Socio-economic influences of Pangani river basin on community’s livelihoods in Korogwe, Tanga Region, Tanzania

EMMANUEL KOMBA, LEOPOLD P. LUSAMBO*
Sokoine University of Agriculture. Monogoro, Tanzania. *email: lusambo2009@sua.ac.tz

Abstract. Komba E, Lusambo LP. 2019. Socio-economic influences of Pangani river basin on community’s livelihoods in Korogwe, Tanga Region, Tanzania. Bonorowo Wetlands 10: 41-51. River basin’s resources are vital to basic livelihoods improvement and to the economy growth of the world. Although river basins played a significant role to Tanzania’s economic growth, little information is known on the socio-economic effects of river basin in the urban areas. To address the information gap between urban and rural areas, this study was conducted to: identify socio-economic activities undertaken by urban community along Pangani river basin, analyse gross profit from identified socio-economic activities and analyse factors influencing urban community's dependency on river basin. Purposive sampling was used to select three wards among seven wards crossed by river basin. A cross-sectional research design was employed involving 90 respondents were randomly selected and interviewed using household questionnaire. Key informant’s informations were collected and three focus group discussions comprising 6-10 people were carried out using a developed checklist. Data were analysed using statistical package for social science (SPSS), gross margin analysis and multiple regression model. The findings revealed that, 33.3% of the respondents were conducting gardening activities, 26.7% crop cultivation, 26.7% brick making, 8.9% sand mining and 4.4% car wash activity. The overall gross profit was found to be TZS 5 263 736.00 per household/year which is higher than that recorded in previous researches conducted in rural areas. Soil fertility, land availability, water availability, access to market, conducive climatic condition and vicinity to new construction area were found to be significant factors influencing urban community to depend on river basin. The result prevail that, there is high utilisation of river basin resources in urban than in rural areas. The study recommends strengthening of community participation and awareness in conserving the sustainable river resources and further study on investigating economic efficiency of socio-economic activities.

Keywords: Community, Pangani river, socio-economic

INTRODUCTION

River basin refers to the portion of land drained by a river and its tributaries. In the world’s second driest continent Africa, the availability and access to water is more crucial to the creatures than it is almost anywhere else on the Earth (UNEP 2010). The establishment of transboundary river basin organizations for many of Africa’s large basins support a powerful opportunity to sustainable management and utilization of the resources in contributing to economic growth of respective countries and people’s livelihoods. The examples of African’s transboundary river basins includes Nile river basin, Congo river basin, Niger river basin, Senegal river basin, Limpopo river basin, Volta river basin and Zambezi river basin.

Tanzania consists of nine hydrological zones or water basins which serves as water resources management. These basins are: Pangani water basin, Lake Nyasa, Rufiji river, Wami/Ruvu river, Ruvuma and Southern coast, Lake Tangakiya, Lake Rukwa, Lake Victoria water basins, and the Internal drainage basins of Lake Eyasi, Manyara and Bubu depression (URT 2002). The Pangani water basin includes five sub basins: Pangani river (43 650 km²), Msangazi river (5 030 km²), Umba river (8 070 km²), Zigi and Coastal rivers including Mkulumuzi (2 080 km²), all of them are independent drain to the Indian Ocean (PBWO 2015).

The Pangani River Basin (PRB) provides a lifeline for biodiversity, domestic and industrial use in Tanzania, thereby plays a significant role on the economic growth of the country. The basin hosts an approximately 3.7 million people, 80% of whom rely directly or indirectly on irrigated agriculture for their livelihoods (Ngereza 2005). Immigration of people to a some areas particularly depends on the availability of water, therefore water resources plays as key factor for urbanization. In the last 15 years these demands have intensified with the increase in population and concurrent growth of economic activities requiring water as an input such as in irrigated agriculture, hydropower generation, industries, mining, tourism, livestock keeping, domestic, fisheries, wildlife and forestry activities (URT 2002).

The increased demand for water in urban areas continues for both domestic and industrial activities as people migrate to urban areas. For instance, the water demand in Arusha city is approximately 93 270 m³/day while the water production ranges between 35 000 and 45 000m³/day depending on season (AUWSA 2015). On the other hand, water pollution increases as the area grow and because farmers use more chemical inputs to grow enough food to feed the fast-growing population (Mbonile 2012). Due to the socio-economic services provided by the river basin to the economy growth, conservation strategies are more vital in order to safeguard the ecological and socio-economic functions of the river basin.
This study aimed to identify the socio-economic activities initiated by urban community along the Pangani river basin, analyse the gross profit obtained from identified socio-economic activities and analyse factors influencing urban community’s dependency on Pangani river basin.

