracks such incidents through its card- monitoring service for financial institutions that represent more than 65% of all U.S. debit cards (Marginally,2015). Debit-card compromises at ATMs located on bank property jumped 174% from January 1 to April 9, compared with the same period last year, while successful attacks at nonbank machines soared by 317%, according to Fair Isaac Corporation FICO (Sidel,2015). The article went further by clarifying that, the incidents come as banks are racing to issue new credit and debit cards with computer chips that make it more difficult for thieves to create counterfeits. However, most ATMs don't yet accept the new technology, though J.P. Morgan Chase & Co. and Bank of America Corp. have recently begun to install the more advanced machines. Criminals send phishing emails or text messages via mobile phones and trick the victims by convincing them to provide their bank details and Automatic Teller Machines (ATM) pins. Using different telephone numbers as request send by the Bank officials requesting some client's details for banks details amendments. Card skimming occurs in the country, whereby cyber criminal's use and record card details by using a device called a "card skimmer" which is placed right over the card slot or over the keypad of the ATM machine and captures card and PIN

information. Web based attacks are becoming more popular in Tanzania which occur when criminals hack websites. Cyber criminals hack the websites to gain unauthorized access to the personal information of clients or web visitors. This in Tanzania imitates how globally the country is positioned in responding to cyber-attacks issues. Hackers are now using the technique to destabilize websites by performing attacks to deny and/or destroy information, steal information, manipulate information, alter the context in which the information is viewed or change the perceptions of people towards the information.

The findings also recognized that there is a case in the Kilimanjaro region in Tanzania concerning theft of money from Mobile Money agents by the same perpetrator (an unidentified female) who is very good at it. She apparently does so by approaching agents pretending to want to draw some money but after a while the agent will find all his money gone after she left the place. It is hard to tell what she does but most of the agents have confirmed that the criminal is the same woman, (Unknown, 2013). Such a report comes after a study that shows that transactions through mobiles are growing rapidly in Tanzania. The use of M-money in Tanzania started in 2005 when Airtel introduced phone-to-phone airtime credit transfer. In 2008 Vodacom launched its M-money service called M-Pesa. Zantel Tanzania also introduced its M-money service in the same year, which was first called Z-Pesa (now called EasyPesa). In 2010, Tigo, the first mobile network operator (MNO) in the country launched its M-money service called TigoPesa. The report by Inter Media in 2013 there are four M-money services brands in Tanzania: M-Pesa, TigoPesa, Airtel Money and EasyPesa. Up to April 2013, the registered customer base of mobile payment services was 28.8 million in Tanzania, 8.5 million being active users Bank of Tanzania (Bank of Tanzania, 2013) Currently, with the new players like Halotel and Tanzania Telecommunications Company Limited (TTCL) Mobile, coming on board by 2016 there were more than 39 million mobile subscribers in the country, of which 16.5 million were mobile money subscribers (Edda et al, 2017)

The weak link that can let a hacker clone the so-called “chip-and-pin” credit and bank cards stems from the fact that use of prepaid debit cards for everything from gift certificates to disaster relief handouts is making it easier for hackers to withdraw large amounts of money before detection (Emily et al, 2018) as the Cambridge researchers showed, the Europay, MasterCard (EMV) scheme has, in too many cases, not been carried out as planned. The authentication process, as originally envisioned, was

supposed to depend on the issuing bank to generate a random number for every unique transaction. In practice, where saving money often trumps security, it was left to point-of-sale terminals or cash machines to generate the number. A large percentage of mobile usage in Tanzania can be attributed to its use as a means of money transfer posing it as a significant threat to become a weak link, as accessibility to mobile money transaction is done through punching in four digits to access the authenticity. This makes it all too easy for a hacker. "If you can predict the number, you can record everything you need from momentary access to a sim card and play it back and impersonate the card at a future date and location (Bond, 2012) The mentioned attacks might seem outdated in developed world but are the most common and fast-growing techniques used by criminals in Tanzania and it is unfortunate that the majority of the population is unaware of this. There have been an increasing number of incidents where victims of credit card fraud had their requests for refunds refused by the issuing banks on the grounds that there is no way to explain the card having been authenticated without the cardholder's involvement. During our research we found that all these are facilitated due to:

The Use of More than One type of Customer ID's

One security weakness of M-Pesa is to allow the use of more than one type of customer ID. For example, a customer who used employer ID to register for M-Pesa account can later withdraw money by using another ID such as driving license, voter's ID or any other ID. This situation makes it possible for an incorrect or forged ID to be used.

Weak Pin

M-pesa PIN is a four-digit number. Moreover, the PIN never expires and is written in plain text during the transaction.

Poor Verification of Customer ID

Another security challenge that M-Pesa agents are facing is on how to authenticate M-pesa customers. The agent usually inspects customer ID physically without having any other mechanism for proving or referencing the validity of that ID from the authorities which issued those IDs. This creates a loophole for a person to register for M-Pesa account with a forged ID.

Poor Transaction Confirmation Procedure

Before a sender completes a transaction, the M-Pesa system requires the sender to confirm each transaction before it is fully executed. For example, when a person withdraws money, the last stage is to confirm the amount of the money to be withdrawn and to whom that money is transferred. Generally, the name of the recipient, amount to be transferred and the account number is displayed for verification. The aim is to avoid wrong or unintended transfer of money. Despite this procedure, several cases of transferring money to unintended recipient have been reported. Inaccurate data entry is the main cause of transferring money to unintended recipient. Some of the reasons that contribute to this problem include poor sender concentration when carrying out the transaction, user illiteracy and unfamiliarity with mobile phones.

Lack of End-to-End Verification

Unlike in banking systems where the bank teller has to verify customer signature and photograph physically and then compare them with electronic copies stored in the system, the agent relies on one side authentication by just examining customer ID. If the customer has forged the ID and places his photo, the agent will not detect it. This loophole allows for a fake customer to use a forged ID to access M-Pesa Services.

Lack of Printed Receipts

Another weakness in M-pesa services is that the agent does not issue a printed receipt to the customer once the money withdrawal or deposit transaction is completed. As already explained, each transaction is issued with a unique receipt number that is included in the confirmation SMS. However, if the SMS is compromised, there will be no evidence to indicate that the transaction was carried out between an M-Pesa agent and a customer. From the analysis above based on our previously findings originated from consolidated research and practical work in the area of cybercrime, emerging perspectives, paradigms and trends which were more based on theoretical aspects mostly (Oreku et al, 2017) deliberate efforts are made in making sure that the role of proposing solutions is undertaken to respond to cyber security problem in Tanzania as additional to what was done previously in research analysis.

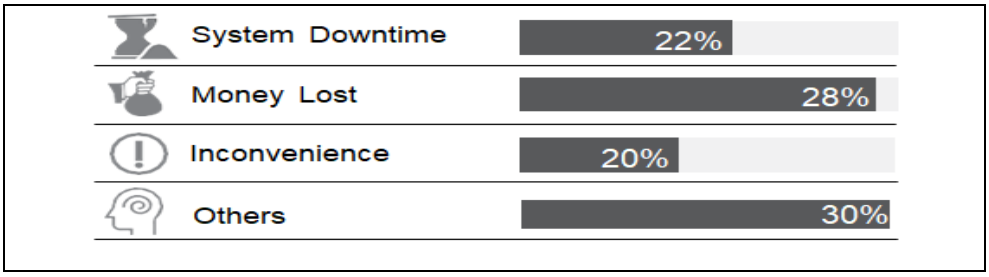
Impact of Cyber Crime

From January to June 2017, 3,340 cases were reported to the police stations. The real impact of the growing interest in fake news however has been the realization that the public might not be well-equipped to separate true information from false information. It is paramount that governments and social media platform owners lay down stringent measures to clamp down on fake news, none the less, we do appreciate that fabricated stories are not likely to go away as they have become a means for some writers to push their narrow agendas, manipulate emotions, make money and potentially influence public opinion. A significant proportion of this cost comes from the insider threat, which we estimate at $30M per annum. In all probability, and in line with our worst-case scenarios, the real impact of Cybercrime is likely to be much greater. As for measuring costs, this report deconstructs the cost based on these four categories:

- ***Costs in anticipation of Cybercrime***, such as antivirus software, insurance and compliance.
- ***Costs as a consequence of Cybercrime***, such as direct losses and indirect costs such as weakened competitiveness as a result of intellectual property compromise.
- ***Costs in response to Cybercrime,*** such as compensation payments to victims and fines paid to regulatory bodies.
- ***Indirect costs*** such as reputational damage to firms, loss of confidence in Cyber transactions by individuals and businesses, reduced public-sector revenues and the growth of the underground economy.

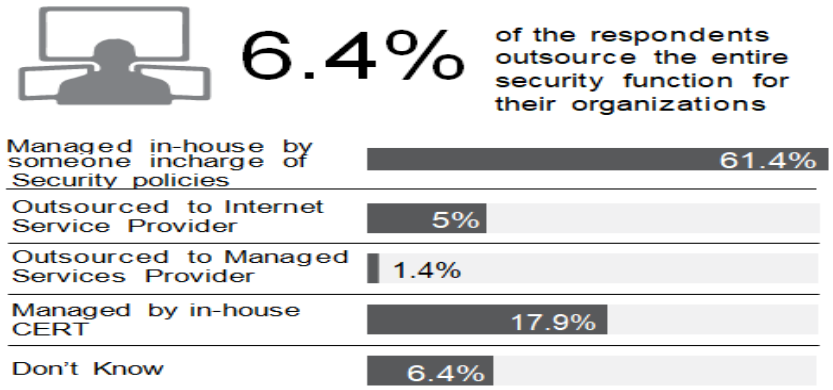
Cybercrime in Financial Institutions

Loss of money, system downtime and inconvenience were identified as the top impacts of cybercrime. This presents one's conclusion that majority of attacks in Tanzania are motivated by financial gain and the reason why Financial Institutions, Savings and Credit Cooperative Societies (SACCOS) and Organization that deal with transaction processing are primary targets for the cyber- attacks. When the study was conducted, particularly with financial institutions, the response to the question, "How has cybercrime impacted you?" majority of respondents indicated an impact of Cybercrime portrayed below.



Managing Cyber Security

79.3% of organizations including Financial Institutions manage their cyber security in-house as follows: - 17.9% being handled by a dedicated in-house Computer Emergency Responses Team (CERT) and 61.4% handled by an individual in charge of security within the organization. This is an increase of 8.3% from the year 2016. Only 6.4% have outsourced these services to an external party managed security service provider and Internet Service Provider (MSSP or ISP). More and more companies are now developing in house capabilities to manage cyber security, this is particularly the case with Banking and financial institutions. Our survey on the question "how is your Organization's cyber-Security being managed" revealed that majority of respondents (55%) who did not know how their cyber security was managed came from the Government sector. This was closely followed by by insurance (11%) then Academia (10%).



Proposed Rule Based Data Mining Model

It is based on the foundation of (Mbowe et al 2016) research work conceptualized in a previously developed prototype which integrated the information security policies to enhance the security strategies for effective protection of critical assets. The generated radar and line graphs for assessing inside threats and security awareness and maturity level in public organization have provided a practical approach for improving the internal security strategies for preserving confidentiality, integrity and availability as core services in security management. After field research and data collections, the study proposed the rule-based data mining approach. Data Mining (DM) has emerged for knowledge discovery especially from big data aimed at predicting the future state of the data for decision making. In so doing, our approach has adopted ruled-based data mining technique for useful information extraction or knowledge discovery (see Figure 2) for visualization of organizational security threats from computer logs, awareness data, security maturity data and other security sources or files.

From traditional DM process model perspective, we have integrated the spoofing, tampering, repudiation, information disclosure, denial of service, and elevation of privilege model (STRIDE) model and organization's security policies into the data mining process model in order to streamline the data mining processes as shown by Figure 7a and 7b contrary to traditional DM approach. By using the classification technique; the security log data, awareness and maturity data were classified at different levels of representation or organizational security threats: spoofing, tempering, repudiation, information disclosure, denial of service and elevated privileges. Five organizations were selected to pilot our approach by testing our model as per table 1 below.

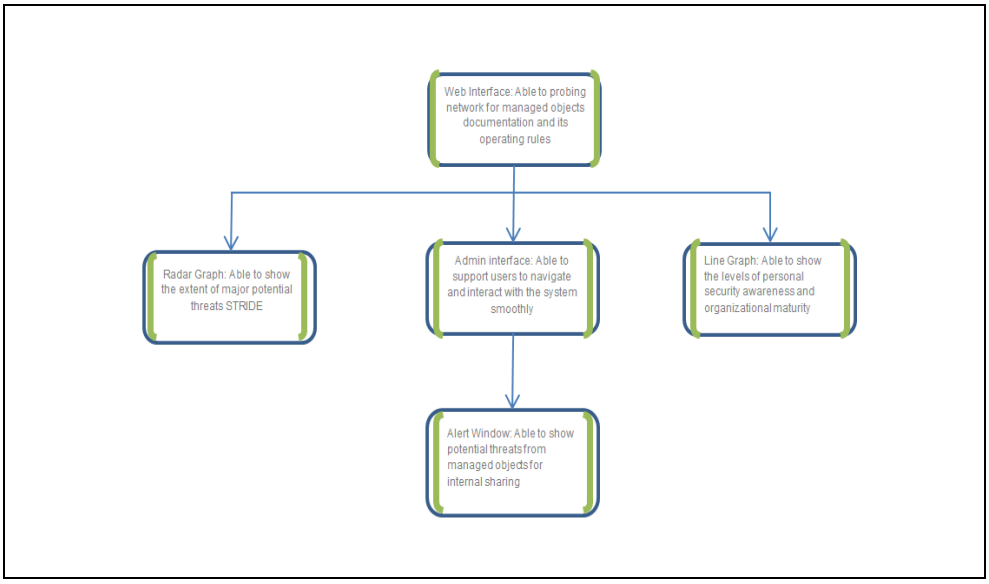


Figure 2. The Conceptual Interface Design Model

Table 1: About 108 participants: 23 IT technical staff and 85 non-IT staff were interviewed using structured questionnaires

Organization	Total Staff	IT staff	Non-IT staff
V	280	14	266
W*	96	3	93
X	236	5**	231
Y	36	4	32
Z	120	4	116
Population	**768**	**30**	**738**
Sample Size(n) C.L=95%, C.I=10		**23**	**85**

**Includes the staff at HQ's only.*
*** Out of 63 IT staff at HQ and up-country, only 5 were drawn from HQ running all critical servers.*

Table 1: About 108 participants: 23 IT technical staff and 85 non-IT staff were interviewed using structured questionnaires.

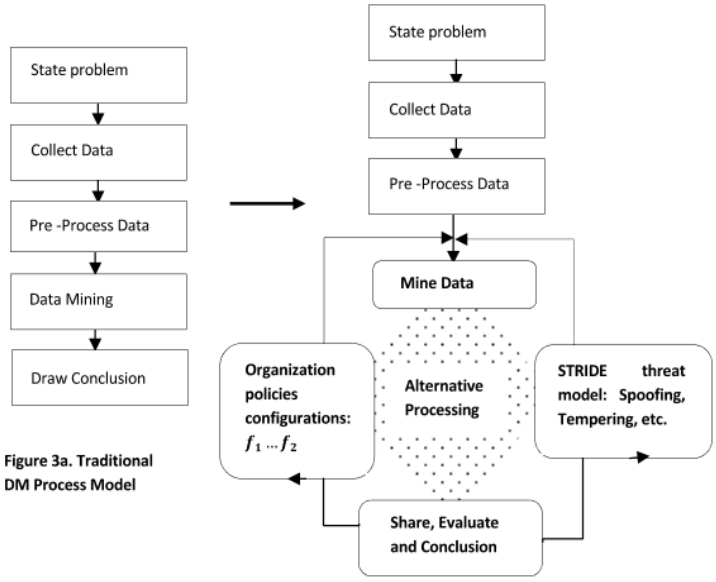


Figure 3a. Traditional DM Process Model

Figure 3b. Processed DM Process Model

To score these organizational security threats, we assessed different levels of the security maturity: non-existence, ad-hoc, repeatable but intuitive, managed and measurable, and finally optimized as indicated by Table 2 and later on the organization's security knowledge and awareness such as non-existence, poor, satisfactory, good, very good and excellent. Furthermore, the Likert-type response anchors (Vagias, 2006) with four possible answers - not at all, a little, quite a lot and completely with compliance numeric value: -0,0.33,0.66 and 1 respectively were used for testing the agreement of compliances of proposed organization's policies for attainment of appropriate security maturity level and security awareness programs. Also, the conversion by (Pederiva, 2003) was used to compute the normalized compliances for the purpose of assessing organization's maturity level and awareness (see Table 2). Thus, predicting the potential organization's threats to be High, Moderate or Low for numeric values 3.33-5.0, 1.67-3.32 and 0.0-1.66 respectively.

Measuring Index	Security Maturity	Security Awareness
0.00 – 0.50	Non-existence	Non-existence
0.51 – 1.50	Ad-hoc	Poor
1.51 - 2.50	Planned	Satisfactory
2.51 – 3.50	Well-defined	Good
3.51 – 4.50	Managed	Very Good
4.51 – 5.00	Optimized	Excellent

2: Security maturity and awareness measuring indicators

Experiment Prototype and Results

After the design phase, the study adopted Web scripting languages and MySQL for web interface and database implementation respectively. The web interface was modeled very simply and intuitively to ensure easy interactivity in security analytic and thus increasing the possibility for wide adaptability across the organization structure. One of the organizations was selected as a case study for experimental prototype implementation. The selected organization has established Information Communication Technology (ICT) policy and its associated ICT information security policy for managing their information assets. However, during data collection we found that its information security policy was based on ISO27001:2005 and thus the controls do not evolve based on organizational risks. Our study adopted ISO27001:2013 information security management framework which rolls based on organizational emerging risks. However, the controls defined by the organization's information security policy were used in order to maintain their existing policy structure. After this technical alignment, the data collected in (Mbowe, 2013) during assessment of security awareness and maturity levels were used as pilot data for testing the experimental prototype while on development stage. The statics of the survey from five companies are presented in the table 1 above.

Prototype Experimentation

The functions provided by the prototype were developed using PHP and R scripting languages. The back-end operations (e.g., analytic engine) was implemented by R scripting language R Core Team (2015) and MySQL database engines. On the other hand, the front-end operations (e.g., web interface for user interactions and data presentation) PHP scripting language was used. The web interface was modeled to be very simple and intuitive to ensure easy interactivity and thus increasing the possibility for wide adaptability across the organization structure.

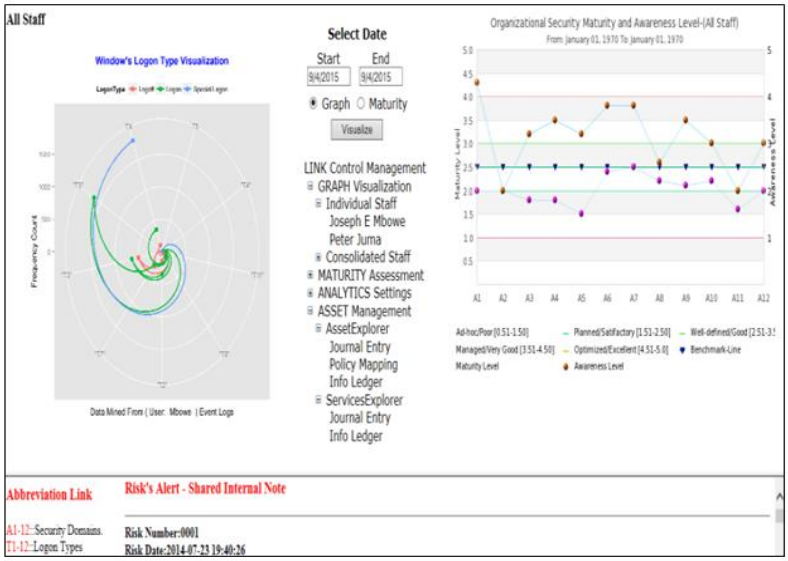


Fig. 4. The panel for visual data representation of experimental results

For experimentation purposes, the organization which was selected as a case study had computer logs collected for analytics and visualization. The output of the prototype is presented by the screen snapshots shown by Figure 4. Our experiment was focused on Windows Logon by analyzing different types of logon or logoff activities prompted by a particular event and thus monitoring unusual logon/logoff for type 2, 3, 8 and 10. The study found that, selected logon types may have high impact on security when window policy configurations are inadequately configured. For example, the check-indicator of each type is described in Table 3.

Table 3: Security maturity and awareness measuring indicators

Logon Type	Description	Check-Indicators
Logon Type 2 - (T2) **Interactive**	A user logged on from console to this computer	Suspicious Type 2 multiple *audit failure* may indicatepassword guess or elevation using console or keyboard.
Logon Type 3 - (T3) **Network**	A user or computer logged on to this computer from the network.	Suspicious Type 3 multiple *audit failure* and later *audit success* may indicate anonymous logon by malware or attacker through a network.
Logon Type 8 - (T8) **NetworkClearText**	The user's password was passed to the authentication package in its un-hashed form with audit success	Type 8 audit success indicate inadequately policy configuration which allows plaintext or clear text as login credentials thus easily to be sniffed.
Logon Type 10 - (T10) **Remote Interactive**	A user logged on to this computer remotely using Terminal Services or Remote Desktop.	As type 3, but user tried to login from remote computer

As shown on Figure 4, the extracted information from window's security logs representing logon/logoff for type 2, 3, 8 and 10 is presented by Figure 5.

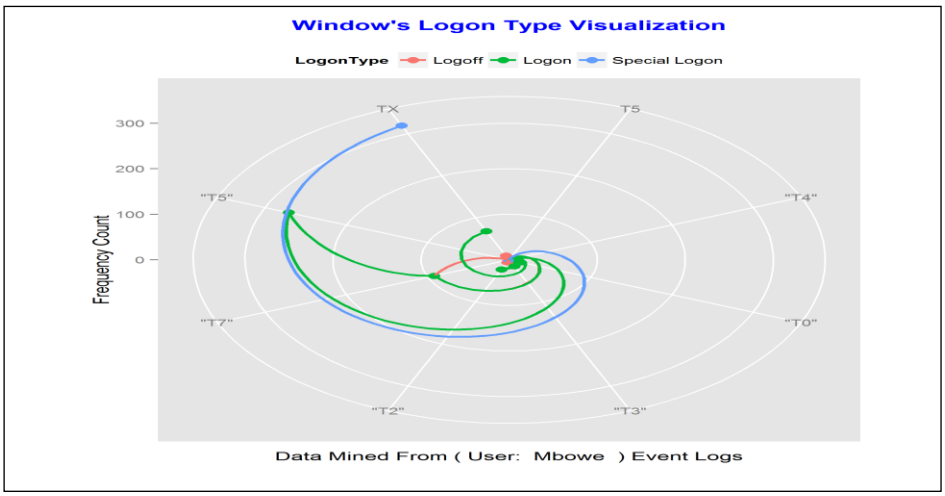


Figure 5. The Security Logs Data Visualization

Prototype Overview

The data visualization using the proposed prototype has shown that it can be useful for leaders, systems administrators and security officers to keep an "eye" on critical systems or computer attached to their cyberspace. Also, the use of pictorial presentation of security logs based on logon types have simplified the visualization of big data such as security logs generated by Windows security logs. For example, the quick-scan of the summary data showed that about 3% (238) of audit failure occurred compared to 97% (7,920) of audit success for a given time interval. Actually, if more Audit failure occurs, it gives an insight for further follow-up to see what is happening in the background to ensure the success or failure is not occurring due to attack through various security loopholes. Also, the processed information presented by the radar graph (see Figure 5) can be used for decision-making in regard to information security management.