MATERIALS AND METHODS

Description of the study area

Location

The Pangani river basin (PRB) is situated in the north-east of Tanzania and covers a total area of 43 650 km², about 3 900 km² of which is in Kenya. The PRB together with other sub basins forms the Pangani water basin which is under management of Pangani Basin Water Office (PBWO). PBWO head quarter is based in Kilimanjaro region. The Pangani river basin covers parts of Kilimanjaro, Arusha, Manyara, and Tanga Regions and it crosses through 14 districts (Figure 1).

The study was conducted at Korogwe town council which is crossed by Pangani river basin in Tanga Region located at latitude 4º15’ and 5º15’ South, and in the longitudes 38º0 and 38º45’ East (Figure 2). According to the population and household census of 2012, Korogwe town council has a population of 68 308 people with an average household size of 4.4.

Climate

Korogwe town council is characterised by the long rainfall which usually takes place during February to May and the short rain fall during September to November. The climate is closely influenced by the topography and ranges from tropical to sub tropical with annual rainfall range of 900mm to 1 300mm. The average temperature during the hot month (October-March) ranges from 29-32°C and during the cold month (May-October) the ranges from 23-28°C.

Topography, geology and hydrology

The topography of Korogwe town council is characterized by lowland and mountainous areas with altitude ranging from 500 to 1 000 meters above sea level. The district is drained by Pangani river, Lwengera tributaries and other small tributaries which flow from the mountains. The Korogwe town council is mainly dominated by the red clay loam soils in the mountainous zone and brown sandy soils in the dry plain zone (URT 2008).

Economic activities at Korogwe town council

The economic activities at Korogwe town council are largely based on agriculture, animal husbandry, wholesale and retail business, and employment opportunity from government and private organisations. Different varieties of crops like paddy, maize, cassava, banana, beans, sisal, mango and oranges are produced. Meanwhile, animals like goats, sheep, cattle, pigs and chicken are kept. Land deterioration is evident along the Pangani river basin and in other parts of the urban area as a consequence of intensified farming in the limited area.

Research design

Data collection employs a cross-sectional research design. This method is used due to the fact that it allows collection of data at one point in time and is the most appropriate method in social studies facing limited time and little budget.

Reconnaissance survey

The reconnaissance survey was conducted at Mgombezi, Majengo and Bagamoyo wards with a purpose of testing a validity and reliability of the questionnaire by conducting face to face interview that included 10 respondents. Few and minor challenges was observed which resulted to modification of some questions in order to collect the appropriate data from the existing situation.

Figure 1. Pangani river as seen at railway bridge, Majengo ward, Tanzania
Table 1. Total number of sampled households

| Name of Ward | Name of “Mtaa” | Number of residents | Total number of household (N) | Number of sampled households (n) |
|--------------|----------------|---------------------|------------------------------|----------------------------------|
| Mgo mbezi   | Mgombezi       | 4,293               | 1,020                        | 30                               |
| Majengo     | Memba          | 1,692               | 200                          | 30                               |
| Bagamoyo    | Kwanduli       | 1,143               | 500                          | 30                               |
| Total       |                | 7,128               | 1,720                        | 90                               |

Sampling procedure and sample size determination

Purposive sampling was used to select three wards out of seven wards crossed by Pangani river among 10 wards present in the study area. These wards are: Mgo mbezi, Majengo and Bagamoyo. The target population was number of households in the selected wards and specifically in the selected “mtaa” namely; Mgombezi (Mgombezi ward), Memba (Majengo ward) and Kwanduli (Bagamoyo ward). The total number of households in the three selected “mtaa” under study were 1,720. The provided list of household from “mtaa” offices who conducts their socio-economic activities along the river basin was used in sampling frame.

The study used the sample size determination as guided by Bailey (1994) and Yurdugul (2008) who argued that, 30 respondents per case are minimum number recommended to represent a population under study. Random sampling method was used to select the samples from sampling frame by using a random number table in MS Excel. A total number of 90 households were randomly selected, one member from each household was interviewed as shown in Table 1.

Data collection

Primary data

Primary data were collected using semi-structured questionnaire, focus group discussions (FGDs) and key informant interviews by researcher through face to face interview with the respondents.

Household questionnaire survey

Both structured and unstructured questionnaires (closed and open ended questions) were adopted during primary data collection (Appendix 2). The questionnaire was designed in order to meet the specific objectives of this study by collecting the appropriate socio-economic data.

Key informants interview

Key informants interview is a qualitative in-depth interview with people who know what is going on in the community and have a wide knowledge about the topic in question. This face-to-face interview was done purposely in order to collect information from a wide range of people having knowledge and understanding of the subject in research. This included “mtaa” executive officers from Kwanduli, Mgombezi and Memba, Pangani basin water office and township officer from department of environment and sanitation, water and irrigation and department of planning and economics.

The key informant’s information was collected by using closed and open ended questionnaire having nine questions (Appendix 3). The questions on population distribution, socio-economic activities along river basin and their economic contribution at “mtaa” and council level were asked. Also factors influencing people’s dependence on river basin resources for their livelihoods improvement were assessed as well as the recommendations for solving the challenges were recorded.

Focus group discussion (FGD)

The focus group discussion (FGD) is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants gather to discuss issues and concerns based on a list of key themes drawn up by the researcher/facilitator (Kumar 1987 cited by Escalada et al. 2009). Three focus group discussions comprising 6-10 people were carried out in the three
selected “mtaa” by using checklist of four questions which were developed by a researcher (Appendix 4). The number of participants in FGD was adopted from Lusambo (2009) and in addition, Liumputtong (2011) recommended that, methodologically, focus group interviews involve a group of 6-8 people who come from similar social and cultural backgrounds or who have similar experiences or concerns, where they gather together to discuss a specific issue with the help of a moderator in a particular setting where participants feel comfortable enough to engage in a dynamic discussion for one or two hours. This approach have been more popular and encourages a range of responses which provide a greater understanding of the attitudes, behaviour, opinions or perceptions of participants on the research issues (Hennink 2007).

Researcher’s field observations

Field observation was done by the researcher and the trained researcher assistants during data collection (Figure 3). The observation was mostly based on how people are involved in various socio-economic activities, how do they operate their activities along the river basin and which technology is used in irrigation, brick making and agriculture practice. The relevant observations were photographed.

Secondary data

Secondary data were collected from Pangani basin water office, Korogwe town council, wards and “mtaa” offices. Also relevant references on river basins eg. reports, thesis, dissertations and journals were used to gather the secondary data.

Data analysis

Data were analysed using statistical package for social science version 20.0 (SPSS), gross margin analysis (GMA) and multiple regression model.

Objective 1. To identify the socio-economic activities undertaken by urban community along the Pangani river basin

The qualitative and quantitative data were collected from households, key informants and focus group discussion. The qualitative data were analysed by content analysis method while quantitative data collected were coded and analysed using descriptive statistics. Content analysis is useful in analysing details of the components of verbal discussions to be held by key informants and focus group discussion (Kajembe and Luoga 1996 cited by Kijazi 2006).

Objective 2. To analyse gross profit obtained from each identified socio-economic activities

The collected quantitative data were coded and entered into MS Excel program. The data were checked for consistence and completeness before analysing using descriptive statistics. Descriptive statistics such as bar charts, pie charts and frequency tables have been used to present the results. Also gross margin analysis was used to calculate the gross profit obtained from each identified socio-economic activity.

Gross margin = Total revenue - Total Variable cost.

GMA = TR - TV

Where;

GMA = Gross margin analysis (TZS/Kg or TZS/year)
TR = Total revenue (TZS/Kg or TZS/year)
TVC = Total variable cost (TZS/Kg or TZS/year).

Objective 3. To analyse factors influencing urban community’s dependency on river basin

Various factors were identified during data collection and were analysed using multiple regression model in order to determine the drivers for urban community’s dependency on river basin resources. The following are the identified factors that influence people to conduct their socio-economic activities along the Pangani river basin; Soil fertility, water availability, land availability, vicinity to district market, availability of transport, conducive climatic condition and vicinity to new construction areas (Table 2).

The multiple regression model was chosen because it is a statistical analysis technique popularly used by economists and other researchers in determining the relationship between independent and dependent variables and can be used to forecast future conditions. According to Nathans et al. (2012) across behavioral science disciplines, multiple regression is a standard statistical technique in a researcher’s toolbox.