The platform also has demonstrated the practical ways for automation of an organization's information security policy for provision of effective strategies for security management. It illustrates the extent of potential inside threats and the user-compliance for a particular organizational environment and culture. Furthermore, it's of our opinion that, the greater understanding of the security awareness across the organization structure will be a catalyst for management accountability to enhance security management. This proposed platform generates graphs and internal risks notifications which can be the source of information for preparing the effective security strategies including security seminars, workshops and training so as to ensure all security domains are well covered to preserve security confidentiality, integrity, accountability and availability.

The Key Findings of the Research

Whilst there was no clear consensus on the trends of cyber security in Tanzania, there was a definite agreement that the top cyber security breaches in Tanzania result from social engineering attacks such as phishing, 419 scams, identity theft and unauthorized access. Breaches resulting in financial fraud and embezzlement through internal collusion and involving e-delivery channels such as ATMs, mobile channels and the web were also rated high, particularly for the financial sector. The third highest category of cyber security breaches is information asset Research by Wolf Park, (2014). Perfecting the findings done previously

in (Oreku et al 2017, & Mbowe et al, 2016) to supplement the foundation put forward. This paper has expanded to reflect the changing emphasis on cyber security extent. Similarly, the small changes and improvements on Theft through session hijacking, email hijacking and website hijacking was also noted throughout. Moreover, respondents rated the internet as the leading source of cyber security breaches in Tanzania, followed by insider collusion, pharming and phishing. Furthermore, the research identified the following results:

- An overwhelming majority of respondents selected social engineering as the key cyber-attack method in Tanzania and also identified malware and key loggers as other frequently used methods.
- For example, from the research conducted, about 92.1% respondents indicated that their organizations had no effective strategies for managing their ICT assets with regard to security breaches and only 41.2% respondents were aware of the existing security awareness programs.
- According to other respondents, they were of the observation that leading cyber vulnerability in Tanzania is the lack of user awareness for both employees and customers. The vulnerabilities arising from weak technical security practices such as poor patch management, outdated anti-virus software and unsecured or misconfigured networks were also highly rated as per our findings.
- According to the survey, the use of monitoring tools and other detection mechanisms could be the principal way of detecting cybercrime threats in Tanzania today. Customer reports also could be the next most prevalent detection method. The use of internal audits and routine staff checks are also key detection methods.
- As currently there is no accurate data addressing the cost of cybercrime cost in Tanzania and most of the loss still goes unreported, the respondents were only able to estimate a conservative loss in excess of 892.18 billion Tanzanian Shillings on Cyber-crimes by the year 2012 annually whilst noting that the key emerging threat to cyber security in Tanzania today is related to e-delivery channels (ATM fraud, mobile fraud & card holder data theft), followed by social engineering attacks.
- However, it is estimated that governments could lose more than USD 50 billion to deal with the costs associated with malware on pirated software by article "'Microsoft Reminds Consumers to be Vigilant to avoid Unintentional Purchase of Counterfeit Software," (2016)
- Respondents from financial institutions and telecoms sectors reported

having in-house staff with requisite Information Security training and certifications. The in-house staff and external service providers used to detect incidents and conduct investigations as experts; though the number of these people was low and hence the need for more experts was paramount.

- Our research also found that many Tanzanian organizations, especially financial institutions, do not report many cybercrime incidents, out of fear of reputation damage. Other reasons include a lack of confidence in the ability of law enforcement agencies to handle cybercrime incidents and the absence of consequences for not reporting cybercrime.
- Many respondents noted the absence of a legal and regulatory framework being in place as a glaring impediment to cyber security in Tanzania. It was, however, noted that the Cybercrime Bill 2013 is awaiting passage by the National Assembly. This bill, together with the existing Task Force (comprising of members from Bank of Tanzania (BoT), Tanzania Communication Regulatory Authority (TCRA), Financial Intelligence Unit (FIU), Tanzania Bankers Association (TBA) and the Police Force Cyber Crime Unit) will have mandate to attain compliance to the ISO27001 and ISO27002 international standards and are regarded as the top initiatives to develop and strengthen Tanzania's legal and regulatory framework.
- Respondents also noted a number of key collaborative initiatives aimed at addressing the cyber threat quandary include the Tanzania Communication Regulatory Authority (TCRA), Police Force Cyber Crime Unit, the UDOM Cyber project, and Professional Association led initiatives. Most respondent organizations participate in various public-private partnerships for the purpose of preventing and detecting cybercrime. However, suggestions were made towards collaborating on a National, Pan- African and International scale. Moreover, respondents felt the need for research to drive these initiatives and combat cybercrime as a whole and this should be driven by public-private partnerships.
- According to the survey, the top skill sets needed in Tanzania are computer and digital forensics, forensics investigation, cybercrime prevention, detection and incident handling and technical ethical hacking skills. Respondents felt that the training needs could best be addressed by a National Cyber Security Training Task Force, in conjunction with private training institutions, which should be properly regulated and accredited.

- The study revealed cyber security related training received by government and regulatory authorities is particularly deficient, whereas, e-payment companies appear to receive adequate training in this regard. Respondents identified various training interventions ranging from general awareness to highly skilled information security courses addressing incident response, attack and defense, secure coding, ethical hacking and forensic investigation.
- An overwhelming majority of respondents do not believe Tanzania is investing enough resources in mitigating cybercrime, although it was noted that considerable investment had been made by Tanzania Communication Regulatory Authority (TCRA), mainly in response to its mandate.
- Most respondents agreed that there should be an inclusive large scale and sustained national awareness campaign on cyber security across the country addressing all stakeholder groups with an emphasis on the key sectors of the economy and targeted at the top tier of organizations.

Further Enhancements of the Prototype

Currently, the prototype includes threats associated with violation of organization information security policy which used for experiment based on ISO 27001:2005 security domains and sample data loaded for STRIDE threats evaluation. However, further work is required to review the existing policy to comply with ISO27001:2013 and also to integrate the automatic assessment of vulnerabilities from security logs and known loop holes associated with malware activities, unmanaged configurations, active Trojan ports and security logs from big data (e.g., security warning and error logs). As part of the future enhancements, the prototype could be developed to be used in other types of threats as well as different operating system apart from Windows only.

CONCLUSION

Cyber security is today without doubt, an issue of national concern demanding urgent, focused and far-reaching measures to address it. Given the results of this paper and lessons learnt on a global, regional and national level we have identified one of the challenges in Tanzania is to build a nation that is aware of the importance of information security. We urge the passing and enforcement of the Cybercrime Bill 2013 to provide a basis for securing the nation's cyber space. Also, we recommend a

national CERT to be an initiative with private sector input. During prototype testing; we selected one organization from five different organizations which participated in the previous study to run the prototype developed. The graphs generated for visual demonstration have provide evidence that, the policies can be automated to support security management based on pre-defined set of rules. The paper encourages the adoption of global best practice standards, with a bias for information security, on a national level to strengthen institutional controls, processes, systems and skills. Taking the lead from the banking regulator, other regulators should follow suit to adopt these standards within their sectors. Taking the lead from the banking regulator, other regulators should follow suit to adopt these standards within their sectors. Key sectors of the economy such as telecoms, public sector, non-bank financial institutions, oil and gas would be a priority as would-be emerging sectors such as mobile and e-payment providers and large retailers.

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Fee-free Basic Education Policy Implementation in Tanzania: A 'Phenomenon' Worth Rethinking

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ABSTRACT
This paper is based on a study that employed qualitative research methods to examine the implementation of the fee-free basic education policy in Tanzania. The study reveals that, the policy is misapprehended, and causing confusion and dissonance among key implementers including heads of schools and parents, and it is threatening the quality delivery of education. However, there is no doubt that the implementation of the fee-free education policy has significantly promoted access to basic education for children from various socio-economic backgrounds. Thus, this paper argues that the implementation of the fee-free basic education policy, albeit commendable, it is not a panacea to achieving equitable access and quality education delivery for all. Hence, the policy and its implementation is a 'phenomenon' worth rethinking for Tanzania to realise equitable and quality universal basic education.

Key words: Fee-free education policy, basic education, policy implementation and Tanzania

INTRODUCTION

Tanzania attained independence in 1961. The Tanzanian government recognises the value of investing in human capital in order to fight diseases, poverty and ignorance among its citizens. Since independence, various education-related reforms have been implemented to address the challenges that undermine the education sector. The majority of the reforms have been made as measures to express government's commitment to ensuring that all school-age children have access to basic education (URT, 2014). The Tanzania's government commitment and efforts are evident in several international, regional and national instruments to which Tanzania subscribes. These instruments include the Universal Declaration on Human Rights (Article 26); the International

Covenant on Economic, Social and Cultural Rights (Articles 13 and 14); the Convention on the Rights of the Child (Article 28); the Convention on the Elimination of All Forms of Discrimination against Women (Article 10); the Convention on the Rights of Persons with Disabilities (Article 24); the UNESCO Convention against Discrimination in Education (Article 4); the ILO Convention 182 on the Worst Forms of Child Labour (Preamble, Articles 7 and 8); the African Charter on the Rights and Welfare of the Child (Article 11); and the African Youth Charter (Articles 13 and 16) (Right to Education Project, 2014).

Tanzania's efforts to guarantee education for all are further informed by the 1990 World Conference on Education for All, which set out a vision for education and restated the goal of achieving Universal Primary Education (UPE) by 2000 (UNESCO, 1990). However, by the year 2000, many countries including Tanzania had failed to achieve UPE targets. Consequently, the Dakar Framework for Action (DFA) (UNESCO, 2000) and the Millennium Development Goals (MDG) restated formally what was required. The DFA and MDG goals for education required governments to ensure that, by 2015, all children, regardless of their gender and geographical location, had access to and completed their basic education. These goals required countries to implement strategies for ensuring access to quality primary education for all children. These goals were further refined in the Sustainable Development Goals (SDGs). One of the SDG education targets is that all nations should ensure that all girls and boys complete free, equitable and quality primary and secondary education, leading to relevant and effective learning outcomes by 2030. In this light Tanzania introduced a fee-free basic education policy that aimed at narrowing the gap for the vulnerable children who shortfall in attaining basic education down to incapacity of their families to afford paying for education expenses.

Fee-Free Basic Education in Tanzania: The Past and Present Contexts

Tanzania has committed itself to ensuring access to education for all school-age children since independence. Immediately after independence, in 1963, school fees were abolished in all secondary schools. This initiative aimed at reducing the disparity in enrolment based on income (Cameron and Dodd, 1970), and providing opportunity for children to

study from primary school up to university level without paying any fees. In the 1970s, however, Tanzania, like many other developing countries, experienced economic instability due to the higher oil prices, among other factors. In response to this devastating problem, the World Bank and IMF introduced a Structural Adjustment Programme (SAP) for which Tanzania was among the countries to accept (Daven, 2008). Among other things, the programme required Tanzania to cut its spending on the social sectors in order to reduce its budget deficit. Consequently, public expenditure on education declined by a quarter from 1975 to 1990 (UNICEF, 1990). In the 1980s, however, the demand for cost-sharing in education increased due to educational deterioration and pressure from the international financial institutions. This led to a gradual increase in households' contributions and the re-introduction of enrolment fees in 1995 (Daven, 2008). In the early 2000s, however, fees for primary education were abolished as a result of the implementation of the Primary Education Development Plan (PEDP) 2002-2006. One of the key PEDP components was to expand primary school enrolment by ensuring that all children aged 7-12 years old were enrolled into standard one by 2004. To achieve this enrolment target, PEDP abolished tuition fees and other mandatory cash contributions from parents from January 2002 (URT, 2004). A United States of America (USA) dollar ($10) equivalent to Tshs 10,000 annual capitation grant per pupil was provided by the government to offset primary school-related costs, although parental contributions were also in place to meet additional school running costs. There was no specific amount of contribution set officially. Schools and parents, through school committees or boards, decided how much parents should contribute to the schools depending on the various needs that were also determined, for example, by the location of the school—urban or rural.

In 2002, the Gross Enrolment Ratio (GER) and Net Enrolment Ratio (NER) in primary schools stood at 98.6% and 80.7%, respectively. The enrolment rate was higher than that in 2000 by almost 20% and 21%, respectively. In 2007, the GER and NER increased to 114.4% and 97.2%, respectively. This gain, however, was not maintained. Since 2010, progress in increasing access to standard one has been marginal. In 2013, for example, the NER slipped to 89.7%. This implied that Tanzania might no longer be on track towards achieving universal education by 2015 (URT, 2015). According to the MoEST and UNICEF (2016) out of school children report, only 31.7% of pre-primary school-age children were attending school.

About 2 million primary school-age children and 1.5 million lower secondary school-age children were out of school in Tanzania. Of these, 1.7 million children of primary school age and 400,000 of lower secondary school age had never attended school. The report identified several reasons for children being out of school, and poverty was identified as one of the key reasons why many children do not attend school. Further, the report suggested that the indirect costs of schooling were high (MoEST and UNICEF, 2016), which might be an obstacle for parents to enrol and keep their children in school. In 2014, the Tanzanian government introduced a revised Education and Training Policy (ETP) to replace that instituted in 1995. The 2014 policy advocated "Fee Free Basic Education", which means that every child would have access to fee- and contribution-free basic education (URT, 2016).

Up until 2015, the formal education system in Tanzania reflected a 2–7–4–2–3+ structure, encompassing two years of pre-primary (non-compulsory) education, seven years of compulsory primary education (Standards I to VII, for children aged 7 to 13 years), four years of fee-paying lower secondary education (O-Level Forms 1 to 4, for children aged 14 to 17 years), two years of fee-paying upper secondary education (A-Level Forms 5 and 6, for youths aged 18 to 19 years) and three or more years of higher education. The formal education system was recently restructured to 1-6-4-2-3+ (URT, 2014). This reform has expanded the compulsory basic education from seven to 11 years, including one year of compulsory pre-primary education. Nevertheless, the reform is yet to be accommodated in the Education Act, which will enshrine it into Tanzania's law. In the meantime, the former structure remains, although the one year of pre-primary education has been accommodated. In the context of this paper, therefore, the fee-free education policy applies to the 11 years of compulsory basic education (URT, 2014). Following the policy statement on fee-free basic education, the Government Circular No. 5 (URT, 2015a) was established to formalise the government's commitment to providing fee-free basic public education, as stipulated in the Education and Training Policy of 2014. The Circular also provided directives to corresponding public bodies to ensure that primary and secondary education is free. Significantly, the circular releases parents from all contributions, as it reads: "The provision of free education means pupils or students will not pay any fee or other contributions that were being [made] by parents or guardians before the release of the new circular".

Following the issuance of this circular, the government released grants amounting to Tshs 49,173,165,000 for the 2015/2016 academic year. Of the total amount, 64 percent was set aside for primary schools while 36 percent was earmarked for secondary schools. Consistent with the previous fee- and contribution-free primary education, the current fee-free basic education initiative exempts parents with children in public primary schools from paying tuition fees and making other school-related contributions. In addition, the initiative extends to public secondary schools at the ordinary level (Form 1 - 4). This is in recognition that fees place a burden on parents, a condition which limits the maximization of school enrolment. The fee-free basic education funding that the government provides for primary schools is Tshs 10,000 per child per year. Of this amount, 60% (Tsh 6,000) is transferred directly from the Treasury into the school's accounts, whereas 40% (Tshs 4,000) is retained by the government for the purchase of textbooks. The capitation grant set for secondary schools is Tshs 25,000 per student per year. Of this amount, only Tshs 12,500 is expected to be transferred direct to a school. Furthermore, the government compensation for day and boarding secondary school tuition fees is set at Tshs 20,000 and Tshs 70,000 per student per year, respectively. The cost of meals at boarding schools amounts to Tshs 405,000 per student per year. Of the funds transferred to schools, the utilisation distribution is as presented in Table 1.

Table 1: Utilisation Distribution of Capitation grants transferred to public schools

Primary School	Secondary School
Administration 10%	Academic purposes 30%
Maintenance 30%	Continuous assessment 15%
Materials 30%	Office expenses 35%
Sport 10%	Minor repairs 10%
Examinations 20%	Medicine and expenses related to female students 10%

Source:(URT, 2015b)

As Table 1 shows, the expected utilisation of the funding for primary and secondary schools differs in terms of the associated items and amounts. Some items receive a greater allocation than others. For clarity and to support the effective implementation of fee-free basic education, the

Tanzanian government has issued a series of circulars: Education Circular No 5 (URT, 2015a) (issued on 27 November 2015); Education Circular No. 6 of 2015 (URT, 2015b) (issued on 10 December, 2015); and Education Circular No. 3 of 2016 (issued on 25 May 2016) and (URT, 2016). Despite Circular No. 5's provisions, tension and mixed feelings about fee-free basic education existed among education stakeholders, including parents, with some perceiving it as precluding making parental contributions for their children's education altogether. As a result, the government issued circular No. 6 (URT, 2015b) to clarify the role of parents with regard to fee-free public basic education. The circular, among other things, states that parents should meet the costs for the following items:

i. School uniforms and uniforms for sports activities; learning materials such as books, pens and pencils
ii. The provision of food for children attending day schools (in co-operation with the school leadership);
iii. Medical expenses for the child, and travel expenses for both day and boarding school pupils; and
iv. Mattress, bed-sheets, and personal hygiene materials for boarding schools' pupils and for those staying in government-owned hostels.

In addition, the parents are obliged to provide information where practices contradict the spirit of the provision of fee-free basic education. These clarifications notwithstanding, confusion persists within a cross-section of the public, particularly among the low-income groups. As a result, the government issued another directive, Circular No. 3 of 25th May 2016, to provide further clarification and list the responsibilities of the various stakeholders: the Ministry of Education Science and Technology (MoEST); the President Office-Regional Authority and Local Government (PO-RALG); the Regional and District Commissioners; the District Executive Directors (DED); the school committees/boards; the heads of schools; and the parents. Overall, the responsibilities range from issuing circulars to guide the implementation of the policy, reimbursing capitation grants, planning, budgeting for capitation grants at various levels, monitoring the implementation of the policy, and taking legal action in cases of poor policy implementation (URT, 2016).

Capitation Grants Releases, 2015/16 – 2017/18

The available information reveals that the budget allocation to the

education sector increased by 22% from 2015/16 to 2017/18. However, recently, the budget has decreased by 1.3%, from Tshs 4,770,952,584,000 in 2016/17 to Tshs 4,706,361,982,000 in 2017/18. The Capitation Grants released to primary and secondary schools oscillate (URT, 2018). Table 2 shows the Capitation Grants (CG) released to government-funded primary and secondary schools for the period 2015/16-2017/18.

Table 2: Capitation grants released to government-funded primary and secondary schools, 2015/16-2017/18

	2015/16	**2016/17**	**2017/2018**
Primary	31,444,671,000	53,905,164,000	53,905,165,716
Secondary	17,728,494,000	30,391,704,000	19,699,194,253
Total CG released	**49,173,165,000**	**84,296,868,000**	**73,604,359,969**
No. of Primary Pupils		8,337,545	8,969,110
No. of Secondary Students		1,469,760	1,564,676
Amount per pupil in Primary schools	3,770	6,465	6,010
Amount per student in Secondary schools	12,010	20,678	12,590

Source: United Republic of Tanzania: Education Sector Performance Report, 2017/2018, Tanzania Mainland, September 15th, 2018

As Table 2 shows, the CG released to primary schools increased by 71 percent, from Tshs 31,444,671,000 in 2015/16 to Tshs 53,905,165,716 in 2017/18. Similarly, the CG released to secondary schools increased by 71 percent, from Tshs 17,728,494,000 in 2015/16 to Tshs 30,391,704,000 in 2016/17. Likewise, the amount disbursed per pupil and student increased. Moreover, the data show that the amount released per pupil and student exceeded the policy mandated amounts of Tshs 6,000 per pupil and Tshs 12,500 per secondary school student in 2016/17 and 2017/2018. Similarly, given the effect of fees on access, the policy-makers, educators, and development economics from other Sub-Saharan Africa countries such as Malawi, Kenya, Uganda, and Zambia, have advocated fee-free primary education in their respective education sectors (World Bank, 2009).

They have raised concerns that the fees are acting as a financial barrier to education. Thus, the abolition of fees would make it easier and less costly for school-age children to enrol in school (USAID, 2007). The available information reveals that enrolment increased significantly in countries where school fees were abolished. In Uganda, for example, the enrolment nearly doubled in the year after the fees were abolished. Similar increases in enrolment following the abolition of fees were noted in Kenya, Malawi and Zambia, to mention but a few. We further learn that enrolment in those countries increased most rapidly among the most disadvantaged children, including girls, orphans and children in rural areas (USAID, 2007). Few would dispute that removing school fees might reduce a significant burden from poor families but it may not be a panacea since the practice may not bring the schooling cost to zero. Even if school fees are abolished, poor and vulnerable children may still face barriers to obtaining an education due to the indirect education-related costs that many households face. Thus, school fees' abolition alone may not necessarily lead to improved accessibility. Other factors need to be considered if the gains made due to the fees' abolition policy and practice are to be consolidated and sustained (USAID, 2007). The initiative of the Tanzania government to provide fee-free basic education has received both national and international attention and, indeed, commendation. However, much remains unknown about how various stakeholders perceive and translate the fee-free basic education policy into practice. We also know little about the impact of the policy implementation within the teaching-learning processes. This study, therefore, aimed to explore the education stakeholders' perceptions and understanding of the fee-free basic education policy and how this policy is translated into practice.

This study is informed by the top-down perspective on policy implementation, which assumes that the policy's goal can be specified by policy-makers and successfully implemented by setting up firm machinery (Paudel, 2009) for implementation. This perspective stresses the formal handling of problems and issues, which can easily be manipulated, centralised and controlled. Of interest are things such as funding formulae, formal organisational structures and authority relationships between the administrative units, plus regulations and administrative controls, such as budgets. In this context, policy implementation begins at the top of the process as an authoritative decision, with a clear statement of the policy-makers' intent, then proceeds through a sequence of increasingly more specific steps to define what is expected of the implementers at each level (Matland, 1995;

Paudel, 2009). The top-down approach, however, fails to recognise the complex implementation structures, placing exclusive emphasis on the framers of the policy as the key actors. Further, this approach neglects the reality of policy modification at the hands of the implementers, and it also assumes that all priorities are known. Moreover, the top-down approach can lead to resistance, disregard and *pro forma* compliance (Paudel, 2009).

METHODOLOGY

The study was informed by the qualitative research approach. This research approach allowed the collection of detailed, comprehensive information on the research topic. Data for the study were collected from seven districts on mainland Tanzania that were conveniently selected, one from each of the seven educational zones spread across the country. The inclusion of one district from each educational zone was necessary in order to facilitate a comprehensive understanding of the implementation of the fee-free education policy from zones containing diverse socio-economic backgrounds. For each district, eight schools (four primary and four secondary) were randomly selected. Thus, a total of 56 schools (28 primary and 28 secondary) were sampled to participate in this study. All of the sampled primary schools were day schools while 5% of the secondary schools were boarding schools.

The study involved 339 participants, consisting of seven District Executive Directors, seven District Council Chairpersons, seven District Education Officers, 56 school committee/board chairpersons, 56 heads of schools, 112 teachers, and 84 parents. The district officials and heads of the schools were purposively recruited to participate in the study. On the other hand, the teachers were randomly selected from their respective schools whereas the parents were conveniently recruited based on their availability and consent. The heads of the schools helped to convene the parents with children in their respective schools.

The study employed interviews and focus group discussion techniques to generate information. Interviews were conducted with the district officials, heads of schools, and school committee/board chairpersons. A total of 28 focus group discussions (FGDs) were conducted. Four FGDs, two with parents (one with parents with children in primary school and one with parents with children in secondary schools) and two with

teachers (one with primary school teachers and one with secondary school teachers) were conducted in each participating district. In addition, the study employed content analysis of relevant documents. These documents included the Education and Training Policy (2014), Basic Education Statistics of Tanzania, 2012-2016 and 2017 and fee-free basic education-related circulars. All of the interview and FGD sessions were conducted and audio-recorded using Kiswahili, which is the language of the majority of people in Tanzania. The data was later transcribed and translated into the English language. The analysis of the data was informed by a thematic analytical approach. The analysis proceeded through three main steps: preparing and organizing the data; creating the themes; and coding. The preparation and organization of the data for analysis started during the fieldwork. This involved listening to each audio-recorded interview and focus group discussion session. This enabled the researcher to become familiar with the data. This process was followed by a verbatim transcription of the interview and focus group discussion proceedings. Thereafter, the themes were generated inductively. After creating the themes, the transcripts were re-read for coding, which involved associating the data with the themes created.

FINDINGS

Understanding of Fee-free Basic Education

The findings showed that, generally, among the study participants, there was confusion and even some misunderstanding regarding what the fee-free basic education policy meant. When asked what they understood regarding fee-free basic education, 40 percent of the heads of schools, for example, said that it entailed the government meeting the total cost of basic education whereas 23 percent of the heads of schools reported that it meant providing education without paying school fees only. About 32 percent of the other heads of schools understood fee-free basic education as involving parents making a partial contribution to the basic education sector. Furthermore, only about half of the parents expressed that fee-free basic education policy frees parents from paying all expenses related to their children's public-school education. This implies that half of the parents involved in this study understood fee-free basic education policy as constituting freeing parents from paying fees or making any other sort of financial contribution to their children's education whatsoever.

The Capitation Grants Received are Insufficient to Meet all Schools' needs

The findings reveal variations in the amount of grants that the schools received. Some schools reported receiving less than the expected amount while others, the secondary schools in particular, received slightly more than they had anticipated. Nearly all of the heads of schools complained that the capitation grants they received were inadequate to meet the basic school requirements. In particular, the heads of schools were concerned about the amount of funding they received for academic and administrative purposes. For administrative purposes, the secondary schools used the funds received to produce identity cards for the students and teachers, buy files and other stationery, and pay for electricity and water as well as security guards. Similarly, the heads of primary schools explained that the funds were inadequate to meet sports, administrative, examination expenses and repair needed at their schools. In fact, some heads of schools added that the funds they received, were on the basis of the number of children enrolled in their schools, failed to meet the school's needs, which varied depending on the school's location and socio-economic factors in the respective school communities. In this regard, they suggested financing each school differently. One of the heads of schools, for example, commented:

> *I fully support fee-free education. However, I feel that it is unfair to treat all schools in the same way. The allocation [of funds] should not be based on the number of students but on the school plan. Each school has particular needs that differ from those of other schools, which need to be considered. For example, the amount allocated for examinations and repairs is insufficient. Administration requires travel, but this has stopped now as there are no funds for that provision.*

Furthermore, the heads of schools reported that, due to inadequate funding, some crucial school aspects had suffered, such as decreased attendance of the school committee/board members at school committee/board meetings, as there were no funds allocated to cover allowances or travel costs. Moreover, the schools failed to provide mid-day meals for their students as no funds had been allocated for this purpose. The district officials (DEOs) also raised concerns about the inadequacy of the funds dispensed to the schools. One DEO, for example,

stated, “the amount for administration that schools receive is inadequate. Many schools have reduced the number of security guards they employ”.

Strict Adherence to School Capitation Grant Guidelines

The study found that strict government guidelines exist on how the capitation grants received by the schools should be used. These guidelines were issued concurrently with Ministry circular No. 6 of 2015. All of the heads of schools explained that they were using the funds strictly according to the guidelines, and that there was no room for modification. The heads of schools had reservations regarding the guidelines, as they instructed the schools to spend funds on specified items only. The guidelines on the use of the funding restricted the heads of schools from modifying the use of the funds for the benefit of the schools and students. For example, some schools had a farm as an income-generating activity, but this could not be continued as there were no funds allocated for the purpose. One of the heads of schools, for example, asked, “Under what line item will the expenditure on buying seeds and buying tools for farming be located?” It was explained that, among other things, farms were used to produce food to provide mid-day meals for the children in schools.

Parents’ Contribute to Supplement the Capitation Grants

Data analysis revealed that 70 and 61 percent of the heads of schools and teachers, respectively, and more than half of the parents indicated that parental contributions were necessary because of the inadequate and inequitable education spending on the part of the government. Indeed, despite the implementation of fee-free basic education, many of the head teachers, teachers and parents still embraced the idea of supporting the government in financing basic education delivery. Moreover, the study findings reveal that nearly all of the participants across the different categories reported that the implementation of fee-free basic education had reduced the parents’ direct contributions to education costs.

However, some parents still contributed in order to supplement the funds received, and 50 percent of the participants agreed that parents continued to bear a considerable share of the expenses related to the basic education of their children. The participants reported that the parents contributed towards meeting the school security, meal programmes, classroom construction, and internal examinations-related costs. Parents with children in Standard VII contributed to their children’s ‘camping’ for

study. It was reported that towards examination, standard seven classes were put in camps to study. Camps were organized in schools by the schools. They were residential camps, whereby pupils stayed in camps a few months before Primary School Leaving Examination months to prepare for their examination. In the camps students were taught and subjected to revisions and tests/examinations locally organized. These camps were supported through parents' contributions both, in monetary and non-monetary terms. Monetary contributions were reported to range from Tshs 1,000 to 5,000 per pupil per camp. This contribution was used to buy food and teachers' token appreciation. In addition to money, the parents also contributed non-monetary items, such as maize and beans. The overall views of the head teachers and teachers regarding the parents' contribution have been captured by the following statement by one of the head teachers, who remarked;

> *The government should allow parental contributions for specific items…There are parents who are more than willing to contribute to ensure that their children get proper education and do well in examinations…There is a need for flexibility in the policy. Applying it rigidly will do more harm than good. There are areas in which parents can contribute. For example, the toilets in some of the schools are unusable and money to carry out major renovations is not forthcoming from the government. Parents should contribute and solve such problems. How do we handle a case where a student breaks a desk? Should the parent not be required to pay for its replacement?*

In other words, the parents were willing to contribute and wanted the government to allow such parental contributions to supplement the funding that the schools received from the government. In addition, the parents found the guidelines for regulating the utilisation of government funding rigid and, hence, called for some flexibility.

Impact of the Fee-free Basic Education Policy on Teaching and Learning

Trends in School Enrolment

The findings revealed that enrolment at the primary schools assessed in this study increased by 41 percent, from 3,278 in 2015 to 4,989 in 2016. For secondary schools, the enrolment increased by 0.3 percent. In 2016, the projected maximum number of 200 pupils was achieved, and the actual enrolment was 285, an increase of 43 percent of the expected

enrolment. Dissimilarly, national data revealed decrease enrolment of Standard One pupils in government streams. In 2017, for example, Standard One enrolment decreased by 2.6 percent whereas, in 2018, the decrease was 10.2 percent, from 2,016,579 in 2017 to 1,810,814 in 2018. Although national enrolment data for 2015 were missing, there was a sharp increase in enrolment from 1,464,376 in 2014 to 2,070,880 in 2016. Total enrolment of pupils in Standard I-VII has increased by 7.9 percent from 8,639,202 pupils in year 2016 to 9,317,791 pupils in year 2017(URT 2017). Similarly, in 2017 to 2018 increased by 8.5% from 9,317,791 pupils in year 2017 to pupils 10,111,671 in year 2018 (URT 2018).

Furthermore, the national data show that enrolment in Government Primary Schools increased by 13.8% from 10,111,671 pupils in year 2018 to 10,605,430 pupils in year 2019. (URT 2019), this increase might be attributed to the implementation of compulsory and fee-free basic education (PO-RALG, 2017). Moreover, the study found that fee-free basic education had also increased access to education among children from poor families and those with special needs. Nearly all of the participants reported that the fee-free basic education policy had increased the school enrolment of children from poor families and children with special needs, and some of the participants stated that it had reduced delayed entry into school. An analysis of the national data revealed that the enrolment of children with disabilities fluctuated. In 2014, the enrolment decreased by 24 percent, from 30,433 in 2011 to 24,541 in 2014. In 2016, however, the enrolment of children with disabilities increased by 50 percent, from 24,541 in 2014 to 37,034 in 2016. Furthermore, the participants were of the view that cases of dropout had slumped in the schools and even those who had dropped out had returned to school. In an interview, one DEO said, “The fee-free policy has led to a decrease in student dropouts. The policy has led to an improvement in girls’ continuing with their education”.

Declining Teaching-Learning Quality Indicators

The parents and heads of school reported that the fee-free basic education policy had brought substantive benefits and also had an impact on the teaching and learning process, although a good number of the participants feared that its implementation had somewhat compromised the quality of teaching and learning. For example, 55.3 percent of the heads of schools and 36.3 percent of the teachers agreed that the “Introduction of fee-free basic education compromises the quality of education”. Furthermore, 40 percent of the head teachers and 60 percent of teachers indicated that the

fee-free basic education policy was likely to affect the academic performance of learners negatively. The majority of the participants further reported that the fee-free basic education policy had resulted in overcrowded classrooms. For instance, the teacher-pupil ratio (TPR) in Standard One stood at 1:164 in 2016 compared to the average of a 1:99 teacher-pupil ratio in 2015 in the primary schools visited.

Furthermore, the introduction of fee-free basic education was reported to have increased the teachers' workload, with only 10 percent of the teachers agreeing that this policy had improved teacher productivity and motivation. The teachers further stated that the implementation of the policy had translated into a surge in the number of pupils, a shortage of resources, and an increased workload for them, without any attendant positive outcomes for them as teachers. Although more children were enrolled in schools, the number of classrooms and teachers remained the same. In 2016 and 2017, for example, the pupil classroom ratio was 1:77 and 1:73, respectively, compared with the standard of 1:45 at the national level. Similarly, one of the teachers lamented:

> *The fee-free education policy is good as it allows children from poor families to access primary education. It reduces the financial burden on poor families. The fee-free education benefits parents, but what does it do for us? Our workload has increased without concomitant adequate compensation.*

In one of the interviews, a head of school reported that fee-free basic education would affect the quality of the teaching and learning process, pointing out that:

> *In previous years, we had panels for different subjects. These teachers used to meet and discuss how to improve the teaching of these subjects. These teachers were provided with transport and meal allowances. We cannot do that now. Similarly, the heads of schools cannot attend meetings of all heads as there is no budget for that…we've been instructed that we can't use school funds to pay for…travelling allowances*.

The findings suggest that the introduction of fee-free basic education is commendable. However, it has led to overcrowded classrooms and increased teacher workload without increase of extra manpower.

Implicitly, the quality of the teaching and learning processes and learning outcomes are most likely under threat.

Parental Withdrawal and Relinquishing Responsibility for their Children's Schooling

The findings further reveal that, previously, the parents had been contributing to their children's mid-day meals at school. In one primary school, for example, the parents were contributing up to Tshs 10,000 for meals for each pupil per year. In some schools, the parents contributed maize and beans to be used for school meals. However, it was reported that, due to the fee-free policy's implementation, the parents in many schools had withdrawn their contribution for meals, believing that the government now funds for the supply of these items. Moreover, due to the implementation of the fee-free basic education policy, many parents were increasingly relinquishing responsibility for the education of their children. Their attendance at school meetings was falling. As one of the heads of schools, for example, succinctly stated:

> *Free education has meant that parents have left the entire responsibility for the education of their children squarely on the government's shoulders. Recently, we convened a meeting of parents…to discuss how to improve the children's performance. Out of 28 parents, only three turned up for the meeting! In the past, most parents would have come.*

Similarly, another head of school stated that there were positive aspects of the previous policy that allowed parents easily to contribute viably to their children's education,

> *The previous policy created a relationship between parents and schools, and the parents realised that they have a responsibility for their children's education by ensuring that the schools functioned properly. I saw the greater involvement of parents; this, I believe, was very positive.*

Another head of school commented,

> *In the past, parents used to come to school to ask how their children were progressing at school. With the implementation of fee-free education, the parents seem to feel that they have no responsibility at all for the education of their children. Hardly any parent comes to enquire about the progress of his or her children.*

The overall impression is that the parents' engagement with their children's schooling has declined due to a belief that the government's fee-free basic education was taking care of everything. This misconception threatens the parents-teachers/school accountability relationship, which could be detrimental to the quality delivery of education and, hence, the country's overall quality education provision in the long-run.

DISCUSSION

Few, if any, would dispute the value of the government's fee-free basic education policy initiative. This study's findings show that the abolition of fees at the primary school level has resulted in a surge in enrolment in pre-primary classes and Standard One. This positive outcome is consistent with the results of the PEDP, when Tanzania experienced heightened enrolment following the reduction in primary school fees. Similar experiences have been recorded in Ethiopia, Ghana, Kenya, Malawi, and Uganda (World Bank, 2009). Moreover, education fees' abolition in 2005 in Burundi led to a sharp drop in the percentage of primary school-age children who had never attended school. Similarly, several studies have found that the elimination of school fees at the primary school level has resulted in an upswing in the enrolment of disadvantaged groups (World Bank, 2009). Furthermore, fee abolition has reduced the number of cases of delayed entry into schooling, incentivised enrolment and reduced the dropout rate, particularly for girls and children in rural areas. Cumulatively, these feats help to foster equity within Tanzanian access to education. Despite the positive aspects that the policy has engendered, several concerns related to the policy's implementation have been noted in this study. The sudden increase in enrolment, for example, was incongruent with the available resources, which remained highly limited and threatening the quality of teaching and learning processes. There has also been an increase in high teacher-pupil ratio, as well as complaints that schools were suffering due to a shortage of classrooms, desks, teachers and other teaching and learning resources. Almost all of the heads of schools, parents, teachers, and school committee/board members reported shortages of this nature. Moreover, the teachers reported that the execution of the fee-free education policy had also increased their workload and led to overcrowded classes, with the policy failing to offer teachers tangible benefits in return for their investment in terms of labour and added responsibilities.

Without remedial action, these negative feelings might reduce the motivation of the teachers, which could threaten education delivery, and consequently undermining teaching and learning outcomes. This surge in enrolment has created quality problems in schools. Tanzania, however, is not unique in this respect. In many countries where fee-free education has been implemented, the quality indicators have been negatively impacted. In Malawi, for example, the pupil to classroom ratio increased to 119:1, the pupil to teacher ratio increased to 62:1, and the pupil to textbook ratio increased to 24:1 (World Bank, 2009). There is a solid body of evidence from around the world that suggests that the single most important factor in children's educational success is effective teachers. A likely consequence of the surge in enrolment is a dramatic rise in the number of pupils per teacher. Many of the teachers in the study cited the large number of pupils that they had to teach as a major concern. Asking teachers to work with twice as many students is likely to lead to academic failure for many students, most notably the poor and vulnerable children who are the supposed beneficiaries of the abolishment of school fees. The deterioration of the quality indicators of primary education delivery is signaled by an increase in the number of children who repeat grades, the lower grades in particular. For example, the number of repeaters in Standard One, increased by 20 percent, from 141,585 in 2015 to 170,234 in 2016, compared with a 15 percent increase from 2014 to 2015. The increase in the number of repeaters is associated with pupils' incompetency in reading, writing and arithmetic. This might subsequently prove costly in the long-run. We might experience this in the near future, from 2021 onwards, when the first cohort of the 2016 fee-free basic education beneficiaries are expected to graduate from primary education.

Despite the surge in enrolment that is attributable to the implementation of fee-free basic education, further analysis revealed that 9 percent of the population of primary school age children (aged 7-13 years) were out of school (URT, 2018), a decrease in enrolment and a persistent dropout rate. In 2017, for example, standard one enrolment decreased by 3 percent, from 2,070,823 in 2016 to 2,016,579 in 2017 (MoEST, 2016/2017). Similarly, in 2016, the number of dropouts was higher for Standards One, Three and Six, at 27,087, 20,178, and 20,468, respectively, compared with 11,947, 16,587 and 15,758 in 2015 (PO-RALG, 2017). There was, however, a decrease of about 3 percent in the dropout rate, from 9 percent in 2015 to 6 percent in 2016. Among other things, the decrease in enrolment and rise in the dropout rate could be attributed to the considerable indirect costs that parents incur with regard

to their children's education (MoEST and UNICEF, 2016*)*. According to Education Circular No. 3 of 2016, the parental responsibilities include covering the cost of items such as: school and sports uniforms; exercise books and pens/pencils; health expenses; and contributions towards mid-day meals for day students and for those in hostels. For those at boarding school, these costs include: mattresses; sheets; personal hygiene materials; and transport to and from the school. The annual cost of these indirect items for a primary school pupil might amount to Tshs 72,000 for girls and Tshs 50,000 for boys. Girls, for example, might need: two skirts (Tshs 25,000); a t-shirt (Tshs 5,000); two pairs of shoes (Tshs 12,000); and exercise books (Tshs 10,000). Boys might need: two pairs of shorts (Tshs 20,000); two shirts (Tshs 12,000); a t-shirt (Tshs 5,000); two pairs of shoes (Tshs 12,000); and exercise books plus pens costing Tshs 12,000 per year.

This implies that the indirect costs that parents incurred related to their children's primary education might be at least eight times higher than the Tshs 6,000 per pupil capitation grant that the government provides for running the schools. Thus, one might argue that some children fail to enroll or drop out of school because of these indirect costs. This threatens the attainment of the targeted education for all. In order to ensure that all children attend school, the government may need to consider how these indirect school costs can be reduced or totally eliminated. Despite the fact that many of the stakeholders appear positive about the fee-free basic education policy, confusion and misunderstandings persist, as already reported. Against this backdrop, doubts arise regarding whether or not the policy is being implemented effectively. The mixed understanding reported in this study is attributable to the seemingly less inclusive and consultative policy establishment process, as well as the inadequate planning prior to its implementation. Despite the repeated clarifications from the government through circulars and other directives, the discussions with the participants indicated that the details about the policy remain largely obscure, as these were not shared with the various stakeholders to the optimum extent. In fact, while the heads of schools received government circulars on policy implementation, there is little to substantiate the idea that these circulars were effectively shared with the relevant teachers, parents, school committee members or even school board members. Apparently, these circulars were largely kept in files, accessible only by the heads of schools. Other implementers only

received verbal information on the policy from the school heads. In this regard, one board member, for example, stated:

"We haven't seen the circular…but we know it amounts to what the head-master told us. We make decisions based on what the head informs us". Nearly all of the heads of schools pointed out that the funds that their schools received were inadequate to meet the school's needs, including the academic and administrative needs. Uwezo (2010), who examined the extent to which the capitation grants met the basic school needs, found that the allocation for textbooks, for example, covered only one book for one subject (out of seven compulsory subjects). At the time, the book's price ranged from at least Tshs 3,500 to 5,000 per copy. Currently, a book would cost between Tshs 4,000 and 6,000. This suggests that each pupil requires a minimum of Tshs 28,000 to buy books for all of the compulsory subjects. In the same vein, the current study found that the capitation grants provided to offset the school needs were insufficient. Moreover, the grants that the schools received were not pegged to the inflationary trends. Consequently, the economic value diminished in the face of high inflation. Furthermore, the study found that the funds allocated to the schools ignored the possibility that the pupils and schools had varying needs. This suggests that the fee-free education policy treats all of the children and schools equally, regardless of their background experiences, needs or whether they are based in the more remote resource-limited or better-endowed urban areas. Children with and without special needs, and those whose parents are better off and those whose parents are poor are lumped together in one 'bucket'.

In addition, although some parents were willing to pay fees and contribute to the school's running costs, the policy simply ignored such an inclination, which neglected a potential fertile area for buttressing the fee-free education. At this juncture, the question becomes, "should the fee-free education funds be used to support the neediest children while continuing to collect revenue from those children whose parents can manage parental contributions to augment this well-intentioned government initiative?" We are aware that the government is in the process of reviewing the capitation grant formula, as evidenced by the production of the draft formula (entitled *The Proposed Revised Capitation Grant Allocation Formula November/December 2017*). The draft formula factors in the needs of schools and equity issues. It thus includes overhead/constant costs and adjusters. Moreover, the formula proposes the covering of overhead cost for all schools to meet the running costs of

each one, irrespective of the school size, location or endowment with physical resources. The costs to be covered under this category include water, security, teaching and learning materials, and facilities. The proposed adjusters would take into account the needs and equity issues to be brokered by enrolment, and distance from school to the council headquarters, the number of students with special needs, and the council poverty headcount, respectively. Despite the promising formula, issues such as school meal programmes have been overlooked. Moreover, the formula depends on previous years' school expenditure data being deployed to determine the percentage of the costs. This application, however, might be problematic because of inflation. Although the formula recognises students with special needs, it does not specify such students' special needs, whose unit cost remains largely indeterminate. Indeed, there are various categories of students with special needs whose unit cost might vary.