The dependent variable is the gross profit obtained from socio-economic activities while the independent variables are environmental and socio-economic factors like soil fertility, availability of land, water availability, education, employment etc. The multiple regression model (equation 2) has been used in this study.

![Figure 3. Residence period of the respondents at Korogwe town council and Number of years used to conducting socio-economic activities along Pangani river basin, Tanzania](image-url)
\[ Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + ... + \beta_n X_n + e_i \] …… (2)

Where;
- \( Y_i \) : Dependent variable i.e gross profit from crop cultivation, gardening, brick making, sand mining and car wash;
- \( X_1, \ldots, X_n \) : Independent variables i.e.
  - \( X_1 \) : soil fertility,
  - \( X_2 \) : water availability,
  - \( X_3 \) : land availability,
  - \( X_4 \) : access to market,
  - \( X_5 \) : access to means of transport,
  - \( X_6 \) : Conducive climatic condition and
  - \( X_7 \) : Vicinity to new construction area.
- \( \alpha \) : The intercept i.e. The value of the dependent variable when all of the independent variables = 0.
- \( \beta_1 \ldots \beta_n = \text{Coefficient} / \text{the slope i.e. The change in the dependent variable per unit change in the independent variable} \)
- \( e_i \) : Error term

| Variable symbol | Variable name                  | Explanations                                      |
|-----------------|--------------------------------|---------------------------------------------------|
| \( Y_i \)       | Gross profit                   | Gross profit from identified socio-economic activities |
| \( X_1 \)       | Soil fertility                  | Dummy variable; Fertile soil = 1, Not fertile = 0  |
| \( X_2 \)       | Water availability              | Dummy variable; Sufficient = 1, Insufficient = 0  |
| \( X_3 \)       | Land availability               | Dummy variable; Adequate = 1, Inadequate = 0      |
| \( X_4 \)       | Access to market                | Dummy variable; Accessible = 1, Inaccessible = 0  |
| \( X_5 \)       | Access to means of Transport    | Dummy variable; Accessible = 1, Inaccessible = 0  |
| \( X_6 \)       | Conducive climatic condition    | Dummy variable; Conducive = 1, Unconducive = 0    |
| \( X_7 \)       | Vicinity to new construction areas | Dummy variable; Vicinity = 1, Not vicinity = 0 |

**RESULTS AND DISCUSSION**

**Characteristics of the respondents**

The respondents’ characteristics include; gender (sex of the respondent), age, marital status, education level, household size, residing period at Korogwe town council, time period used to conduct activities along the PRB, distance from site of operation to Pangani river bank, involvement of urban community in river basin conservation strategy, ownership status of the area of operation, migration status of the river basin dependants, and livelihoods improvement from PRB.

**Gender of the respondents**

The overall respondents consist of 95.6% male and 4.4% females as shown in the Table 3. These numbers reflect the fact that majority of the household were man and were the were mostly found conducting their economic activities along the Pangani river basin. Females are not much involved themselves compared to men eg. in brick making and sand mining, this may be due to the nature of work as they consumes more energy where female cannot withstand and are not homestead based activities that do not provide more time to conduct domestic activities like fetching water and cooking. The data on the sexes distribution is supported by Manik et al. (2009) who conducted the research on the role of gender in economic activities and they found that, activities within the household were found to have a weak impact on women’s empowerment were only 85% of men and only 6.3% of women over 14 years old were engaged in rural economic activities in the year 2000.

**Age of the respondents**

The age distribution of the respondent where; 10 % were between 46-60 years, 76.7% were between 18-45 years, and 13.3 % below 18 years (Table 4). We found that, at the age of 18-45 years, 76.7% of people have engaged themselves in conducting the socio-economic activities to sustain their life followed by the age of below 18 years and the age above 46-60 years. At the age of 18-45 years people have more energy to participate in hardship work. The result also this implies that, the population of most beneficiaries along the Pangani river basin fall between the ages of 18-45 years who are considered as youth. According to UN (2009), youth have high potentials in poverty alleviation and in the labour market. The results are in the line with the research done by Lamsal (2015) who concluded that, age of respondents positively and significantly affected the household wetland income. URT (2009) through the poverty and human development report also indicated that, almost all people 15 years and older in Tanzania are working, and the central issue is not unemployment but the reliability, quality and productivity of employment.