Thus, the formula might need to draw on a rigorously determined unit cost. To avoid drawbacks in the implementation of the revised formula, the process needs to be sufficiently inclusive and consultative. Parental engagement with their children's education is instrumental in children's learning outcomes. However, nearly all of the heads of schools reported that the implementation of the fee-free education policy had severely curtailed parental involvement in their children's education. The parents were reportedly less responsible for their children's schooling than in the past, pre-fee-free education period. Only a few of the parents reportedly attended teacher-parent meetings, let alone monitored their children's school progress. This lack of parental involvement endangers participatory accountability, which is crucial in building an equitable education system and providing quality education (UNESCO, 2016) yet, in educational contexts where the degree of participatory accountability is low, parents also fail to hold schools accountable for their children's poor learning outcomes (Komba, 2017). Similar challenges have been observed in other African countries that implement similar fee-free education policies. The rapid surge in enrolment posed a challenge to the quality of education (World Bank, 2009). These countries experienced a severe shortage of classrooms, desks, instructional materials and teachers' housing, as well as insufficient numbers of teachers to cater for the school-age population. These hurdles threaten the delivery of quality education. Had Tanzania effectively drawn lessons from its past and from other African countries, it could have minimised or even avoided

altogether these threats to the provision of quality basic education. Overall, the quality threats are attributable to a lack of proper planning and a limited inclusive and consultative process. In this regard, it is vital to consider various steps for ensuring that fee-free basic education policy initiatives are implemented in an orderly manner without negatively affecting the running of the schools (World Bank, 2009).

CONCLUSION

On the whole, the implementation of fee-free education was informed by a top-down policy implementation approach. The main government intention was to increase access to basic education for all children, regardless of their background. The government set goals, guidelines, and control mechanisms for the effective implementation of the policy. Despite the fact that the policy implementers are complying, there was an impression from the participants that they wished that they could modify the utilisation of the funds in order to meet their school's needs more effectively. In the light of the findings, this paper contends that, despite being misapprehended, causing confusion and parental withdrawal from school engagement, and threatening equitable and the quality delivery of education, the implementation of the fee-free basic education policy has significantly expanded access to education for children from various socio-economic backgrounds. The implementation of the fee-free basic education policy, albeit commendable, is a 'phenomenon' worth rethinking in order for Tanzania to consolidate and sustain the gains, hence, realise quality universal basic education and the 2030 global education agenda. This rethinking may focus on how best and how quickly education stakeholders in Tanzania can intervene in the trade-offs between expanded school access and quality, a re-contextualisation of the amount that each student and school receives on the basis of a rigorous context-specific cost analysis, and whether the fee-free education funds might be used to support the neediest while continuing to collect revenues from those children whose parents can afford to engage in cost-sharing within education.

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Behavioural Predictors of Students' Career Intentions in the Hospitality and Tourism Industry in Tanzania

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ABSTRACT
This study assessed the career intentions of the hospitality and tourism students to identify their predictors, based on the theory of planned behaviour. Descriptive, correlation, and multiple regression analysis techniques were applied on survey data from a conveniently determined sample of 232 students enrolled in certificate and diploma programmes at the National College of Tourism in Tanzania. The results indicate that students' career intentions were, on average, high and so were their attitudes toward a career in the industry, subjective norms and perceived behavioural control. Career intentions and attitudes towards the career were significantly higher for the hospitality programme and NTA 6 students. Attitudes (perceived behavioural control) were significantly higher (lower) for students in the travel and tourism programme than those of students in the tour guide operations programme. Students with personal exposure to the industry (also in NTA 6) showed higher subjective norms than those without exposure (NTA 5). Students' career intentions were significantly positively predicted by their attitudes toward a career in the industry, subjective norms and perceived behavioural control, even after controlling for the effects of skill level and programme type. Perceived behavioural control had the strongest predictive power. The study calls for a dynamic review of the curricula, resourcing the training institutions, and availability of well supported and monitored internship opportunities.

Keywords: career intentions, theory of planned behaviour, hospitality and tourism industry.

INTRODUCTION

The contribution of the hospitality and tourism industry in the growth of many country's economies across the globe has been on a rapid increase (UNCTAD, 2013; WTO, 2020). In many developing countries, the industry is regarded as an important means of accelerating social-economic development because of the role it plays in foreign exchange earnings and job creation (Wamboye *et al*., 2020; WTO, 2019; WTTC-Tanzania, 2020). In many African nations, the industry is among the main contributors of gross capital formation, means of transferring

technology and managerial expertise, improving citizens' quality of life, and of escaping from economic hardships (Anderson and Sanga, 2018). For example, Tanzania's development agenda recognises tourism as among the group of products in which the country is experiencing growth, both in comparative advantage and in demand (URT, 2016). According to Anderson and Sanga (2018), tourism's contribution is recorded at 18 percent of GDP; export earnings at 30 percent, and total employment at 10.9 percent. In 2020, contributions to GDP, export earnings and total employment were estimated at 18.3 percent, 21.4%, and 12 percent, respectively.

In addition, the targets for the same in 2025 have been pegged at 19.5 percent, 21.1 percent, and 11.5 percent, respectively. Moreover, earnings are projected at USD 4.2 billion in 2025 compared to USD 1.9 billion earned in 2014, whereas the number of international tourist arrivals is estimated to be 2.468 million visitors compared to the 1.14 million tourists received in 2014. Despite the recognition of the position of the industry in Tanzania's development agenda together with the recorded achievements so far, the industry is marred with many challenges/constraints. Among the most widely cited challenges that are relevant to the present study are the inadequate skilled (quality and quantity) personnel at all levels (operational and managerial), poor planning for human resource development and investment, and the mismatch between the content of the hospitality and tourism education curricula on one hand and the needs of the hospitality and tourism stakeholders on the other (Anderson and Sanga, 2018). While URT (2016) acknowledges the inadequacy of quality skilled local labour, it further points out the insufficient public investment in tourism training institutions, limiting the potential of such institutions to become internationally accredited. The hospitality and tourism industry is both labour intensive (Baum and Kokkrainkal, 2005) and service quality – dependent. Its growth, therefore, increases the demand for skilled personnel (Anderson and Sanga, 2018). This increased demand of skilled personnel pressurizes the academia to prepare and supply the industry with qualified graduates, who hold skills appropriate and relevant to it, at both operational and managerial levels. Against the identified challenges, several interventions have also been identified, some of which included improving training and skills development (URT, 2016) and increasing coordination of all stakeholders in the industry to ensure that training

capacity if fully utilized and the curricula are made relevant to the needs of the industry (Anderson and Sanga, 2018).

In line with the suggested interventions, the Government of the United Republic of Tanzania has created an environment where both private and public institutions contribute to the preparation of the personnel required by the industry. According to Anderson and Sanga (2018), there are more than 116 hospitality and tourism training institutions in the country, at all levels, yielding an average of 1,000 plus graduates into the job market. However, 78.5 percent of these trainings institutions are accredited by the Vocational Educational Training Authority (VETA), most of which are privately owned. The remaining institutions are technical educational institutions accredited by the National Council for Technical Education (NACTE) (13.8 percent) and Universities accredited by the Tanzania Commission for Universities (TCU) (7.7 percent). Both these public and private training institutions at all levels train and contribute graduates to the industry. However, despite all these efforts; (i) the output is lower than the industry's demand; and (ii) the quality is questionable especially the VETA group, on account of the institutions being ill-resourced, together with the absence of a cohesive professional organ at the national level to coordinate their professions hands-on training (Anderson, 2015). Anderson predicts the demand for human resource in 2020 at 720,000 employees to cater for the predicted 2 million international tourists in the same year against the current supply of about 1,000 graduates per year (p.72). Worse still, not all of the graduates join a career in hospitality and tourism industry (Wen *et al.,* 2018), exacerbating the demand gap. The characteristics of the industry, as perceived by the students, also add to the problem.

Walmsley's (2004) review of previous researches revealed that students perceived the industry's jobs as jobs that are low paid, low skilled, and are seasonal. Walmsley adds that the industry's jobs are exposed to poor management, marred by negative image and they lack career structure, in addition to the industry being viewed as a refugee sector. Jing and Tribe (2009) also opined that the industry's jobs are repetitive and unstable. Thus, besides the mismatch between the industry's demand for adequate and qualified personnel and the output of such personnel from the training institutions, the aforementioned characteristics raise an additional but important question: i.e. whether those who graduate from these institutions do intend to (behavioural intentions), or actually, join and develop careers in the industry (actual behaviour). In China, for example,

Wen *et al.* (2018) show, from a review of past studies, that 80 to 90% of graduates from the hospitality and tourism programmes joined careers other than the hospitality and tourism industry careers. This trend goes against the understanding that recruiting and retaining well educated and qualified employees can provide companies in this industry with a competitive advantage in the long run (da Silva and do Valle, 2015; Kusluvan and Kusluvan, 2000). However, the intentions of these graduates to join the industry are practically more valuable than their actual behaviour. It is, therefore, important to establish the extent to which the students enrolled in the hospitality and tourism programmes in Tanzania intend to join and develop careers in the industry (career intentions), upon graduation. In addition, understanding the factors that drive these intentions is important and has practical implications for the industry, academia, and other stakeholders, including the students. This is because the resulting knowledge will help all stakeholders to take appropriate actions to ensure that the few graduates do join, and stay in, careers in the industry.

Globally, studies on career intentions are many (Amani and Mkumbo, 2016; Arnold *et al*., 2006; Gorgievski *et al*., 2018; Huang, 2011; Park *et al*., 2017; Wen *et al.,* 2018; Zellweger *et al*., 2011), but only a few of them are from the hospitality and tourism industry, especially those that deal with behavioural predictors. Even so, these few studies are from the Asian region (Park *et al*., 2017; Wen *et al*., 2018), leaving the African region, Tanzania included, under-researched. Majority of these studies also focused on undergraduate students leaving the other competence levels (diplomas and vocational training) under-investigated. The few studies and reports available on Tanzania (Anderson and Sanga, 2018; ATE, 2011; URT, 2016) lay down the ground for this study. Taking the stakeholders' theory view – tourism educators, students, tourism service providers and government authorities - Anderson and Sanga (2018) identify the challenges of the industry to include a serious shortage of specialized managerial and operational skills and a mismatch between hospitality and tourism curricula and the needs of the industry (ATE, 2011). Little, if any, research in Tanzania is directed toward assessing the students' career intentions and their predictors (behavioural or otherwise). One study on behavioural predictors of students' career intentions in Tanzania is the study by Amani and Mkumbo (2016). However, it focused on career intentions of students in disciplines other than

hospitality and tourism and it called for further studies, not only in disciplines other than the four they covered (education, law, engineering and business studies) but also in other cultural groupings. This study is a response to the call.

Training, deploying and developing skilled personnel is one thing, but attracting graduates to join and stay in the industry is something else. The latter, requires managers to have knowledge about these intentions and what determines them. The present study, therefore, extends the existing works by examining the career intentions and their behavioural predictors focusing on technical diploma students in hospitality and tourism programmes, based on the framework of the Theory of Planned Behaviour (TPB). The main objective of this study was to assess the hospitality and tourism students' intentions to join and develop careers in the industry and to identify the behavioural predictors of these intentions. Although only a few studies have investigated the effect of these behavioural predictors (e.g., Amani and Mkumbo, 2016; Park *et al*., 2017; Wen *et al*., 2018), the three predictor variables are considered to be conceptually independent determinants of intentions (Hsu, 2012). Moreover, other scholars like Al-Shammari and Waleed (2018) and Hsu (2012) point out that the contribution of these behavioural predictors vary across cases/behaviours and contexts/situations, implying that there is need to learn more from the experiences in different cases and contexts as well as in different cultural groupings (Amani and Mkumbo, 2016). Further, the study compared the TPB variables based on selected variables – gender, skill (programme) level, industry exposure, and programme type. Lastly, the study determined whether the behavioural factors uniquely explained the variance in the students' career intentions after controlling for the effects of programme type and skill level.

Theoretical Foundation

This study mainly applied the TPB's framework of Ajzen (1991). The theory postulates that an individual's actual behaviour is best predicted by behavioural intentions to perform that behaviour, which in turn is predicted by three factors, namely attitudes towards the behaviour, subjective norms, and perceived behavioural control. The basic TPB indicates the predictive relationships among five constructs – actual behaviour, behavioural intentions, attitudes toward the behaviours, subjective norms and perceived behavioural control. The present study, however, restricted itself on the behavioural intentions part of the underlying model by determining its behavioural predictors. It is argued

that the hospitality and tourism programme students' intentions to join and develop careers in the hospitality and tourism industry are predicted by their attitudes toward a career in the industry, subjective norms and their perceived behaviour control. Behavioural intentions refer to the individuals' readiness to perform a certain behaviour. The importance of these intentions is that they are the immediate and most important antecedent to the actual behaviour (Ajzen, 2002). Thus, the study considers the students' intentions to join a career in the hospitality and tourism industry because it is an antecedent to their actual decision to join the industry when they graduate. Attitude towards a behaviour is the individuals' positive or negative assessment of other people, objects, events, activities, ideas, or just about everything in their environment (Zimbardo *et al.*, 1977, cited in Wen *et al.*, 2018, p.71). Thus, attitude towards a career in the hospitality and tourism industry in the present study is defined as the students' favourable or unfavourable evaluation of careers in the industry (Park *et al.*, 2017). Subjective norms refer to an individual's perception of the social pressures of relevant/significant others who believe that he or she should or should not perform a given behaviour (Ajzen, 1991).

These relevant/significant others are the people, opinions and/or expectations of whom the individual values highly. Kim *et al.* (2016) identify these people to include parents and other family members, friends, other relatives, college/university teachers/dons, etc. It is argued that individuals tend to behave in a manner that meets what is expected of them by these significant/relevant others, and in so doing, their behavioural intentions improve (Kim and Cho, 2008). Subjective norms is a two-dimensional construct (Fishbein and Ajzen, 2010 cited in Moore and Burrus, 2019, p. 140), i.e., injunctive norms and descriptive norms. Injunctive norms refer to the social rules about what ought to be done. This is highly practised in African societies where parents tend to exert pressure on their children to pursue what they (parents) believe is the right thing to do; e.g., becoming a teacher, a doctor, or an engineer. Descriptive norms, on the other hand, represents the results of a comparison of the individual's behaviour with that of the friends they value. For example, drawing from Moore and Burrus (2019) on intentions to engage in science, technology, engineering, and mathematics (STEM) fields, it can be argued that students in hospitality and tourism management programmes who have friends or people already in the

industry, and whose opinion they value, would tend to have higher intentions to join a career in the same industry. Perceived behavioural control is the individuals' perception of the relative ease or difficulty with which he/she can perform a given behaviour (Ajzen, 1991).

It is argued that students in hospitality and tourism programmes would evaluate the behaviour (joining a career in the industry) in terms of whether such behaviour is under their control (Han and Lee, 2001) by looking at their skills, ability, knowledge, commitment (internal factors) and time, opportunities and support from others (external factors) (Park *et al*., 2017). The more they feel that they are in control of the decision to join a career in the industry the higher will be their intentions to execute the decision to join in. The TPB has, for many years, been used to explain the determinants of an individual's behavioural intentions and covered many areas such as sociology, education, health, management and information and communication technology (Akhtar and Das, 2018; Al-Shammari and Waleed, 2018; Amani and Mkumbo, 2016; El-Mosalamy and Metwale, 2018; Malebana, 2014; Suffian *et al*., 2018; Srirejeki *et al.*, 2019; Zaremohzzabieh *et al*., 2019). Specifically, in the hospitality and tourism industry, Hsu (2012) used the theory to explore the relationship between the attitudes towards internship, subjective norms, and perceived behavioural control of hospitality vocational college students in Taiwan and their career intentions. Goh and Ritchies (2011) also used the theory to investigate hospitality students' attitudes and perceived constraints towards field trips. In addition, Park *et al*. (2017) and Wen *et al*. (2018) applied the theory to predict hospitality and tourism students' intentions to pursue careers in the industry in Korea and China, respectively.

Hypotheses Development

Behavioral predictors

The TPB-based empirical studies on career intentions in the hospitality and tourism industry as well as their predictors are few, biased toward the Asian region, and much fewer in Africa. Besides, the evidence is varied and covers universities' undergraduate students in hospitality and tourism programmes. Using a sample of 307 undergraduate hospitality and tourism students in Korea, Park *et al.* (2017) found their career intentions in the industry to be positively predicted by attitudes toward the career and perceived behavioural control, but only attitudes were significant. These career intentions were insignificantly negatively predicted by subjective norms. However, the perceived behavioural control in their

study was measured using indicators different from those that are normally used in the TPB framework – i.e., they were based on language skills and experience requirements. In another study, Wen *et al.* (2018) used a sample of 525 three- and four-year undergraduate degree students in the hospitality and tourism programmes in China. They reported all three TPB variables to predict positively and significantly the career intentions in the industry. Past researches also show conflicting evidence on the relative importance of the behavioural predictors in influencing career intentions. For example, in a review of 19 empirical studies, Ajzen (1991) established that subjective norms contributed very feebly to the intentions to perform different behaviours. This was supported by a subsequent study by Armitage and Conner (2001). Conversely, attitudes toward a behaviour have been shown to be the most important factor influencing behavioural intentions in Park *et al.* (2017). In another study, however, Wen *et al.* (2018) reported that perceived behavioural control is the most important predictor of career intentions. These conflicting results, therefore, support the suggestion in Ajzen (1991, 2002) that the relationship among the three predictors should be studied empirically for each specific behaviour.

The only study on career intentions' behavioural predictors in Tanzania is Amani and Mkumbo (2016) who studied a sample of over a thousand undergraduate students in education, law, engineering and business studies professional disciplines from four universities. They reported career intentions of the education students to be significantly higher than those of their colleagues in the other three disciplines. They further reported that all the three behavioural predictors had positive and significant effects on career intentions, with attitudes toward the career having the most predictive power. They recommended further studies to consider not only other fields and cultural groups but also the final part of the model (i.e., the actual behaviour). From this short review, students' intentions to pursue careers in the hospitality and tourism industry are likely to be predicted by their attitudes toward a career in the industry, subjective norms, and perceived behaviour control. The present study, therefore, hypothesizes that:

H_{1a}: Students' attitudes toward careers in the hospitality and tourism industry will have a significant positive effect on their career intentions in the industry.

H_{1b}: Students' subjective norms will have a significant positive effect on their career intentions in the industry.

H_{1c}: Students' perceived behavioural control will have a significant positive effect on their career intentions in the industry.

Other Potential Predictors

Personal exposure to the hospitality and tourism industry: Students earn exposure to the industry in at least two formal ways – through an opportunity to work in it before joining a training programme and through an opportunity to participate in an internship programme while on the training programme. During such exposures students are brought closer to the working environment, professionals, and customers - an opportunity to gain more knowledge about the industry. This exposure, in turn, improves their perceptions about the industry. Park *et al*. (2017) argue that internship programmes increase the students' likelihood of developing favourable perceptions about the hospitality and tourism industry, making them likely to consider joining the industry as a suitable career option.

On the other hand, other scholars argue that exposure to the industry will have a negative or positive influence depending on the students' degree of satisfaction with the internship experience. Chao (2019) provides evidence that satisfaction with internship positively impacts on tourism's students' occupational choice, while Richardson (2009) found in Australia that students with unsatisfactory experience in the industry are discouraged from joining careers in it. Unsatisfactory experience may also fuel dropouts from the study programme (Baum, 2006). In addition, Chan's (2017) study in New Zealand shows that students formed more negative attitudes toward the hospitality and tourism industry as they gain more exposure to it. Elsewhere, the effect of the internship has been shown to vary across students' generations (Richardson, 2010; Goh and Lee, 2018) and gender, with females showing higher career intentions in the industry the more they are exposed to it (Chuang and Dellmann-Jenkins, 2010). In another study by Hsu (2012), internship attitude was shown to affect positively both the career intentions and the actual behaviour. The present study posits that exposure to the industry is a function of whether the students worked in it before joining the programme of study or had an opportunity of an internship in it, or both. It also posits that exposure will affect either negatively or positively their perceptions about, and attitudes toward, a career in the industry as well as

their level of confidence that they can decide to join the industry. Thus, the study hypothesizes that:

H_{2a}. There will be a significant difference in career intentions between students with and without exposure to the hospitality and tourism industry.
H_{2b}. There will be a significant difference in attitudes toward a career between students with and without exposure to the hospitality and tourism industry.
H_{2c}. There will be a significant difference in subjective norms between students with and without exposure to the hospitality and tourism industry.
H_{2d}. There will be a significant difference in perceived behavioural control between students with and without exposure to the hospitality and tourism industry.

Moreover, from the evidence that internship affects students' perception about the industry differently with exposed females having higher career intentions than exposed males (Chuang and Dellmann-Jenkins, 2010), the present study hypothesizes that:

H_{3a}. There will be a significant difference in career intentions between male and female students.
H_{3b}. There will be a significant difference in attitudes toward a career between male and female students.
H_{3c}. There will be a significant difference in subjective norms between male and female students.
H_{3d}. There will be a significant difference in perceived behavioural control between male and female students.

Skill level and programme type: The diploma programme is a combination of two competence levels – NTA 5 and NTA 6 - with no direct entry to the latter by school leavers. Each level takes a year to complete. NTA 6 students are viewed as students who have interacted more with the programme content. The majority will also have had the opportunity to attend an internship programme. NTA 6 student will be seen as, on average, more knowledgeable about the industry than their NTA 5 colleagues. Thus, the present study hypothesizes that:

H_{4a}. There will be a significant difference in career intentions between skill level groups.
H_{4b}. There will be a significant difference in attitudes toward a career between skill level groups.
H_{4c}. There will be a significant difference in subjective norms between skill level groups.
H_{4d}. There will be a significant difference in perceived behavioural control between skill level groups.

There could also be differences across the type of programme of study. For example, the tour guide operation programme offers more travel opportunities and contact with foreign visitors than the others, but perhaps it demands high language skills and subject matter expertise. Some will serve as porters, which is more muscular. Thus, this study hypothesizes that:

H_{5a}. There will be a significant difference in career intentions across programmes of study.
H_{5b}. There will be a significant difference in attitudes toward a career across programmes of study.
H_{5c}. There will be a significant difference in subjective norms across programmes of study.
H_{5d}. There will be a significant difference in perceived behavioural control across programmes of study.

METHODOLOGY

Participants

The study adopted a quantitative, cross-sectional survey design. A structured questionnaire was used to collect data in November 2019. Participants were students pursuing hospitality and tourism management programmes at the National College of Tourism (NCT), Tanzania. NCT is a sector-specific agency run by the Government of the United Republic of Tanzania, through the Ministry of Natural Resources and Tourism (MNRT). The College is responsible for offering technical education in the sector leading to the awards of certificates (NTA 4) and diploma (NTA 5 - 6) at three campuses – Bustani and Temeke (both in Dar es Salaam), and Arusha. All three campuses together enrolled 611 students in different programmes in the 2018/19 academic year. The campuses and the share of enrolment in brackets were: Arusha (149) Bustani (216) and Temeke (246). Programmes of study cover the four skill areas of hospitality, travel and tourism, tour guide operations, and events

management. Form six leavers and NTA 4 graduates are eligible to join NTA 5 while graduates from NTA 6 are eligible to join degree programmes. There is no direct entry at NTA 6. The college graduated 200 students (2016), 129 (2017) and 209 (2018). Although several other colleges, universities and vocational training institutions have training programmes in hospitality and tourism, NCT was chosen for its role in producing technical personnel much needed in the industry at the supervisory level, the key to any labour-intensive system.