**Marital status of the respondents**

About 72.3% of the respondents were married while 26.7% were found to single. The findings shows that married respondents are highly beneficiaries of the PRB resources because the married people have many family responsibilities which in need of more money than a single person. This result is supported by Okayo et al. (2015) who commented that, it is inferred that the households who possessed families have huge responsibilities of taking care of other people, other household members (for example, children), or even property than a single or separated or divorced person.

**Household size**

Table 5 shows the households size distribution in Korogwe town council. The average household size is 4.5, which isin line with the 2012 population and housing census for United Republic of Tanzania which reported the average size of household was 4.4l. This implies that the sample taken from streets under study were good representative in all other streets and wards in general.
Previous study suggested a positive relation between wetland cultivation and household size in which the researcher commented that, it was possibly caused by lack of access to land leading households with large family sizes to invade wetlands in search of land for cultivation (Zidana et al. (2007)).

Because the population of Korogwe town council is increasing, there is significant increase of socio-economic activities along the along the Pangani river basin. This rapid population growth and high population density could lead to conflict of interest over natural resources as scarcity grows (Mbonile 2012). Moreover Lamal (2015) found that, family size positively and significantly affected the income that was earned from the lake resources where one additional family member increased the income from lake resources by NPR 239/yr ($3.4/yr USD). Therefore, it is important for local people to have proper planning in utilising the river basin resources by considering the population that depends on.

**Education level of the respondents**

The education level of the respondent shows that; 65.6 % have attended primary education, 28.9 % have attended secondary school, 3.3% have attended college education, while 2.2% have not gone to school (Table 6). This result indicates that most the respondents who have only attended primary and secondary school education have highly engaged in the economic opportunity available along the river basin. The lack of chance to proceed with further studies and may affect the decision why they decided to employ themselves. Kagembe and Luoga (1996) commented that, education tends to increase awareness, positive attitudes, motivation and values. Okayo et al. (2015) pointed that, education is a powerful driver of development and one of the strongest instruments for improving wellbeing. The level of education has a great influence on improvement of productivity and adaption of new technology. Taruvinga and Mushunje (2010) argued that, a household head education has a positive impact on influencing households’ participation in wetland cultivation, thereby increasing household income. From this observation, Pangani river basin plays as a source of employment and hence reduces unemployment crisis in urban areas leading to the improved house income.

**Table 3. Gender distribution of the respondents**

| Gender  | Frequency | Percentage |
|---------|-----------|------------|
| Male    | 86        | 95.6       |
| Female  | 4         | 4.4        |
| Total   | 90        | 100.0      |

**Table 4. Age distribution of the respondents**

| Age category | Frequency | Percentage |
|--------------|-----------|------------|
| < 18 yrs     | 12        | 13.3       |
| 18-45 yrs    | 69        | 76.7       |
| 46-60 yrs    | 9         | 10.0       |
| Total        | 90        | 100.0      |

**Table 5. Household size of the respondents in the study area**

| Number of people per household | Frequency | Percentage |
|--------------------------------|-----------|------------|
| 1-3                            | 48        | 53.3       |
| 4-6                            | 42        | 46.7       |
| Total                          | 90        | 100        |

**Table 6. Education level of the respondents**

| Education level | Frequency | Percentage |
|-----------------|-----------|------------|
| Not gone to school | 2         | 2.2        |
| Primary school  | 59        | 65.6       |
| Secondary school| 26        | 28.9       |
| College level   | 3         | 3.3        |
| Total           | 90        | 100        |

Data on the socio-economic activities along PRB was based on the residence period of the respondents at Korogwe town council in relation to number of years. The results indicated that, 46.7% have lived in Korogwe town council for more than 10 years, 37.8% have been living for 6-10 years, 13.3% for 3-5years while 2.2% for 1-2 years. The decision making to engage in economic activities along the Pangani river basin was influenced by the residence period. This fact might be attributed by the situation that staying longer in the same areas results into familiarity with the economic opportunity available in specific area. Staying longer in the particular area it indicates that the respondents are knowledgeable enough in terms of time and have useful information with regard to the use of wetland resource in study area (Musamba et al. 2011). These results are in line with Gilbia et al. (2011) who emphasize that, people who live in a certain area for a longer period of time accumulate various experience and knowledge, with regard to respective area of interest.