It was also chosen because the hospitality students are better prepared for hospitality jobs than students in the other academic backgrounds since they receive more comprehensive knowledge and practical training related to what the industry requires (Airey and Frontistis, 1997). As an agency of the Government, the college was likely to have the national interests in the hospitality and tourism industry at heart. Four hundred (400) questionnaires were distributed proportionately to the three campuses (Arusha 100, Temeke 170, and Bustani 130). Efforts to promote participation were employed. Finally, a total of 232 filled questionnaires were collected (58 percent response rate overall); 18 from Arusha and 164 and 48 from Temeke and Bustani, respectively.

The Instrument

The instrument included a consent form, as a part of ethical requirements to ensure that students read and consented participation based on full knowledge of the study's purpose and how the data so collected would be used and the results reported. The main section contained items based on the TPB model originated from Ajzen (1991, 1998), but as used in Wen *et al.* (2018). These items were adapted to suit the study's context. Student attitudes toward the hospitality and tourism industry career was measured by four items using semantic differential response format. A sample item was: "I find the idea of having a career in the hospitality and tourism industry…", to which respondents response ranged from 1 = very uninteresting to 5 = very interesting. Another item was "definitely, a career in the hospitality and tourism industry will be (pleasurable…very unpleasurable) for me. This was negatively worded to serve as an "attention trap" to identify unengaged respondents as well as a means for controlling for common method bias (CMB). Subjective norms were measured by two items. One of the items was "Most people who are important to me want me to work in the hospitality and tourism industry after graduation".

Perceived behavioural control was measured by two items. A sample item was "It is completely up to me to decide whether I will work in the hospitality and tourism industry after graduation." Finally, career intentions were measured by three items. A sample item was "I plan to work in the hospitality and tourism industry after graduation". In all the three measurement scales, a Likert-like scale was used with five responses ranging from 1 = strongly disagree to 5 = strongly agree. Age was measured continuously from the year of birth, gender = 1 if male, 0 otherwise, and qualification level = 1 if NTA 4, 2 if NTA 5 and 3 if NTA 6 (later redefined as a skill level dummy with 1 if NTA 6, 0 otherwise). Whether the respondent had worked in the hospitality and tourism industry before joining the programme (Yes/No), and whether the respondent had an opportunity to attend an internship programme in the industry (Yes/No). These two were later redefined as "personal industry exposure" dummy scoring 1 if the respondent had either worked or had an opportunity for internships in the industry, 0 otherwise. Programme of study (hospitality, travel and tourism, tour guide operators, and event management) was dummy coded in three dummy variables – hospitality, travel and tourism, and tour guide operations, with the latter used as a reference category in the *post hoc* comparisons in the analysis of variance (ANOVA). No student in the event management programme participated in the survey. The last item was whether a closest relative was engaged in the hospitality and tourism industry (Yes/No). The instrument was pilot tested on 35 students conveniently sampled from Bustani (11) and Temeke (24). From the results, the instrument was fine-tuned and administered to the rest of the sampled students.

Data Screening, Processing and Analysis

The 232 questionnaires represented a response rate of 58 percent, higher than the minimum of 35 to 50 percent acceptable in business research (Mellahi and Harris, 2016). Using frequency distribution, errors in data entry were identified and corrected. A total of 58 cases were lost due to: (i) missing values in all the TPB variables (12); (ii) lack of engagement in filling the questionnaire (44) identified by the use of an attention trap; and (iii) outliers (2) for having scores larger than the Mahalanobis Distance cut-off of $\chi^2_{(3)} = 16.27$, $\rho < .001$ (Tabachnick and Fidell, 2018). Finally, 174 usable questionnaires were retained for analysis. The fourth item of the attitudes scale was reverse-coded. A scale test for reliability analysis was used to check for internal consistency of each of the four scales. Mean scores were computed for each of the four scales followed by both

descriptive and correlation analysis. The following linear multiple regression (1) and hierarchical regression (2) models were run:

$$CI = \beta_0 + \beta_1 AT + \beta_2 SN + \beta_3 PBC + \varepsilon \quad (1)$$

$$CI = \beta_0 + \beta_1 Hosp + \beta_2 Skill + \beta_3 AT + \beta_4 SN + \beta_5 PBC + \varepsilon \quad (2)$$

Where, CI = career intentions in the industry, AT = attitudes toward a career in the industry, SN = subjective norms and PBC = perceived behavioural control, Hosp = hospitality programme dummy (=1) and Skill = skill level dummy (1= NTA6). Other underlying regression assumptions were checked: Normality (Normal P-P plot inspection), multi-collinearity (bivariate correlation in pairs of independent variables and variance inflation factors), Linearity (bivariate correlation between dependent and independent variables), and homoscedasticity [Breusch – Pagan Lagrange Multiplier (LM) and Koenker tests using Ahmad Daryanto plugin tool in SPSS (Daryanto, 2013)].

FINDINGS

Sample Description

Table 1 summarises the respondents' characteristics. Majority of the respondents were male (72.1%) and from Temeke campus (70.5%). Over half of the respondents were registered in the Travel and Tourism programmes (51.1%) while the tour guide operations programme contributed only 17.2% of the respondents. All NTA 4 respondents were lost in the data cleaning process, leaving three-quarters of the respondents in NTA 5 (75.6%). About half (49.4%) of the respondents had an opportunity to attend internship programmes and 23.7% had an opportunity to work in the hospitality and tourism industry before joining the study programme. The two groups put in perspective had personal exposures to the hospitality and tourism industry either before or during the programme. These were taken as students who had personal knowledge about various aspects of the industry. It is expected that this exposure would bear on their career intentions, attitudes toward the industry, social influence and the feeling of being in control over the career decisions and their implementation. Lastly, respondents with parents or relatives working in the hospitality and tourism industry constituted 45.4% of the sample.

Table 1: Sample description

Variable	Frequency	Percentage
Gender *[N = 172]*		

Male	124	72.1
Female	48	27.9
Campus *[N = 173]*		
Bustani	37	21.4
Temeke	122	70.5
Arusha	14	8.1
Programme *[N = 169]*		
Hospitality	50	29.6
Travel and Tourism	89	51.1
Tour Guide operations	30	17.2
Skill level *[N = 172]*		
NTA 5	130	75.6
NTA 6	42	24.4
Internship *[N = 172]*		
Yes	85	49.4
No	87	50.6
Worked in HTI *[N = 172]*		
Yes	42	23.7
No	132	76.3
HTI Exposure *[N = 174]*		
Yes	92	52.9
No	82	47.1
Relatives in HTI *[N = 174]*		
Yes	79	45.4
No	95	54.6

Reliability, Descriptive and Correlation Statistics

From the scale test for reliability analysis, the Cronbach's alpha coefficients (Table 2) ranged from .74 (SN) to .77 (AT, CI) indicating acceptable internal consistency while that PBC was .62, indicating questionable internal consistency but usable (George and Mallery, 2019; Hair *et al.*, 2019). All mean scores were higher than the cut-off point of 3.5 based on a 5-point Likert scale (Albdour and Altarawneh, 2014). These mean scores indicate that students had high intentions to join careers in the hospitality and tourism industry. The scores also indicate that the students had high attitudes toward the industry and felt high social pressure from the people, opinion of whom they value highly, to join the industry. They had a high feeling of being in control of the

decision to join the industry. Perceived behavioural control had a higher mean score than the rest of the predictor scales.

Against Cohen's (1988) cut-offs, the Pearson Product-Moment correlation analysis results (Table 2), show that there were strong positive correlations between career intentions and attitudes toward a career in the industry ($r = .49$, $n = 174$, $\rho < .001$), subjective norms ($r = .57$, $n = .174$, $\rho < .001$) and perceived behavioural control ($r = .63$, $n = 174$, $\rho < .001$), indicating satisfaction of the linearity assumption of multiple regression analysis. There were also moderate correlations between pairs of the independent variables ranging from .33 and .46. Against the maximum correlation of .90 (Pallant, 2016), the results indicate the absence of multicollinearity problem in the data. This result was subsequently confirmed by the variance inflation factor (VIF) test from the regression's collinearity diagnostics, which were found to range from 1.25 to 1.38 (Table 3). A VIF of above 5.0 (Rogerson, 2001) would indicate concerns for multicollinearity problems in the data. Therefore, both assumptions – linearity and no multicollinearity – were met. The homoscedasticity assumption test returned Breucsh-Pegan LM $\chi^2_{(3)} = 82.95$, $\rho < .001$ and Koenker $\chi^2_{(3)} = 53.35$, $\rho < .001$, indicating the presence of heteroscedasticity problem in the data. This problem was then, controlled by generating and reporting heteroscedastic robust standard errors (Table 3) (Hayes and Cai, 2007; Daryanto, 2013). In addition, the correlation coefficient was estimated between TPB variables and respondents' age. Age had moderate positive and significant relationship with attitudes toward career in the industry ($r = .35$, $n = 145$, $\rho < .001$), and weak but significant positive correlations with subjective norms ($r = .17$, $n = 145$, $\rho = .04$),

Table 2: Reliability, descriptive and correlation statistics

	Cronbach's α	Mean	S.D.	1	2	3	4
1. Career intentions (CI)	0.77	4.55	0.64				
2. Attitudes (AT)	0.77	4.43	0.73	0.49 **			
3. Subjective Norms (SN)	0.74	4.42	0.72	0.57 **	0.46 **		
4. Perceived Behavioural control (PBC)	0.62	4.48	0.68	0.63 **	0.33 **	0.42 **	
5. Age in years		21.25	2.09	0.13	0.35 **	0.17 *	0.05

**ρ < .05; **ρ < .001*

Multiple Regression Results

Multiple Regression analysis was used to determine whether the TPB variable predicted the students career intentions. The results show that the model (Table 3) as a whole explained 54.7% of the variance in career intentions, and fitted the data well ($F_{(3,170)} = 68.46$, $\rho < .001$). Career intentions were positively and significantly predicted by attitudes toward careers in the industry (b = 0.180, t = 2.10, ρ = .037), subjective norms (b = 0.254, t = 2.687, ρ = .008) and perceived behavioural control (b = 0.419, t = 3.954, ρ < .001). Perceived behavioural control was the strongest predictor of the variance in career intentions (beta = .445, ρ < .001).

Table 3: Multiple regression results

	b	SE(b)	beta	t	VIF
(Constant)	0.752	0.504		1.493	
Attitude	0.180	0.086	.207	2.100*	1.38
Subjective norms	0.254	0.095	.289	2.687**	1.40
Perceived behavioural control	0.419	0.106	.445	3.954***	1.25

R^2 = .547; F-Stat (3,170) = 68.46, ρ < .001
**ρ < .05; **ρ < .01; ***ρ < .001*
Results based on heteroscedastic consistent standard errors (HC3) (Cai & Hayes, 2007; Daryanto, 2013).

Hierarchical Regression Results

Hierarchical multiple regression was used to assess the ability of the TPB variables to predict levels of the career intentions, after controlling for the influence of skill level and programme type (Table 4). Skill level and programme type (dichotomized as 1 = hospitality, 0 = other programmes) were entered at Step 1, explaining 4.8% of the variance in the career intentions. After entering the TPB variables at Step 2, the total variance explained by the model as a whole was 55.3%, $F_{(5,166)} = 40.99$, $\rho < .001$. The three TPB variables explained an additional 50.5% of the variance in career intentions, after controlling for skill level and programme type, $\Delta R^2 = .505$, $\Delta F\text{-}Stat_{(3,166)} = 62.43$, $\rho < .001$. In the first model, only skill level was statistically significant (Table 4).

Table 4: Hierarchical regression results

	Unstandardized Coefficients	
	Model 1	Model 2
(Constant)	4.43***	0.790**
Skill level	0.274*	0.079
Hospitality	0.187	0.085
Attitude		0.166**
Subjective norms		0.250***
Perceived behavioural control		0.419***
R^2	.048	.553
F-stat	4.225*	40.99***
ΔR^2		.505
ΔF-*Stat*		62.43***

** ρ < .05; ** ρ < .01; *** ρ < .001*

Comparison of TPB Variables across Demographics

The independent samples t-test and analysis of variance (ANOVA) (with *post-hoc*) techniques were used to compare the mean scores in the TPB variables across respondents' groups based on exposure to the industry, gender, skill level, and programme of study. The results (Table 5) show that there was a significant positive difference only in subjective norms between respondents who had, and those who had no personal exposure to the hospitality and tourism industry (Mean diff. = 0.23, $t_{(172)} = 2.144$, ρ = .033). Those who were personally exposed to the industry had significantly higher subjective norms. Male students had higher but insignificant career intentions. Male students also had lower but insignificant attitudes toward a career in the industry, subjective norms, and perceived behavioural control, than female students. There were also statistically significant differences between skill levels, i.e. NTA 6 vs. NTA 5, in career intentions (Mean diff. = 0.26, $t_{(170)} = 2.29$, ρ = .023), attitudes toward the career (Mean diff. = 0.42, $t_{(170)} = 4.33$, ρ < .001), subjective norms (Mean diff. = 0.25, $t_{(170)} = 1.98$, ρ = .049), but not in perceived behavioural control (Mean diff. = 0.13, $t_{(170)} = 1.04$, ρ = .30). Thus, career intentions, attitudes and subjective norms were higher for NTA level 6 than for NTA level 5 students. Lastly, a one-way between-groups analysis of variance (ANOVA) shows that across the three programme types, there were statistically significant differences at ρ < .05 level in career intentions ($F_{(2, 166)} = 3.605$, ρ = .029), in attitudes toward

careers in the industry (F (2, 166) = 8.455, ρ < .001), in perceived behavioural control ($F_{(2, 166)}$ = 3.867, ρ = .023), but not in subjective norms ($F_{(2, 166)}$ = 2.642, ρ = .074).

Post-hoc comparisons based on Hochberg GT_2 and Games-Howell (Field, 2018), with the tour guide operations group as a reference category, indicated significantly higher career intention (Mean diff = 0.38, ρ = .028) and attitudes toward the career (Mean diff. = 0.55, ρ < .001) for students in the hospitality programme. Means scores for subjective norms (perceived behavioural control) were higher (lower) for the hospitality group, but the differences were insignificant. There were significantly higher (lower) scores of attitudes toward the career, Mean diff. = 0.59, ρ = .004 (perceived behavioural control, Mean diff = - 0.38, ρ = .023), for students in the travel and tourism programme. No significant differences were found in career intentions and subjective norms across programme types.

Table 5: Group comparison analysis

Variable	**Mean differences**			
	CI#	**ATγ**	**SN#**	**PBC#**
HTI Exposure *[Yes = 1]*	0.16	0.15	0.23*	0.12
Gender *[Male =1]*	0.13	- 0.22	- 0.06	- 0.003
Skill level *[NTA 6 = 1]*	0.26*	0.42***	0.25*	0.13
Programme‡				
Hospitality	0.38*	0.55**	0.35	-0.02
Travel and Tourism	0.29	0.59***	0.32	-0.38*

**ρ < .05; ** < .01; ***ρ < .001*

CI = Career intentions; AT = Attitude towards a behaviour; SN = Subjective norms; PBC = Perceived behavioural control. ‡ANOVA with Post hoc comparison using the tour guide operations programme as a reference group. # = Hochberg's GT_2, γ = Games-Howell.

DISCUSSION

The purpose of this study was to assess the behavioural predictors of the career intentions of hospitality and tourism students in Tanzania. The specific objectives were to (1) determine students' level of career intentions to join a career in the hospitality and tourism industry after graduation; (2) to determine the behavioural predictors of career intentions; and (3) identify the differences of career intentions and predictors using personal exposure to the industry groups, gender, skill level and programme type. Hospitality and tourism students were found to have high intentions to join careers in the industry, attitudes toward careers in the industry, subjective norms and perceived behavioural control. These students, therefore, are of significant potential to the industry. Since many of them were at the beginning of their respective programmes of study, the results call for the institution to encourage them and nurture their intentions, attitude as well as their level of self-confidence so that they maintain these intentions and attitudes up to the time of graduation. All three behavioural predictors significantly positively predicted the students' career intentions in the hospitality and tourism industry, confirming hypotheses H_{1a} - H_{1c}. The findings are consistent with the theory of planned behaviour, which posits that individuals' behavioural intentions are determined by their attitudes toward the behaviour, subjective norms and perceived behavioural control. The three predictors together explained over half of the variance in the career intentions, even after controlling for the effects of other variables (programme type and skill level). This proportion of variance explained is higher than the average of 41 percent reported in other sectors such as the Godin and Kok's (1996) meta-analytic study which covered a range of health-related behaviours.

The findings on individual predictors are consistent with some of the previous studies (e.g., Wen *et al*., 2018), but inconsistent with the results reported in Park *et al.* (2017) that subjective norms and perceived behavioural control did not have a significant effect on students' career intentions in the hospitality and tourism industry. In the present study, perceived behavioural control was the most influential predictor, similar to the findings by Wen *et al*. (2018), while attitudes toward the career was the weakest contributor contrary to the findings by Amani and Mkumbo (2016) and Park *et al*. (2017). Moreover, the findings are inconsistent with Ajzen's (1991) and Armitage and Conner's (2001) extensive studies,

which highlighted subjective norms as the weakest predictor. Unlike in Park *et al*. (2017), attitude in this study was the weakest predictor, contradicting the findings in Amani and Mkumbo (2016) and Wen *et al*. (2018). These contradictions viewed together lend support to the observations and suggestions that the contributions of the three variables vary across cases and contexts (Al-Shammari and Waleed, 2018) and that the relationship among the TPB variables should be empirically tested for each specific behaviour (Ajzen, 1991; 2002). Only subjective norms differed between the exposure groups, confirming hypothesis H_{2c}, but not $H_{2a, b, \& d}$. The gender differences were insignificant in all four variables ($H_{3a} – H_{3d}$ not supported). Career intentions, attitudes toward a career, and subjective norms differed significantly between skill levels, confirming hypotheses H_{4a}, H_{4b}, and H_{4c}, but not H_{4d}. They were all higher in NTA 6 than in NTA 5 students.

The career intentions, attitudes toward careers in the industry and perceived behavioural control differed significantly across programmes of study, confirming hypotheses H_{5a}, H_{5b}, and H_{5d}. Career intentions were significantly higher for students in the hospitality programme (relative to colleagues in the tour guide operations programme). Both these results and those of significant differences in the mean scores of all TPB variables across skill-level, call for the need to re-examine the curricula's content (and the associated learner support services) across the programmes. The review will help to ensure that both the curricula and learner support services enable the student to make informed career decisions irrespective of their level, or programme, of study. Consistent with the aforementioned interpretation, the attitudes of both hospitality and travel and tourism students toward a career in the industry were significantly higher than those of their colleagues in the tour guide operations group. In addition, the attitudes of the students in NTA 6 were also significantly higher than those of their colleagues in NTA 5. On the other hand, subjective norms were significantly higher for NTA 6 as well as for those personally exposed to the industry. These two results suggest that skill level and personal exposure to the industry could be working together because the students in NTA 6 are highly likely to have engaged in internships. The skill level variable included students who had an opportunity to work in the industry before joining the programme. Therefore, skill-level and personal exposure results may signal the importance of having in place well-designed and well-supervised internship programmes. Such importance arises from the assumption that student's interaction with colleagues, people who matter in the industry,

as well and the industry's environment and set up, will increase the pressure on them to see working in the industry as a good career option. This will, in turn, elevate their intentions to join the industry after graduation. Finally, the differences in the perceived behavioural control across programmes of study may indicate differences in the curricula's ability to impart knowledge and skills so that the students feel confident enough and able to see opportunities in the industry instead of seeing inabilities and barriers.

CONCLUSION AND RECOMMENDATIONS

The present study extended the empirical knowledge on behavioural predictors of career intention literature in several ways. Firstly, it tested and added evidence from a frontier tourism market (Tanzania). Secondly, it engaged students in technical level programmes, rarely studied before, as opposed to the dominancy of university-level students (see for example Amani and Mkumbo, 2016) in Tanzania. The study, therefore, concludes that the TPB model applies in predicting career intentions of non-university level hospitality and tourism students, and in the Tanzanian context. Thirdly, the study extends the study by Anderson and Sanga's (2018) by offering support to the stakeholders' view in bridging the gap between academia and the hospitality and tourism industry. Both the academia and the industry should work together to ensure that the content of the curricula is relevant, up-to-date, and capable of fuelling student's positive intentions of joining the industry. These desires will be satisfied if the curricula are capable of building the right attitudes and providing skills, knowledge, emotions, and abilities. The satisfaction of the desires also requires the curricula to be capable of illuminating on the opportunities available in the industry. Personal exposure to the industry is also important but its value will be enhanced by cooperation between the stakeholders – instructors and on-the-field supervisors.

These two players should work together to offer sufficient value-adding support to the students so that they see opportunities and responsibility from the eyes of their superiors and professionals in the industry. The resulting pressure will increase the students' intentions to join the industry. Learner support services ought to be right and supportive of the acquisitions of these attributes by the students. Technical education colleges should monitor closely their students' internship engagements in the industry to identify and mitigate the challenges they face. Then the

colleges and the industry should work together to bridge any observed gaps by carefully considering the benefits and the challenges of the students' engagement experiences in the hospitality and tourism industry. The two parties should align these experiences with the curricula to better influence the professional lives of the current and future students so that they become potentially valuable players in the hospitality and tourism industry when they graduate and join it. The two ministries – Ministry of Education Science and Technology and Ministry of Natural Resources should work together to equip the training institutions with appropriate teaching and learning environment (physical, human and financial resources). They should also create a supportive environment for the private sector institutions to increase their investments, and subsequently, improve on their contribution to the training efforts. The regulators - VETA, NACTE and TCU - should also ensure that the curricula are appropriate, and the training institutions under their respective jurisdictions meet the minimum programme accreditation criteria. They should also play a supportive role to ensure that the curricula are frequently updated to meet the changing dynamics in the industry. Parents and other social groups have the responsibility of shaping their children's attitude towards the hospitality and tourism industry.

These contributions notwithstanding, the study's findings are limited in terms of their support to the theory of planned behaviour as well as generalizability. This study used the TPB to examine the behavioural predictors of hospitality and tourism students' career intentions focusing on its behavioural predictors. The consequences of behavioural intentions on the actual behaviour as well as that of perceived behavioural control and its interaction with behavioural intentions in predicting the actual behaviour were beyond the scope of this study. This makes it difficult to reflect the results on the entire or the revised TPB model. Furthermore, the analysis included students who were studying various aspects of hospitality and tourism programmes at diploma level from one college, excluding those who were studying at the same level in other colleges. It also excluded those who are studying similar programmes at university or vocational training levels. In these regards, therefore, any generalization of the results presented in this paper to students in hospitality and tourism students in Tanzania should be made with caution. Future research should consider a sample drawn from across levels and from other institutions, and consider the excluded parts of the TPB model. This approach will help coming up with a more generalized understanding of how these behavioural predictors affect the career choices of Tanzania's hospitality

and tourism students. A longitudinal study assessing career intentions at the beginning and the end of the programme could help to capture the influence of the programmes' content, including internships and/or field trips, on the career intentions. Among the benefits of doing this extension will be to capture not only the impact of the curriculum but also the effect of behavioural intentions and perceived behavioural control (and the mediation thereof) on the actual behaviour.