Moreover, the results showed that, 48.9% of the respondents have been conducting their socio-economic activities along the Pangani river basin at Korogwe town council for 3-5 years, 24.4% for 6-10 years, 16.7% for 1-2 years, and 10% for less than 12 months. This result implies that, the residence period has a direct relationship with the number of years used to conduct socio-economic activities along the Pangani river basin as shown in Figure 3. The findings indicates that, in the recent years (1-5 years back), many people by 75.6% have been involved themselves in different activities along PRB. This may be due to the increase of employment opportunities in township areas thus people facing unemployment crisis in rural areas tend to migrates to urban areas seeking for jobs and they find PRB as among of their solution for employment opportunity. The result is supported by a Pull and Push factor of migration which pointed out that, under the capitalistic model of development, there is a tendency for large proportion of investments to concentrate in the urban centers which encourage people to move to urban areas in the expectation of higher paid jobs (Maruti 2016).
Distance of the site of operation to Pangani river bank

As many as 55.6% of the respondents are conducting their various socio-economic activities along the PRB within a distance of 60m, 37.7% between 61-120m and 6.7% between 121-200m. The data indicates that the majority are conducting their activities close to the river bank contrary to the environmental management Act No.20 of 2004 section 57, which stipulate that within the distance of 60m there should be no any human activities from the river bank for the purpose of conservation and management of rivers, river banks, lakes or lake shore and shore-lines. Additionally, there is low implementation of this law at Korogwe township area due to inefficient supervision and monitoring of all activities along the river basin with regards to river resources conservation.

Involvement of urban community in conserving the Pangani river basin This study has revealed that, a large percentage (86.7%) of the respondent have never been involved in any of the conservation activities despite of their awareness to participate, and only 13.3% of the respondents have been involved in various conservation activities along the Pangani river basin. During the focus group discussion and key informant interview, it was noted that Korogwe town council and Pangani river basin have been involving the urban community in tree planting and proper practice of conservation agriculture along the river basin occasionally.

As a consequence of low participation of community in conserving the river basin, there is a potentially high chance of law violation and hence unsustainable utilization of river resources which may lead to environmental degradation. The positive attitudes and perceptions are a good indicator that if some conservation initiative is taken, for example, a community-based conservation approach, there is a greater possibility of increased participation of local people in the conservation activities (Lamsal 2015). Also several previous studies such as Mehta and Heinen (2001), Andrianandrasana et al. (2005), Bajracharya et al. (2006), Munishi et al. (2011) have also proposed a community-based conservation approach for better wetland resource use and conservation.

Migration status of the respondents

In trying to find whether the respondent has been migrating from other areas prior to their occupation along the Pangani river basin, the study found that, 42.2% of the respondents have been conducting their similar activities in other areas while 57.8% of the respondents have not been conducting their activities in other areas because some are typical residents at the study area. The study indicates that there is significant immigration of the people along the river basin for the sake of finding the economic opportunity particularly at Korogwe town area. This concur with the research done by Mbonile (2012) who commented that; new developments within the basin such as the lower Moshi irrigation scheme, and tanzanite mines, new towns have attracted migrants from more distant regions. Moreover, Maruti (2016) mentioned that, the non-availability of alternative sources of income (non-agricultural activities) in rural areas is also important factor for migration.

Average farm size of the household

Figure 4 shows the distribution of farm size of the respondents in the study area. It indicates that, 33.3% were found to have a farm size of 0.26-0.5 acre, followed by 27.8% having 0.6-1 acre and 26.7% having less than 0.25 acre where above 1.1 acre are 12.2%. Earlier report also described the plot sizes of small-sclae farmers that fall between 0.1 and 0.2 ha (equivalent to 0.25-0.5 acre) (Mwamfupe 1994). The land availability per household, however, has declined by almost half from 0.7 ha per person in the 1990s to 0.4 ha per person in the 2000s in the region (FAO 2011).

The farm size has an effect on household income generating from community of their river basin. This finding concur with the results obtained by Safa (2005) and Fadipe (2014) who did the research on determinant of household income who concluded that, farm size has positive significant related to farmers’ income. Among other factor, the larger the farm size, the higher the harvest and vice versa. Since the majorities have farm size ranging from 0-1 acre, this implies that their harvests are at moderate level resulting to medium household income, this is why the majority (62.2%) have confirmed that their livelihoods have moderately improved due to the income obtained along the Pangani river basin at Korogwe town area.