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Challenges facing Wastewater Management in Fast Growing Cities in Tanzania: A Case of Dodoma City Council

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ABSTRACT

The main objective of this study was to examine the challenges facing the Urban Water Supply Authorities in fast growing cities on wastewater management, Dodoma City as a case study. The study used field observation and interview methods to collect data. The primary data were complimented by literature search to enrich the findings. Purposive sampling to Dodoma Urban Water supply and Sewerage Authority (DUWASA) and City Council Health officials was adopted to obtain the required information for this study. The findings revealed the major challenge facing DUWASA to include rapid expansion of the city associated with lack of funds for extension and rehabilitation of infrastructure. However, there is a minimal use of the available wastewater systems by the current population due to high cost of installation. The study recommends collaborative efforts by DUWASA and Dodoma City Council on the expansion of sewerage system to match with the current growing speed of the City. The study recommends for The Ministry of Water and Irrigation Tanzania to support DUWASA to execute its planned project of constructing larger waste stabilization ponds away from the residential areas.

Key words: Wastewater, wastewater management, sewerage, waste stabilization ponds

INTRODUCTION

The global sewage generation is increasing at an exponential rate as a result of rapid population growth and urbanization (Bleninger and Jirk, 2008), all of which are exerting pressure on water system infrastructures. There have been concerns that with the current world' rapidly growing population, the trend of shifting from rural areas to urban settlements is likely to continue, and the overall growth of the world's population could add another 2.5 billion people to urban areas by 2050, with close to 90% of this increase taking place in Asia and Africa (Bodo, 2019). In addition to rapid population growth and urbanization, poverty has been a big

challenge facing the third world countries. World Bank and the United Nations Millennium Development Movement define poverty using an income threshold (at purchasing power parity) of US$ 1 a day per person for Africa. Lusambo (2016) in his study in Tanzania found that using selected poverty lines: overall, 29.3% - 98.2% of the households are poor. In rural areas, 24.5% - 96.8% of the households are poor. In peri-urban areas, it was found that 20% to 100% (depending on the poverty line used) were poor, while in urban areas the poverty rate was found to be between 37.1% and 99%. According to Tanzania Human Development Report, Dodoma is among the 5 lower ranked regions in Tanzania based on human development index (UNDP and URT, 2017).

In Tanzania, taking into account the high urbanization rate, the population in the 20 biggest towns will increase to 13.8 million people by 2020 and about 26 million people by 2030. It should be note that currently, 74% of the population lives in Low-Income Areas. In most cases, the unplanned inhabitants of these Low-Income Areas have inadequate access to basic services such as safe water and adequate sanitation (Pauschert *et al.*, 2012). The increase of slums in cities for instance, has been making thousands of people live in appalling housing structures and without facilities like sewerage, electricity, water or paved roads (Hove *et al.*, 2013). Hove further argues that social services like transport, energy, communications and water supply are among the municipal services that are often inadequately provided. This inadequacy has caused dissatisfaction to customers of utilities and they have become reluctant to pay user charges. This erodes the tax base, which in turn, the governments both at the central and local levels find themselves with insufficient funds to maintain or upgrade the existing facilities. Dodoma is among the fast-growing cities in Tanzania; the reason accounting for this speed is the shifting of the capital functions from Dar es Salaam to Dodoma. The establishment of Dodoma as a Capital City was conceived some decades ago, but it came into reality in 2015 when the government of the United Republic of Tanzania, under the leadership of his Excellency Dr. John Pombe Magufuli, deliberately implement this idea. Shifting of capital functions has been in concomitance with shifting of people, capitals/assets and investment opportunities, which have resulted to rapid population growth and expansion of the city that created more demand for land, social services and increase of waste production.

This requires efficient wastewater treatment techniques to manage liquid wastes emitted from residential, industrial and commercial areas. Dodoma urban, is the jurisdiction operational area for Dodoma Urban Water Supply and Sanitation (DUWASA). DUWASA was established on 1st July 1998 as per Act No. 8 of 1997. It is full autonomous entity with the legal mandate to provide clean and safe water and sewerage services to the urban area of the Dodoma City council. The authority was subsided by an Urban Water Department which also took over from the Capital Water Engineer in 1996. However, the sewerage system remained under Capital Development Authority (CDA) until in the year 2002, when it was handed over to DUWASA. The Authority is in category "A" which therefore is obliged to meet all operations and maintenance cost plus some capital investment. This implies that construction and maintenance of sewerage systems are the obligations of the Authority (DUWASA Annual Report, 2018).

Wastewater treatment and management is the overall process that involves the improvement of the quality of wastewater between points of production and points of discharge. This process is aimed at improving the physical, biological and chemical properties of wastewater to eliminate both the known and emerging contaminants from the wastewater eventually available for release into the environment (Bruce *et al*., 2015). Donde (2017) asserts that, biological treatment has gained much ground over other methods since it has become an important and integral part of any wastewater treatment plant that treats wastewater from different sources having soluble organic impurities or a mix of different wastewater sources. Biological treatment using aerobic activated sludge process has been in practice for well over a century and is undergoing more and more modification and improvements.

According to Pauschert *et al.* (2012), only 10 out of the 20 public service providers operate a rudimentary sewer system. The respective coverage is presented in brackets behind the name: Mwanza (3.1 %), Moshi (5.8%), Arusha (7.0 %), Dodoma (11.6 %), Iringa (11.9%), Mbeya (0.6 %), Morogoro (1.6 %), Songea (3.7 %), Tabora (1.3 %), Tanga (9.3 %) and Dar es Salaam (4.8 %). Pauschert *et al*. further observe that, only 30% of households with on-site sanitation facilities empty their facility relying on contractors or cess pit-emptier. Many households simply shift the facility to another place as long as space is available. Often people refrain from using emptying services, because of the high cost for those services.

However, wastewater management is crucial in protecting public health by preventing diseases as well as environmental pollution from sewage contaminants. A large volume of untreated wastewater has been dumped directly into the water streams threatening human health and ecosystem biodiversity resources (United Nations World Development Report II, 2006).

Early in the 19th century, the English scholar Reverend Thomas Malthus published "An Essay on the Principle of Population." According to Malthus, while resources tended to grow arithmetically, populations exhibited exponential growth. Thus, if left unrestricted, human populations would continue to grow until they would become too large to be supported by the available resources. Humans would outpace their local carrying capacity, the capacity of ecosystems or societies to support the local population. Malthus proposed alternative to moral restraint that, if allowed to grow unchecked, population would outstrip available resources, resulting in what came to be known as Malthusian catastrophes naturally occurring checks on population growth such as famine, disease, or war.

Malthusians would cite epidemics and starvation in overpopulated urban slums, as natural checks on growing populations that have exceeded the carrying capacities of their local environments. Proponents of this theory, Neo-Malthusians, state that these natural checks such as famines were examples of Malthusian catastrophes. On a global scale, however, food production has grown faster than population due to transformational advances in agricultural technology. It has often been argued that future pressures on food production, combined with threats to other aspects of the earth's habitat such as global warming, make overpopulation to be still a more serious threat in the future (https://socialsci.libretexts.org.). This theory is relevant to this study as it relates the population growth and utilization of resources. As stated before, the exponential growth of Dodoma city exerts pressure on available social services including water infrastructure. Urbanization theories also apply to this study. According to Bodo (2019), urbanization is the steady increase in the number of people living in cities or urban centres. The urban growth results from the continuous mass movement of people from rural settlements to urban areas or the movements between urban areas. It can also result from natural increase through high fertility rates accompanied with low mortality rates. Bodo further argues that, when people move in their numbers to a particular location, there will be pressure on the available

resources. In the case of this study, the influx of people from other towns to Dodoma is expected to exert pressure on the existing infrastructures.

Varon and Mara (2004) acknowledge the wastewater stabilization ponds (WSPs) as the most appropriate method of domestic and municipal wastewater treatment in developing countries, where the climate is most favourable for their operation. According to Varon and Mara, WSPs are least-cost, low-maintenance, highly efficient, entirely natural and highly sustainable. The only energy they use is direct solar energy, so they do not need any electromechanical equipment, saving expenditure on electricity and more skilled operation. WSPs are particularly suited to tropical and subtropical countries since sunlight and ambient temperature are key factors in their process performance. Dodoma region being a tropical region its climate favours the optimal operations of WSP. Varon and Mara, describe WSP are man-made earthen basins, comprising of the series of anaerobic, facultative and, depending on the effluent quality required, maturation ponds (Figure 1). Basically, primary treatment is carried out in anaerobic ponds, secondary treatment in facultative ponds, and tertiary treatment in maturation ponds. Anaerobic and facultative ponds are for the removal of organic matter (normally expressed as "biochemical oxygen demand" or BOD), Vibrio cholerae and helminth eggs; and maturation ponds for the removal of faecal viruses, faecal bacteria like Salmonella spp, Shigella spp. and pathogenic strains of Escherichia coli, and nutrients (nitrogen and phosphorus). Due to their high removal of excreted pathogens, WSPs produce effluents that are very suitable for reuse in agriculture and aquaculture (Varon and Mara, 2004).

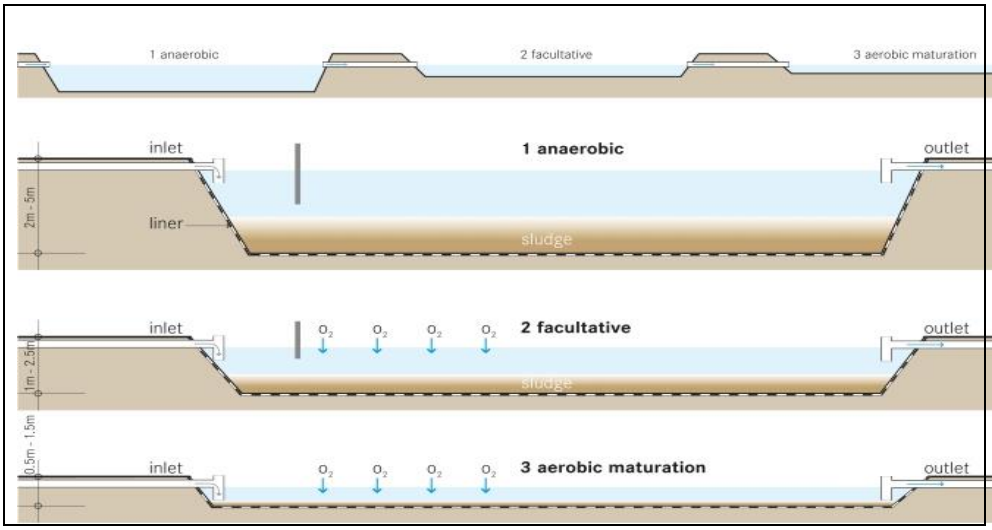

Figure 1: Structure of Waste Stabilization Ponds
Source: https://en.wikipedia.org/, accessed March (2019)

The use of aerobic wastewater treatment as a reductive medium has been receiving increased interest due to its low operation and maintenance costs. WSP performs well in pathogen and nutrient removal thus leaving the effluent being nutrient-rich for farming purposes. Mkude and Saria (2014) comment that wastewater effluent if efficiently treated, contributes to water resource conservation and expansion of irrigated land. It also reduces the disposal problem hence protecting the environment and improves public health. However, WSP system comprising only anaerobic and facultative ponds produces an effluent suitable for restricted irrigation only (for all crops except salads and vegetables eaten uncooked and for discharge to a stream, river or lake). Maturation ponds are needed if the effluent is to be used for unrestricted irrigation. However, in all cases, the appropriate design calculations must be done to determine whether or not suitable effluents will be produced (Varon and Mara, 2004).

WSP technology has been adopted by Dodoma Urban Water Authority in treating wastewater. The trunk sewer has the capacity of serving 423,000 people. However, the system had served about 40,000 people by 2018, which is only 10% of Dodoma City population. Only few areas have been completely covered by lateral sewers of 23 km length. Wastewater from this system is finally treated by waste stabilization ponds [WSP] which are located at Swaswa area (DUWASA Report, 2018). Interview with DUWASA sewerage and environmental engineer revealed that WSP in Dodoma were designed 30 years ago considering the number of people at that time. WSP are located at Swaswa area about 7 km from the city centre, in north eastern part of Dodoma town, the area which is now surrounded by residential houses. It is a place where wastewater is transported from different parts of the city through sewerage system and on-site sewage facilities. Sewerage engineers furthermore revealed that the available ponds were constructed for temporary use before the permanent WSP was constructed at a distant area from the city. Unfortunately, the temporary ponds are still used to-date regardless of the increase in the population. Additionally, the constructed ponds are not fully utilized due to incomplete construction hence not allowing the completion of treatment process. The structure of WSP consists of two anaerobic and two facultative ponds working in series only, no maturation

ponds at all.

Lack of maturation ponds makes the wastewater effluent not suitable for unrestricted agriculture due to a risk of contamination of crops. However, the surrounding community is tempted to use the partially treated wastewater for irrigation purposes which threatens the health aspect of the surrounding society. Dodoma region being semi-arid area experiences severe shortage of water, and farming activities are competing for the scarce water sources with industrial and municipal users. Alternatively, farmers use wastewater directly to their farms and for construction purposes. This study therefore intended to investigate the challenges facing the DUWASA in managing wastewater and to identify the associated impacts. Specifically, the study intended to: examine the extent to which the existing sewerage system in Dodoma city is utilized. Secondly the study examined the challenges facing DUWASA in managing wastewater in Dodoma city, and finally, the impact of sewage disposal in relation to health aspects of people in Dodoma city. The findings emanating from this study provide feedback to the responsible authority aiming at exposing the challenges hence recommendations for improvement of wastewater management. This information is also vital for policy makers at ministerial level to make them facilitate establishment of a comprehensive and sustainable wastewater infrastructure and conservation measures.

METHODOLOGY

The Study Area

The study was conducted in Dodoma City Council. Dodoma City is the new national capital of The United Republic of Tanzania and the capital of Dodoma Region. According to 2012 census, Dodoma had a population of 410,956 (NBS 2012). However, the discussion with the responsible officer at National Bureau of Statistics indicated the difficulty of projecting Dodoma city population due to the currently high influx of people in Dodoma following the shifting of Capital city from Dar es Salam to Dodoma. Dodoma town was founded in 1907 by German colonists during construction of the Tanzanian central railway. The literal meaning of Dodoma originally '*Idodomya*' in a native (Gogo) language is translated as 'it has sunk'. The natives give a history of an elephant which sunk in a wetland. The city is seen as lowland sunk in-between hills. It is in a semi-arid region with relative warm temperature throughout the year

(Dodoma City Council Profile, 2016). Dodoma city is located at 6.17 latitude and 35.74 longitudes and it is situated at an elevation of 1,125 metres above sea level. The city lies in the heart of Tanzania in the central part of the country, 450 km west of Dar es Salaam. Dodoma city lies on a strategic cross road including The great North road with access to Arusha and Kenya in the north; Morogoro to Dar es Salaam in the east; Iringa and Mbeya to Zambia in the south and Singida to Kigoma and Mwanza, in the West (Figure 2) .

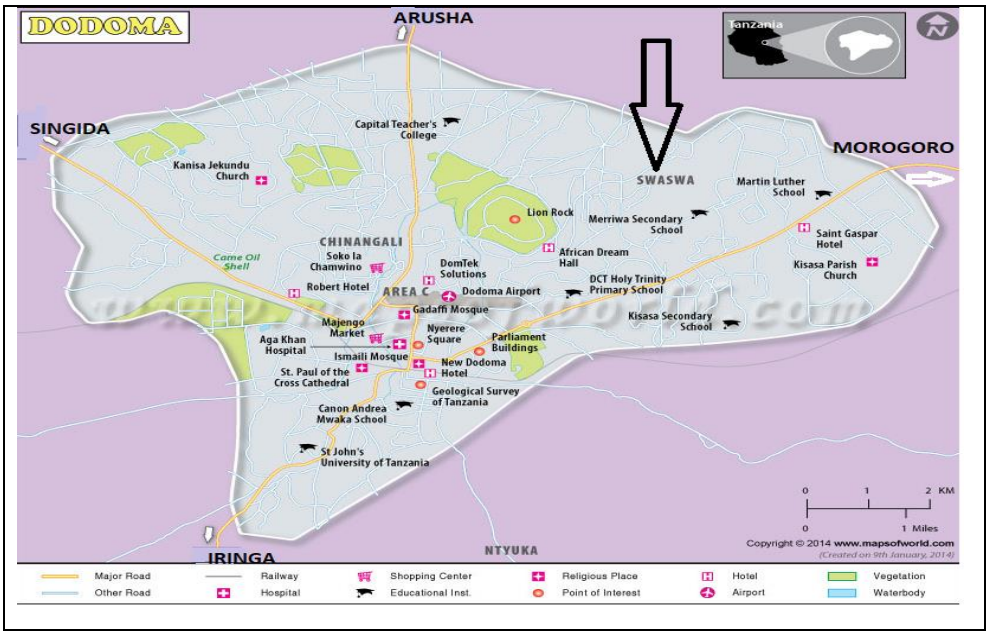

Figure 2: Dodoma City Council showing its location and bordering regions https://www.google.com/search

According to Dodoma City Profile, about 75% of the people's income in the Municipality is from agriculture and animal husbandry. 25% of the population is engaged in petty businesses such as retail shops, carpentry and food vendors. Other activities include small and medium industries, consultancy and construction work. The main industrial products are wine, mattresses, furniture and mineral water. Others include honey, wax and herbs from the forests. Per capita income is estimated to be Tshs 407,486. Dodoma was selected to represent the fast-growing cities in Tanzania which have been experiencing challenges of wastewater management. The study involved three officials from Dodoma Urban Water Supply and Sanitation Authority including: Sewerage and Environmental engineer, WSP attendant; and head of Municipal Health

Department. These officials are dealing with wastewater management and were purposively selected to provide information related to the study objectives.

Methods

The study adopted a case study approach to allow the in-depth investigation of challenges facing DUWASA in managing wastewater in a fast-growing city of Dodoma. Two sources of data were collected: primary data were obtained from field survey and secondary data from documentary reviews. For primary data, the study used interview and field observation to collect data to substantiate various issues pertinent to wastewater management in the study area. An interview schedule was used for face-to-face discussion with DUWASA and City council officials while observation activity was guided by a list of issues to be observed in the field. Interviews enabled the researcher to have detailed in-depth discussions with responsible officials to meet the main objective of the study. Pictures were taken during the field visit to illustrate the real situation of sewerage system management and waste water stabilization ponds at Swaswa area. The collected data were primarily qualitative in nature hence necessitated the use of content analysis. Qualitative data analysis involved ideas and opinions which are categorized into themes, this kind of data use verbal statements or explanations. Documentary review involved secondary data derived from second hand information; information that is already documented elsewhere. Secondary data collection is cost effective and provides data that are permanent as well as available in a form that can be checked by others (Kothari, 2004). In this regard, the researcher used a number of documents including organizational profiles, annual reports and literatures including books, journal articles, published and unpublished materials available online relevant to the topic. This helped the researcher to get wider understanding of the topic, be able to analyze data and make conclusion and give recommendations.

FINDING AND DISCUSSION

The Extent of Use of the Available Sewerage System

DUWASA reports show that only 10% of the Dodoma city population is connected to sewerage system while the remaining 90 % use other means of disposing waste water. Sewerage coverage network by the year 2018

was 89.4 km (Figure 3). The number of households connected to sewer was 5,760 houses including commercial areas and institutions.

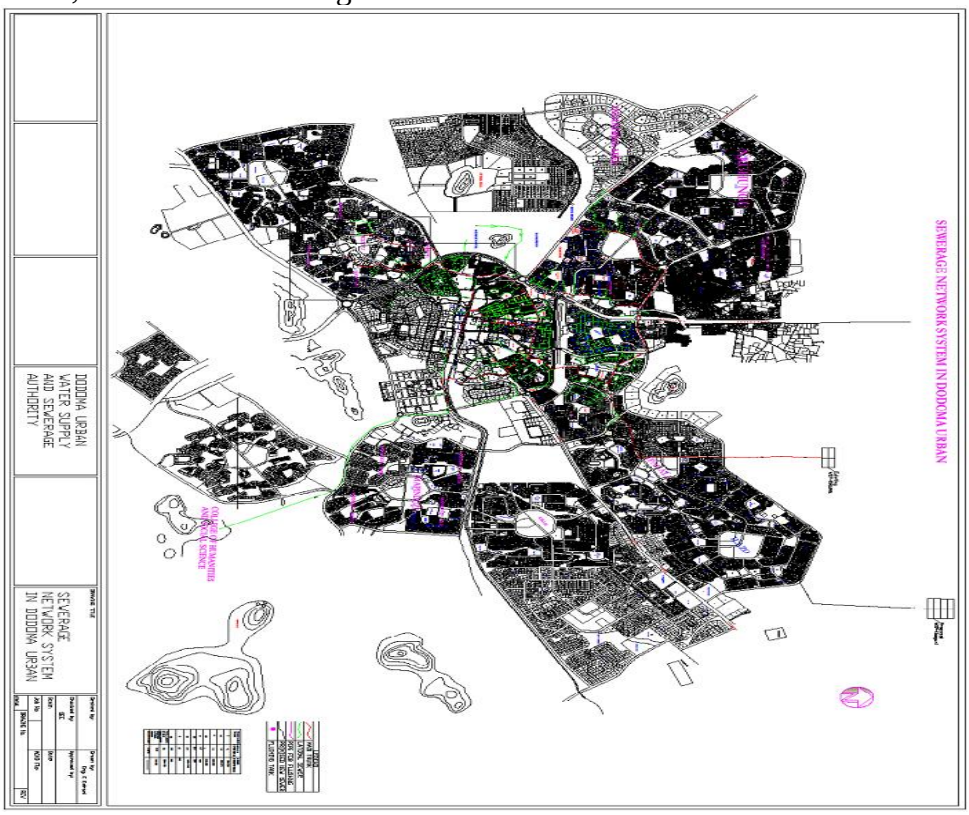

Figure 3: Sewerage network within Dodoma city (indicated by green lines)

Source: DUWASA (2018).

This study found that those houses which were very close to the sewerage system were connected to it. However, only few houses and commercial centres were connected to the sewerage system. Discussion with DUWASA sewerage engineer revealed the reasons for the small percent use to be unwillingness of residents due to high costs. This is due to high connection fees and maintenance as the users are supposed to pay in their monthly water bills. These findings tally with Pauschert *et al.* (2012), who found that the sewer network for Dodoma was 11.6% at that time, and the reason for this was high connection fees that discouraged the potential customers. The current coverage seems to be lower as a result of the expansion of the city which has increased the area to be covered. Connection to sewer network, according to sewerage engineer is safe for

human health and environment since the sewage is carried into pipes to the waste stabilization ponds (Figure 4).

Figure 4: Sewerage pipes in Makole street transporting wastewater to Swaswa WSP

Source: Field survey (2018).

DUWASA uses WSP to treat wastewater naturally. During the site visit at Swaswa area, four ponds were observed where only two of them were in use and the remaining two were under construction. The frequency of empties visiting the ponds was observed to be high with the average of 5 trunks per hour. One of the ponds maintenance challenges observed was emptying of sewage outside the ponds particularly during rainy season when the roads towards the ponds are not easily passable. This contaminates the environment causing bad smell and unattractive surroundings thus greatly posing a health risk to the nearby community. Interview with sewerage engineer revealed that the small percentage of sewerage system users was caused by high connection fees that kept at bay the potential customers. The estimated costs were that, only 10 metres length of the system, would cost about Tshs. 100,000 equivalents to USD 43, that means a person whose house was one kilometre from the system would be required to pay about Tshs 1,000,000 equivalent to (USD 435) to be connected to the system. As revealed in the literature, Dodoma is among the 5 regions categorised as lower human development level, characterized with low-income residents. The connection fee is relatively high to the majority of citizens who live below poverty lines as asserted by Lusambo (2016). In addition to connection fee is monthly charges hence unaffordable to a normal low-income earner.

Interview with the City Council Health department officer revealed other methods of disposing waste water in Dodoma city were septic tanks, sewerage ponds, and storm water drainage. Use of septic tanks is the main method of disposing waste water in Dodoma city. During site visits, septic tanks were observed in many houses in the study area. Septic tanks are large air-tight holes in the ground lined with bricks or concrete with an inlet pipe for incoming sewage and outlet pipe for treated sewage. The tank has a removable concrete cover with air vents for gases to escape. In emphasizing this, the municipal health officer had these to say;

> *Septic tanks were ascertained as more hygienic because sewage does not come out to the ground surface and does not occupy floor area on the roadsides or impair the beauty of the surroundings*

Sewer trunks come to suck sewage in households, transport and dump it into sewage reservoir pond at Swaswa WSP (Figure 5).

Figure 5: Trunk emptying collected wastewater to WSP at Swaswa in Dodoma

Source: Field survey (2018)

However, carefulness is required in handling sewage in septic tanks. This is substantiated by a study by Marshall (2005) in Jakarta. The author found that in Jakarta, there were more than one million septic tanks in the city, but they were poorly maintained and had contaminated the ground water with faecal coli form bacteria. The contents in tanks (untreated) were often emptied illegally into water ways. During interviews with DUWASA officials, it was revealed that during rainy season septic tanks do overflow hence their users opt to empty their contents in seasonal rivers and water channels thus posing health risks to city dwellers. Storm water drainage is another method used to dispose sewage in the study area. In this method, people construct small outlets at the ground level that discharge wastewater into storm water drainage constructed by the city council. This was mainly observed along market places and the houses located close to the storm drainage system, the sewage flows directly to the drainage and is carried to natural rivers. Since the water in storm drainage system mixes with wastewater, it is exposed to the environment. Again, posing health risk as some people are tempted to use it for irrigation of rice farms and children sometimes play with it.

The Challenges facing DUWASA in Wastewater Management

The study revealed challenges facing wastewater disposal in Dodoma city including financial constraints, incomplete construction of WSP, and use of partly treated water for agriculture, and the low use of the existing sewer network by the customers.

Financial Constraints

Interview with the sewerage engineer revealed that DUWASA was facing financial problems which were hindering the required department from connecting all the houses to the sewage network and maintaining the existing sewer system. With a particular focus on this, the engineer narrated that,

> *Financial problems hinder the reconstruction of the lines which are frequently affected by salinity and gases. There have been frequent collapses of concrete pipes which require frequent maintenance but suffer from lack of funds. Lack of funds also hinders the expansion of the network to new customers. Additionally, our customers fail to connect to sewer system due to high installation costs. As a result, DUWASA provides services to only 10% of the total population of Dodoma city.*

The Use of Temporarily Constructed WSP in Dodoma City

According to sewerage and environmental engineer, WSP at Swaswa lack maturation pond which is an important stage in the biological waste water treatment. Again, the current WSP are confined; surrounded by residential areas in such a way that there is no room for extension and for that they pose potential risk of health to the surrounding community. Generally, the current waste water treatment units do not meet the Tanzanian standards to the effluent and how to reduce the environmental impacts to the surrounding. Functioning of WSP is also affected by shortages of unblocking tools and equipment to disludge the ponds as revealed by WSP attendant. This causes a high concentration of dirtiness (Biological Oxygen Demand (BOD) that affects the functioning microorganisms to decompose the wastes.

Blockage of Sewerage System and Use of Partially treated Wastewater

The interview with Sewerage engineer revealed the problem of frequent blockage of sewerage system caused by solid waste entering into the system,

> *Overflowing of sewage in the city is a common problem. This is often caused by blockage of chambers. This has been reported to be caused by residents who illegally use the sewerage system to dispose solid wastes into sewers. Furthermore, the scattered solid wastes particularly plastic bags also enter the open chambers. Blockage of sewerage system discourages other users to continue using the sewerage system and therefore opt to use other methods.*

Bodo (2019) argues that high rates of urbanization affect land, water, and air because of the large number of people, the number of buildings and the increased demands on the available resources in the cities. The lack of sanitation and sewerage systems has been leading to the blockage of the drainage system thus causing flooding in cities. Topographical structure of Dodoma city, being a low land is prone to flooding particularly during heavy rains. This has caused a mixing up of wastewater from septic tanks and blocked chambers to environment natural streams which are health risky to surrounding community. The use of partly treated wastewater was also revealed by the study. During field visit at Swaswa WSP, the

researcher observed people using the waste water in the first pond that is, the one not partially treated for irrigation activities.

The study by Mkude and Saria (2014) revealed the poor performance of WSP in Dodoma in BOD, Nitrogen and Phosphorus removal, which was associated with poor construction and partial completion of WSP, lacking maturation stage. This stage is essential for polishing wastewater and nutrient as well as pathogen removal. Sewerage engineers further explained the challenges they were experiencing as the Authority when trying to prohibit the use the partially treated water; sometimes they were meeting resistance from the residents surrounding the areas who were using this water for irrigation and construction activities. The WSP attendant claimed to have sometimes been threatened by the users of the wastewater hence hindering him from efficiently discharging the operations of WSP. Furthermore, he disclosed that there were some elements of underground politicians' influences supporting the community to use the wastewater regardless of its danger to their health. He had these to say,

> *Politicians including ward Council members and parliamentary members, particularly during election period, tend to side with community members pretending to deal with their concerns while preventing professionals to perform their duties.*

DUWASA's Future plans for Improving Wastewater Management

During interview with DUWASA officials, the following were revealed as future plans of the Authority to cope with the fast growth of the city; first is to extend the sewer network to about 250km for trunks, sub trunks and lateral sewer. Secondly, is to construct trunk sewers from the existing ponds (Swaswa area) to the new proposed site for waste stabilization ponds (WSP) at Nzuguni area. A third plan is that the Management of sewer disposal trucks (Exhosters) should equalize the cost based on the size and volume relatively to the disposal cost

Impacts of Sewage Disposal to the Public health

Discussion with Dodoma City health officer, revealed the eruption of epidemics like typhoid, malaria and dysentery which are directly associated with poor sewage disposal. It was revealed that vectors for the

disease were being nurtured in the stagnant water that had been created in sewage outlets, drainage, puddles, and ponds. According to Dodoma City Council Profile; the top 6 frequently occurring diseases in Dodoma City included; malaria, urinary tract infection, diarrhoea, skin infections, pneumonia and intestinal infection. Most of these are bacterial diseases associated with the contaminated environment. The stagnant water influences the breeding of mosquitoes and other water born disease vectors. In addition, discussions with the health officer affirmed that these diseases were mostly affecting children because they normally used to play in storm water streams. This scenario is in line with WHO report that; worldwide, 2.2million of people die each year from diarrhoea and over half of the world's hospitals beds are filled with people suffering from water borne disease (UNDP, 2006). The experience of the researcher being a resident of Dodoma City for 28 year agree with WHO report, the most frequently mentioned diseases in Dodoma include typhoid, cholera and Malaria. All these are linked to the contaminated environment.

CONCLUSION AND RECOMMENDATIONS

Urbanization has given rise to several challenges or problems such as, the build-up squatter settlements and spread of diseases, inadequate waste disposal and poor sanitation. Responsible authorities should come up with workable solutions through review and implementation of policies. Managing of sewage is intrinsically linked to management of the entire water chain. Sewage disposal is an everyday activity as it is intertwined with domestic, industrial, commercial, and agricultural activities. Meanwhile, poor sewage disposal influences the spreading of water borne disease, air pollution, and awful environment. The study recommends the following: there should be collaborative efforts by DUWASA and the City Council to facilitate smooth functioning of wastewater treatment in Dodoma to match with the current growing speed of the City. The responsible Ministry should support DUWASA in executing the planned project of constructing larger Waste Stabilization Ponds away from residential areas. DUWASA should also continue to create community awareness on guidelines of reuse of wastewater for agriculture and the associated dangers. The assessment of wastewater quality after WSP treatment should be done to reduce the impacts on the public health and environment at large.

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Assessment of Beekeeping as an Adaptation Strategy to Climate Change in Iramba District

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ABSTRACT:

The effects of climate change in Tanzania affect rain fed agriculture and reduce the productivity in most parts of Tanzania. Indigenous knowledge and different agricultural strategies, on how to diversify to other agricultural activity like beekeeping has been adopted by different communities in Tanzania, especially in semi-arid areas. This paper focuses on assessing potentials of beekeeping as an adaptation strategy against impacts of climate change in Iramba District. The research used different methods in collecting information such as key informants' interviews, focus group discussions and observation methods. Secondary data were collected through documentary review, while the questionnaire was administered to 150 heads of households from four villages namely: Kyalosangi, Galangala, Mdonkolo and Songambele. The results show that over a period of 30 years, about 77% of respondents reported decrease in maize and 78% decrease in sunflower productivity. In interviews, the respondents indicated that they have shifted to beekeeping which contributes more to household's income than land tilling which is rain-fed. This is supported by 33.1% who were attracted in beekeeping for income purposes. The average honey production per hive ranges from 10 – 15 Lts/hive in top bar hives and frame hives, while traditional hives ranges between 5 – 10 Lts/hive. This study therefore recommends provision of appropriate capacity building and financial support to beekeepers in order to optimize production of bee products in the study area.

Keywords: climate change, adaptation strategy, agriculture, beekeeping, rain-fed agriculture

INTRODUCTION

Recently, Tanzania has experienced severe and recurring droughts with devastating effects to agriculture (IDRC, 2016). For the past decade, we have witnessed a number of climate related disasters in many parts of the

country such as widespread crop failures, flooding, extensive droughts, livestock deaths and intensification of climate sensitive diseases among others (Shemsanga*et al.,* 2010). Climate variability, a precursor of climate change, is already affecting Tanzania. Climatic patterns are becoming both less predictable and more severe. For instance, a 1997 drought was followed by a fivefold increase in rainfall in 1998, and then one of the worst droughts in four decades in 1999 (Shemsanga *et al.,* 2010). Rainfall patterns are expected to become increasingly variable across the country, with an increase in the north of 5 to 45 per cent and decreases of 5 to 15 per cent elsewhere (Mwandosya*et al.,* 1998).

Changes in rainfall reliability, onset and cessation can result in crop failure and hunger, exacerbated by other stresses such as land degradation and insecurity of land tenure. Agriculture is one of the human activities, mostly affected by the climatic change (Saria*et al.,* 2015). However, the impacts of climate change are not just of environmental concern, but will impede efforts to tackle poverty and promote national development. According to Saria *et al.* (2017) many human development systems have been affected by these changes, particularly agriculture, water resources, industry and human health. Yanda (2015), indicates that there is a positive correlation between climate change and crop yields under the rain-fed scenario. According to Ahmed *et al.* (2011), rainfall has significantly decreased in Tanzania, especially in the recent years, and is further expected to decrease by the middle of this century. It should also be noted that such climatic impacts will not affect the country like Tanzania uniformly due to diverse climatic patterns, from equatorial to semiarid and arid climates. Sawe*et al.* (2018) on assessment of the impacts of climate change and variability on crop farming systems in Singida region, found a decrease in rainfall, increase in temperature and increase in incidences of droughts. The crop yield for maize and ground nuts have shown a decreasing trend while that of millet has shown an increasing trend proving that the crop was indeed versatile enough for this type of climate regime (Mongi *et al.,* 2010). Where rainfall will be less, fewer crops and lower yields will be produced, thus negatively affecting household food security. Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Dilley and Boudreau, 2001).

In Tanzania for example, in 2013/2014 the food requirement was 7,656,673 tons but only 5,613,221 tons were produced; which is only about 73%, making a food deficit of 2,043,452 tons (27%), leading to serious implications to food security and poverty (URT, 2014). Beekeeping is an efficacious tool in rural development as bees are omnipresent and the required equipment and tools namely: hives, smokers and protective clothing are locally made (Reddy*et al.,* 2012). Losses in the agricultural sector and spikes in food prices can push vulnerable consumers into poverty (Milder*et al.,* 2010). Vulnerability to climate change is seen to disproportionately affect the poor owing to a number of social, economic and physical factors that increases their exposure to the impact of climate change shocks but at the same time limits their capacity to cope and adapt (Pardey*et al.,* 2013). Climatechange has required farmers to change crop species/varieties and modified management of soils and sometimes application of water (Sacco *et al.,* 2014). In addition, farmers have developed strategies for pest management, including using of pesticides (Klein *et al.,* 2007).Due to expanding and emerging pests, farmers in most African countries have started using a number of agro chemicals (pesticides for crop pests, mosquitoes and household pests control, herbicides for weeds), which, if improperly used, cause honeybee colony losses and bring the real possibility of damaging the delicate equilibrium in the honeybee colony, as well as the contamination of hive products(Aynalem, 2017).

In spite of the existing beekeeping potential in Tanzania as a coping strategy to climate change, the opportunity remains unexploited by most of the people due to insufficient documentation on its profitability, performance and specific contribution to poor people basic needs (Mujuni*et al.,* 2012). Beekeeping is still marginal with only 10-15% of the households engaged in it (Kidd*et al.,* 2001). The sub-sector is basically accepted but subsistence in nature and it requires improvement or support by the Government to improve it (Msalilwa, 2016). Tutuba and Vanhaverbeke (2018) indicate that though honeybee contributes to the national economy by generating some US$ 19 million per annum and employing more than two million people, still this potential is not fully exploited, and the sector is still non-commercial. Beekeepers in rural areas still remain local and relatively poor (Msalilwa, 2016). The quality and quantity produced per hive is still below average (MMA, 2012). Moreover, exports of honey and beeswax have been declining despite the rise in global demand and increase in investment (ITC, 2015). This paper

aimed to assess the determinants of smallholder farmers in achieving food security due to climate change in Tanzania through beekeeping in Iramba District. Specifically, this paper examines the perception of farmers on status of crop production, factors that influence smallholder farmers to adopt beekeeping, establish the economic benefits of beekeeping to small beekeepers. It is anticipated that information gathered from this study will not only add knowledge to the existing literatures to address issues related to impacts of climate change and food security but will also provide an assessment of factors driving beekeepers in adoption and production in Iramba District along with conditions that would motivate rural farmers to take up beekeeping to enhance household food security.

METHODOLOGY

Study Areas

Iramba District (Fig. 1) lies between Latitudes 4º to 4º.3º S and Longitudes 34º to 35° E. Altitude ranges from 1,000 meters to 1,500 meters above the Sea level. Administratively, according to the GN, 2014 vol. V, the Council is divided into 4 divisions, 20 wards, 70 villages and 392 hamlets (URT, 2006).

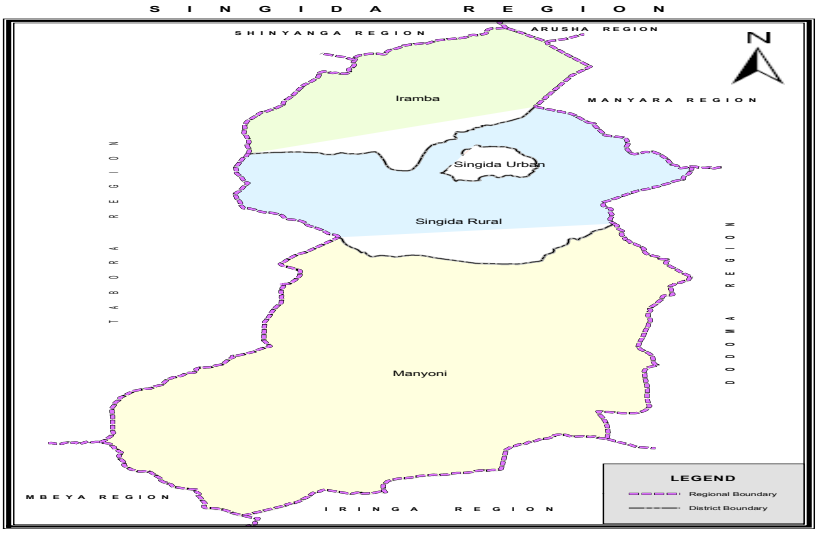

Figure 1: Map of Singida region showing administrative districts (URT, 2006)

In regard to climate there are two key features which are temperature and rainfall. The District forms part of the semi- arid central zone of Singida

which experiences monomial rainfall and the rain season interrupted by two notable dry spells in mid-February and mid-March. The total annual rainfall which is unimodal, it ranges from 500 mm to 850 mm per annum with high geographical, seasonal and annual variation. There are two well defined seasons, the short rainy season during the months of December to March or sometimes goes to April and the long dry season from April to November.

Methods

This study used a multistage sampling technique where three stages were involved (Kothari, 2004). In the first stage Iramba district was selected purposefully from the list of seven districts that constitute the beekeeping in Singida region. In the second stage, two wards (2) Ndago and Kinampanda out of 20 wardswere purposefully selected. The same approach was used to select the four (4) villages two from each ward. Ndago ward: Mdonkolo, Songambele and Kinampanda ward: Kyalosangi and Galangala.

Field surveys, informative interviews, physical observations, group discussions and literature reviews were the main approach of data collection in the study area, where purposive sampling was employed to sample beekeepers among the semi-arid districts of Tanzania mainly based on the frequency of food shortage and other physical aspects (FAO/UNESCO, 1988). Two types of data were collected which included primary and secondary data. Primary data were collected from beekeepers household heads or their respective representatives. Secondary data were collected from Ward Executive Office (WEO), Village Executive Office (VEOs), the District Beekeeping office (DBO), Extension Officers (EO), District Forest Office (DFO), and IRDP library. The sampling unit was households, and the sample size was 150 respondents (beekeepers) from four villages, they were obtained using a formula developed by Yamane (1967), that;

$$n = N/ [1+N (e)^2]$$

Where by: n = sample size, N = sampling frame, e = prediction error 0.1 (10%). The sample size of the household survey consisted of 10% of the total number of heads of households in each study ward. According to URT (2007), total number of household's beekeepers in Iramba district is 62,528. This gives; $n = 62,528/ [1+62,528(0.1)^2]$, where, n = 99.86. Therefore n = 100 respondents. Adding 15% we have 115 respondents

(Yamane, 1967). Table 1 shows calculation for the distribution of respondents per village.

Table 1: Calculation of Distribution of respondents per village

Ward	Village Name	Total HH	Estimation	Respondents
Ndago	Mdonkolo	477	115/2279× 477	24
	Songambele	615	115/2279 ×615	31
Kinampanda	Kyalosangi	651	115/2279 ×651	33
	Galangala	536	115/2279 ×536	27
TOTAL		**2,279**		**115**

Source: Iramba Beekeeping Officer

Table 2 shows the profile of respondents. Primary data sources includes focus group discussions (n=6 for each ward), interviews with key informants (n = 8) consisting of village elders and agricultural extension officers. Household survey (n=150) and direct field observation through transect walks were other sources of primary data. Field observation was deemed necessary in order to confirm some of the issues raised during focus group discussions and the household survey.

Table 2: Respondents Profile

Category	Number
Household Head (Beekeepers)	115
Villages executive officer (VEO)	4
Ward executive officer (WEO)	2
Village Community Development Offices	4

District Beekeeping Officer (DBO)	1
District Forest Officers (DFO)	1
Agriculture Extension Officers	8
Beekeeping NGO working in study area	5
Village leaders	10
Total	**150**

Formation of FGD involved a purposive selection of ten (10) members who represented households, where five (5) represented beekeepers households and village elders, while three (3) represented agricultural extension offices, two (2) represented extension officers, two (2) beekeeping NGO representative. Secondary data such as publication materials such as books, journal papers, original scientific work, government reports and academic dissertation were consulted during review to identify and bridge up the gap basing on the study's objective.

Quantitative data were gathered using structured questionnaires as the main tool. The structured questionnaire covered questions on main trends of crop production in five years, the factors influencing beekeeping practices, the quantity of honey produced, the implication of the financial obtained to food security, and the major constraints in beekeeping. Multiple response questions were analyzed so as to get frequencies and percentages. After being collected from the field using questionnaire, primary data were edited before punching them into the computer software Statistical Package for Social Sciences (SPSS 11.5). Data were analyzed mainly at univariate level where descriptive statistics and frequencies for study variable were computed. Analyzed data in this paper have been mainly presented in tables and graphs for meaningful interpretation and discussion.

FINDINGS AND DISCUSSION

Respondents' characteristics

Different characteristics have direct and indirect influence on the adoption of bee keeping among rural farmers. During the study, different parameters such as age, sex, gender of household head, education level

and marital status, of respondents were assessed. The results and responses are shown in Table 3. Out of the 150 total respondents, 70% were male. This agreed with what have been observed earlier (Mujuni *et al.*, 2012) in which they indicated that in most of African countries like Uganda, Kenya and Zambia beekeeping has often been considered a male-dominated enterprise. According to study conducted earlier (Qaiser *et al.*, 2013), African women often encounter social and cultural constraints that hinder them from performing apiary cultural practices.

Table 3: Socio Demographic Characteristics of Respondents (n = 150)

Respondents characteristics		**Frequency**	**Percent**
Age of respondent (Years)	31-40	18	12.0
	41-50	67	44.7
	51-60	57	38.0
	61 and above	8	5.3
	Total	**150**	**100.0**
Sex of respondent	Male	105	70.0
	Female	45	30.0
	Total	**150**	**100.0**
Marital status	Single	43	28.7
	Married	82	54.7
	Separated	10	6.7
	Divorced	5	3.3
	Widowed	10	6.7
	Total	**150**	**100.0**
Gender of household head	Male	118	78.7
	Female	32	21.3
	Total	**150**	**100.0**

Education level	Non-Primary education	22	14.7
	Complete primary	113	75.3
	Above primary education	15	10.0
	Total	**150**	**100.0**

These are bee-sting phobia, lack of time due to taking care of family matters, inability to raise and harvest from the traditional bee-hive. The small percentages of women practicing beekeeping could be those who are either separated, divorced or widowed, and hence were the sole breadwinners for their family. Namwata*et al.* (2013) indicate few women participate in beekeeping, their apiaries are located on farms nearby their homes, and beehives are sited on stands or short trees at reasonable height easy for women to manipulate the bee colonies. The majority of respondents (54.7 %) are married while the remaining are either single, divorced or widow. The majority of beekeepers (44.7%) are at the age ranges between 41-50 year. This is followed by 38% with the age range between 51 – 60 years. The lowest are those old people with the age above 60 (5.3%). The age between 40 – 60 years is known to be energetic and they have family responsibility. Therefore, being active in beekeeping makes more sense because traditional beekeeping in the area is a labour intensive activity usually undertaken in the forests which need energetic experienced people who are committed and able to bear life threatening risks.

The majority of respondents (75.3%) completed primary education while 15% have no formal education and 10% have secondary education. These results contrast with the results reported in Western Uganda where the majority had attained formal education with 17.5% being tertiary education graduates (Mujuni *et al.,* 2014). However, this result shows the majority of respondents have been exposed to education. Exposure to education will increase ability of the keepers to obtain, process, and use information relevant to the adoption of improved innovations of beekeeping at their disposal. Namwata *et al.* (2013) indicate that beekeepers with a minimum of basic education are more likely to adopt improved beekeeping innovations and hence increase productivity of bee

products. This is due to the fact that beekeeping is a self-employment opportunity available in the study area.

Status of Crop Production in the Study Area

Agriculture has a significant contribution to economy of beekeepers' households. Field surveys, and physical observations made show that the most important cash and food crops commonly cultivated in Iramba district were maize, sunflower (*Helianthus annuus*) beans, sunflower, sweet potatoes (*Ipomoea batatas*) and groundnuts. Table 4 summarizes the responses on the trends of crop productivity over the last 30 years (1989 to 2019 years). It is discernible that maize (*Zea mays L.*) is the main food crop, at both local and regional levels including countries like Kenya, Uganda, Burundi and Rwanda. In Tanzania, maize accounts for over 70% of the cereal food requirement (URT, 2013). Therefore, its production has a strong link to food security. Majority of respondents (77.3 %) indicated that maize production has declined for the past thirty years. This is followed by 19.3% who shows the production of maize is fluctuating.

Table 4: Trends of productivity of various agricultural crops over the last 30 years (1989 to 2019years)

Trend		**Frequency**	**Percent**
Maize productivity	Increasing	2	1.3
	Decreasing	116	77.3
	Fluctuating	30	20.0
	no change	2	1.3
	Total	**150**	**100.0**
Beans productivity	Increasing	3	52.0
	Decreasing	4	2.7
	Fluctuating	1	0.7
	do not know	142	44.6
	Total	**150**	**100.0**
Sorghum productivity	Decreasing	10	6.7
	do not know	140	93.3
	Total	**150**	**100.0**

Sunflower productivity	Increasing	2	1.3
	Decreasing	117	78.0
	Fluctuating	29	19.3
	no change	2	1.3
	Total	**150**	**100.0**
Sweet potato productivity	Decreasing	4	52.7
	Fluctuating	1	0.7
	do not know	145	46.6
	Total	**150**	**100.0**
Groundnut productivity	Decreasing	17	86.7
	Fluctuating	3	2.0
	do not know	130	11.3
	Total	**150**	**100.0**

Meteorological data trends (Table 5), show that the study area experienced eight dry seasons in a period of 14 years. The mean rainfall seasonal per season in this area is 777.4 mm in the period between 1994 and 2011. This is an insufficient amount for requirements of many crops, given inconsistency rainfall patterns demonstrated by higher standard deviations. For example, maize rainfall requirement ranges from 500 to 2,000 mm, sorghum 250 to 1,200 mm, paddy 1,200 to 1,800 mm and sunflower 600 to 1,000 mm per annum (TARO, 1987a).

Table 5: Measured Rainfall Variability during Growing Seasons in Iramba District from 1994 to 2008 (Kabote *et al.,* 2017)

Period	**November**	**December**	**January**	**February**	**March**	**April**
1994-1998	71.0±68.9	195.6±197.6	140.2±68.1	158.8±49.5	151.8±112.8	120.8±56.1
1999 - 2003	123.6±84.8	139.1±54.0	192.4±97.2	60.1±26.4	202.2±57.1	87.6±45.3
2004-2008	67.3±50.6	112.9±59.3	149.9±65.7	65.7±134.7	135.3±100.4	66.6±69.1

Similar trend was observed to other food crops (Table 4); sunflower 78% of respondents indicated the harvest was decreasing, groundnuts 86.7%. Sorghum is among the dominant crops in the study area (semi-arid) produced under smallholder farming (TARO, 1987b). It is among the most drought resistant crops and therefore its resilience to climate change impacts is a bit high. That's why 93.3% of respondents do not see the difference in production. Similar results were reported by Sawe*et al.*(2018) in the study conducted at Manyoni Singida district, there is a

crop damaging and persistent of low harvest. These results collaborated the results of Malley *et al.* (2009) who observed that productivity of crops in semi-arid areas of central Tanzania was increasingly becoming threatened by increasing drought frequency. According to Urassa (2016), this is probably due to climate change, drought, depletion of plant nutrients from the soil and infestation of crop pests and diseases. Information from both focus group discussion and in-depth interviews revealed that there is tremendous decline in crop production. The response from key informant (male, 67 years old) from Songambele village said:

> *My brother, since I moved to this village about 42 years ago, I have never experienced this life of buying everything. I have never bought maize, sorghum or beans for my family. Previously I could harvest 10 bags of maize in my 2acre farm, but recently I could hardly get a bag or two. The increases in temperature have accelerated the increase in drought in our village. Nowadays agriculture has become unpredictable because even the rainfall amount has decreased to the maximum.*

Farmers' perception on increasing rainfall unpredictability coincides with higher standard deviations in monthly rainfall from the results determined earlier (Kabote*et al.*, 2017). The higher standard deviations implying that rainfall patterns are inconsistent in each month during crop growing seasons, and some months receive much rain while others get considerably low rains. These results coincide with farmers' perceptions, which show extending back of the dry spell from February to January resulting into decreasing crop growing season. The rainfall in December and April also shows a clear decreasing trend for the period between 1994 and 2008 in Iramba district (Table 5). Sweet potatoes are short duration crops that are relatively drought tolerant therefore, the high in importance in food security in semi-arid areas. About 52% of respondents indicated that there is a decrease in production of sweet potatoes (Table 4). In focus group discussion at Ndago ward, one respondent indicated,

> *When we came to this farm about five year ago, we could harvest 10 bags or 8 bags of sweet potatoes. Now, I only harvest 3 or 4 bags. Now, there is less rain, they don't grow very well. I get a very poor harvest (45 years old man).*

Interview with respondents a 55-year-old female from Kyalosangi village indicated,

> *for almost 10 years now we are experiencing different pests who do not respond to any chemical. When I was young my mother used to use ashes to kill pests. These days, the new pests do not respond to any chemical. Probably, they are used to high temperature. They are the one responsible to decline of our harvest…*

The only crop which shows increasing trend is beans. About 52% of respondents indicated increase in yield of beans (Table 4). This is linked with the introduction of new type of seed which are heat tolerant and they are now commonly grown at the study area. In the survey made at different seed companies, four different varieties were found in the market. These were: *Uyole* 94, *Lyamungo* 90, *Jesca,*and *Kablanketi.*In the discussion with extension officers about the variety preferred by farmers they rank in the order of Jesca followed by Lyamungo 90 and the lowest was Kablanket, which was in line with another study conducted earlier (Hillocks*et al.*, 2006).

Different Reasons Motivating Small Holder Beekeepers

Figure 2 identifies difference reasons which motivate smallholder farmers to be beekeepers. The majority of respondents (33.1%) reported they were attracted in beekeeping for purpose of income generation, this is followed by 31.1% of respondents who reported that they adapted out of own motivation (personal interest) followed by 29.7% of respondents reported that they keep bees just for food security.

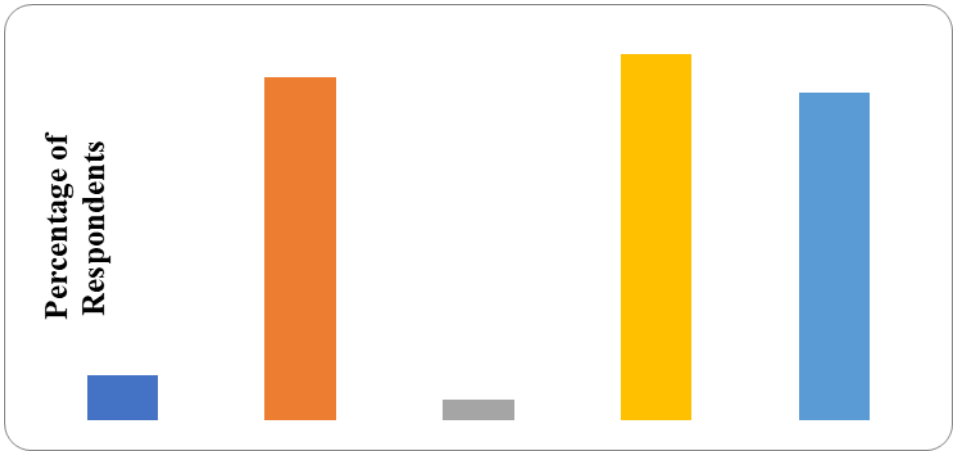

Figure 2: Different reasons motivate smallholder farmers to be bee keepers (n = 150)

These results agree with the report by Paji (2016) where 50% of the respondents were influenced by the need to increase the income, while only 16% of the respondents got engaged in bee keeping activities due to the fact that honey is medicinal and 6% of the respondents were influenced by the need to obtain food. According to Dadant, (1980), honey bees play a critical role in agriculture and beekeeping has many relative advantages and importance that help farmers to improve their livelihoods to ensure food security. Beekeeping conserves the natural resource and contributes to the globe through environmental protection, as beekeeping and agro-forestry are integrated activity. It also provides valuable products like honey, beewax, propolis, bee venom and royal jelly, which farmers use as source of income (Keralem, 2005; Doss, 2006).

Quantity of Honey Production

Under good management of beekeeping, harvested honey can reach up to 15 kg per hive per harvest. However, in Tanzania honey yield per hive is generally low due to several factors. The production ranges of honey per house hold in the study area are shown in Figure 3.

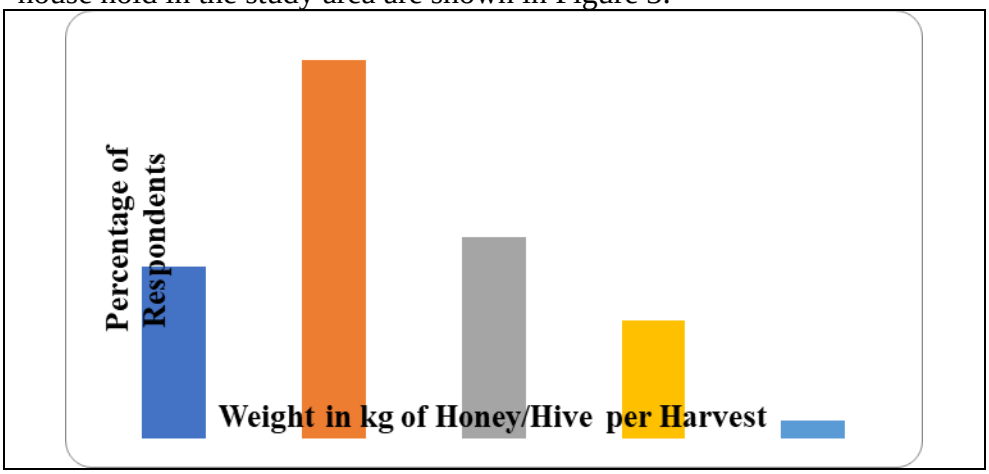

Figure 3: Honey Production per hive per Harvest per Household

Results in Figure 3 indicate that most respondents (42.7%) harvest 6 to 8 kg of honey per hive per harvest followed by 22.7% harvest 9 to12 kg per hive, 19.3% harvest less than 5 kg per hive, 13.3% harvest 13 to 15 kg and only 2% of respondents harvest more than 15 kg of honey per hive per harvest. In average, more than 60% of beekeepers in Iramba District

harvest less than 9 kg of honey per hive per harvest. According to the interview with Iramba District Beekeeping Officer (DBO) the total number of house hold beekeepers is 396 with total number of 1,475 hives, making an average of 3.7 hives per household. The hives are divided into three categories: Top bar hives (146 hives), frame hives (682 hives) and traditional hives (647 hives). The average honey production per hive varies as production in top hives and frame bar ranges from 10 – 15 Lts/hive while traditional hives ranges between 5 – 10 Lts /hive.

These values concur with traditional hive determined earlier by Gidey and Mekonen (2010), which is 8-15 kg/hive and 5-6 kg /hive. Tessega (2009) in the modern hive produces twice as much to the traditional hives which gave 15.6 kg per hive. The difference observed in honey yield between traditional (the common in Iramba district) and modern hive might be due to time of honey bees spent for building comb, while in the modern hive the foundation sheet is prepared and provided by the beekeepers. This might have enabled the honey bee colonies in modern beehives to spend their time and energy on collecting nectar for honey than building new combs.

Preference of Respondents to Beekeeping Compared to Crop Agriculture

According to Mujuni *et al.* (2012), beekeeping is emerging as a very successful agricultural practice for rural communities in less developed countries mainly due to its economic benefits from the products of this practice. Figure 4, indicates that the majority of respondents (63.4%) prefer beekeeping compared to crop agriculture. Only 33.3% said thatit is just like production of other crops and only 3.3% indicated it is less than other crops.

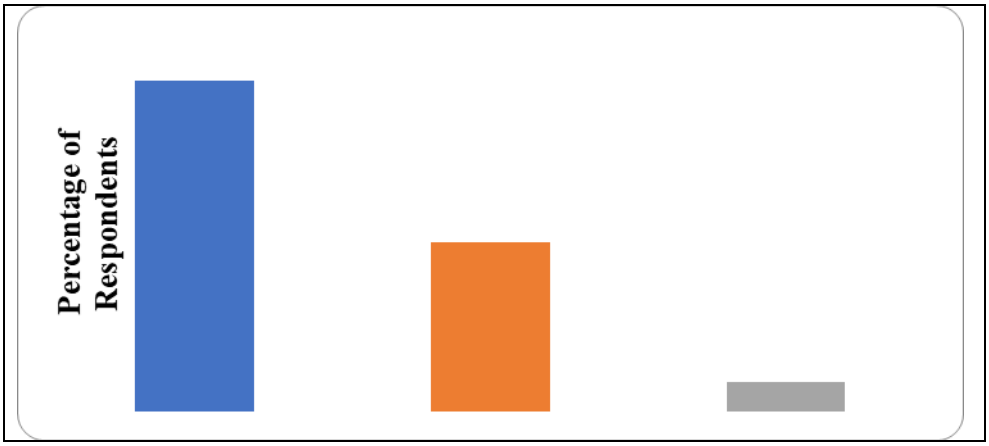

Figure 4: Preference of respondents to beekeeping compared to Agricultural crops

In the FGD the respondent indicated:

> *Beekeeping is the most profitable activity compared to maize and other crops. Also, the price of honey is usually very high compared to the labour it takes. Crops like maize need rainfall, but honey does not*

These findings agreed with Dalang (2001) who noted that on a comparative basis, apiculture stands out conspicuously as a high revenue-generating venture compared to arable cropping. The implication of the above results is that given beekeeping, livestock production and crop farming, beekeeping is a better enterprise to the study area community because it generates a higher income for smallholder farmers. It is estimated that 90% of honey produced in Tanzania is consumed as food in Tanzania. A significant amount of honey is used to make local beer in areas where honey is produced in huge volumes. In an interview with one village elder from Mdonkolo village who is also beekeeper he indicated:

> *"I normally sell my honey to traditional beer brewers, in an average of Tshs 8,0000 – 10,000 per liter. This is because it is easy to get cash to meet my personal requirements. I can get 60 Liter from my hives per harvest; therefore, I am sure of getting about Tshs 600,000" (1 $ = 2230 Tshs).*

This corresponds to another study in Tanzania (ITC, 2015) which indicated, beekeepers own more than 20 hives, they harvest honey twice a year and harvest 5-10litres per hive depending on the season. The price of honey was Tshs. 8,000 per litre. During the study, respondents reported various ways in which funds from beekeeping contributes to household socio-economic welfares. They reported benefits such as increased household's income, food security, poverty reduction, capital accumulation, source of medicine, payment for education and health expenses. Figure5, summarizes the responses on social economic benefits of beekeeping to household's economy. The majority of the respondents (30.5%) use the money they got from selling honey to cover medical expenses for family members (Fig. 5). According to Bright *et al.* (2017), financial barriers are a key limitation to access health services in low- and middle-income countries.

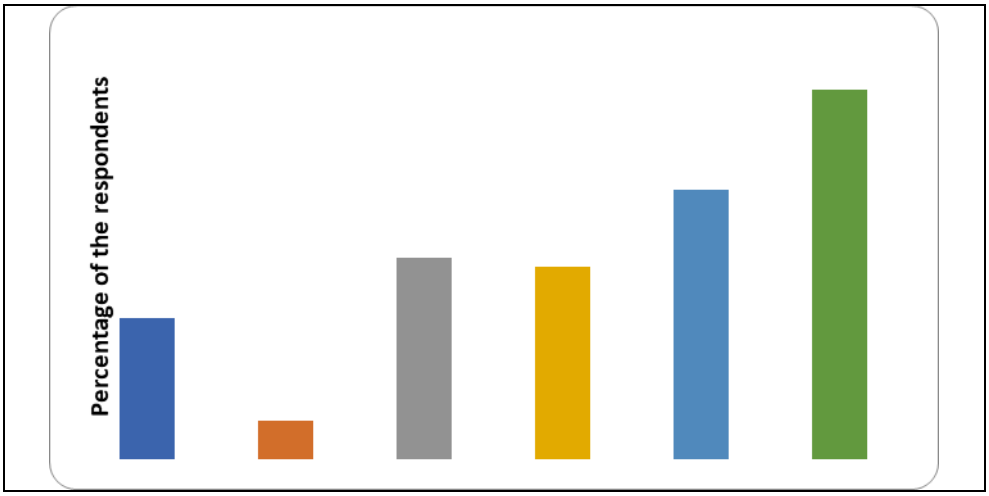

Figure 5: Social Economic Benefits of Beekeeping to Household's Economy

Due to financial barriers in study area, head of family often end up with out-of-pocket patient payments which impact on household budget. Education is an important component of human development. Parents have to pay for tuition fees, meals and accommodation for their children at various levels of education. About 22% of the respondents indicated that the revenue from beekeeping helps to pay for education expenses. These results correspond to those reported in western Tanzania where beekeepers spent revenue from selling bee products to pay school fees for their children, buy assets and clothing, and construct houses. (Ntalwila *et al.*, 2017).

Major Beekeeping Constraints Faced by Farmers in the Study Area

Based on the result of this study, the major constraints faced by beekeepers were: lack of reliable market, bush fire, theft of hive and products, drought, limited knowledge, pests and diseases, lack of common flowers and poor technologies as summarized in Table 6. When asked about the constraints that faces beekeepers, respondents reported several problems. Results in Table 6 show that 15.2% of the respondents reported drought as the major problem facing bee keepers in the study area. Due to drought few flowers bloom hence bees cannot access the honey. This is evident from a number of respondents (12.7%) who said that due to drought common flowers are not available these days.

Table 6: Problems facing Bbeekeeping in the Study Area (Multiple response)

Problems facing beekeepers	Frequency	Percentage
Aggressiveness of bees	11	1.2
Limited space	48	5.1
Limited market for bee products	135	14.2
Bush fire	146	15.4
Theft of hive and products	10	1.1
Drought	144	15.2
Limited knowledge	136	14.3
Pests and diseases	59	6.2
Lack of common flowers	121	12.7
Poor technology	140	14.7

Urassa *et al.* (2016) observed that in Iramba district, agricultural production is poorly performing, mainly due to low and erratic rainfall, which range between 500 and 800 mm per annum. As it is in Singida region as a whole, famine is a common phenomenon in the district due to lack of rainfall and droughts. Drought has caused many problems including bush fire rated by 15.4% of the respondents. Kumar *et al.* (2012) indicates that the use of fires may increase the risk of accidental wild fires especially during dry months. Markets for honey and other bee products in Tanzania are not fully established. Beekeepers in Iramba Districts are mainly smallholders who depend on local markets to sell the honey produced. The market is unstructured and unreliable due to inadequate customers, difficult transportation, lack of realization of the honey value and inadequate ability of beekeepers to search for markets.

Namwata*et al*. (2013) reported that bee keeping industry face a series of drawbacks namely technology, market, equipment, climate, transportation, credit accessibility, lack of training/skills and cultural practices.

This corresponds to findings by Tutuba and Vanhaverbeke, (2018) who established that commercialization of beekeeping in Tanzania is constrained by low market prices and poor, marketing systems and limited market information. These results also compare with Arse *et al.* (2010), who reported on the shortage of honeybee forages, shortage of honey bee colonies, poisoning by agro-chemicals, shortage of modern hives, prevalence of honeybee enemies and market problems, shortage of improved bee equipment, absconding and swarming problems, prevalence of honeybee diseases, lack of knowledge of the right harvest time and theft problems as the major beekeeping constraints. This is in line with the work of Kerealem *et al.* (2005) which stipulates that drought is the main constraint of bee keeping. These constraints have a direct and indirect effect on the reproduction and productivity of honeybees.

CONCLUSION AND RECOMMENDATIONS

This study provided information on the current status of beekeeping in two wards inIramba District as adaptation strategies against impacts of climate change in the district. Climate change is evident due to rainfall patterns inconsistent in each month during crop growing seasons, most of Iramba district receive considerably low rains. This situation has caused frequent food shortages and famine. In order to respond to the impact of climate change in Iramba district, smallholder farmers opt for beekeeping instead to crop production as the source of food and income to meet the family basic needs. The honey production has played a critical role in agriculture and beekeeping has many relative advantages and importance that help farmers to improve their livelihoods, and food security.

Since food security cannot be achieved without income security, beekeeping could be a useful tool for improving rural economy. It is hereby recommended to have the capacity building for beekeepers so that they can get knowledge about the various practices employed in beekeeping through a mixture of practical and theoretical sessions.

Sessions should involve the practices necessary to ensure the cultivation, management and maintenance of healthy beehives. Beekeepers must be introduced to the biodiversity-friendly, livelihood opportunity that beekeeping provides. As an entrepreneurial avenue, beekeeping can have positive impacts on biodiversity and ecosystems, in addition to serving as a source of income to provide a level of financial sustainability to farmers.

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