Livelihoods improvement due to utilisation of PRB resources

The respondents who agreed that livelihoods of the community rank higher due to the presence of Pangani river basin at Korogwe urban accounted 27.8% of the total respondents. Meanwhile62.2% of the respondents have medium livelihoods improvement while 10.0 % have low livelihoods improvement. The majority of the respondents (62.2%) have answered to have medium livelihoods improved and not high livelihoods improved. This could be due to the fact, the majority of respondents have small farm size (less than 1 acre) which results to low harvest. By considering these percentages on how the river basin contributes to livelihoods improvement, with regardless of farm size, it is generally clear that the contribution of Pangani river basin to livelihoods improvement is significant. It has been argued that wetlands make appreciable contribution to rural livelihoods in terms of direct cash income and contribution to food security (Munishi et al. 2011), and many households that live close to wetland ecosystems in Tanzania and elsewhere utilise wetlands in coping strategies during times of drought and food scarcity.

Identified socio-economic activities along the PRB

Various socio-economic activities have been identified to be conducted along the PRB at Korogwe town council (Table 7). The results indicates that, in the order of high to low, most of the respondents are conduicnting gardening, crop cultivation eg. maize, brick making, sand mining, and car wach activity, respectively. The result has shown that
in township areas, there is a high diverse utilisation of Pangani river basin than in rural areas where the dominant activity is agriculture. Rural households in the Pangani river basin are highly dependent on agriculture (Turpie et al. 2007). Also Munishi et al. (2011) found that, wetland based socio-economic activities included agricultural production (farming) practiced by over 98% of the population in Great Ruaha river basin followed by livestock grazing and fishing. All these activities contribute to livelihoods improvement.

**Gross profit obtained from socio-economic activities conducted along PRB**

The study showed that people have engaged to various socio-economic activities along the Pangani river basin due to the economic benefits they obtain from various activities. Based on the calculated gross profit from each identified socio-economic activities, Pangani river basin plays an economic role as a source of household income. The results shows that; Gardening has an average gross profit of TZS 14 108 340.00 per year, brick making TZS 4 665 000.00 per year, crop cultivation TZS 1 581 340.00 per year, sand mining TZS 1 404 000.00 per year and car wash TZS 4 560 000.00 per year as shown in Table 8. The overall average gross profit per household/year is TZS 5 263 736.00 which is higher than that recorded in previous research conducted in rural areas (Turpie et al. 2007). Income from dryland farming along the Pangani river basin in rural areas was about TZS 200 000.00 to 300 000.00 per household apart from the northern highlands, where an average of over TZS 600 000.00 was recorded (Turpie et al. 2007). Munishi et al. (2011) also observed that, wetland based socio-economic activities carried out in valley bottoms commonly known by local people as vinyungu contribute about 15% of household food and 55-95% of household income annually, equivalent to TZS 3 234 721.00.

The results suggests that it is more profitable to engage in various socio-economic activities along the Pangani river basin in township areas than in rural areas which have been contributed by the easy access to District markets, availability of convenient transportation and adaptation of improved agriculture technology eg. use of green house, improved seed and use of herbicides and pesticides.

Gardening activity has been identified as a leading activity of getting high gross profit followed by brick making and car wash (Figure 4). In urban areas the population is high and this leads to high consumption of gardening products eg.green vegetables, tomatoes, water melon, sweet pepper and okra. Thus, gardening activity has been identified as a leading activity of getting high gross profit followed by brick making and car wash (Figure 5). Also, many construction of new houses and high vehicle ownership status have caused more income to be obtained from brick making and car wash activity respectively at the study area when compared to rural areas. On the other hand, sand mining has no variable cost due to the fact that working gears such as spade and hoes are purchased once and therefore have been treated as fixed cost.

**Factors influencing urban community’s dependency on Pangani river basin**

The factors influencing dependency of urban community to PRB were examined using multiple regression model (Table 9).

In general, six independent variables factors; soil fertility, land availability, water availability, access to market, conducive climatic condition and vicinity to new construction area were found to be significant variables influencing community dependence on Pangani river basin. Meanwhile, access to means of transport has been observed as insignificant variables.

**Table 8. Gross profit obtained from each identified socio-economic activities**

| Activity               | Total revenue, TR | Total variable cost, TVC | Gross profit, TZS/year |
|------------------------|-------------------|--------------------------|------------------------|
| Crop cultivation       | 1 790 660.00      | 209 320.00               | 1 581 340.00           |
| Gardening              | 14 365 780.00     | 257 440.00               | 14 108 340.00          |
| Brick making           | 4 960 000.00      | 295 000.00               | 4 665 000.00           |
| Sand mining            | 1 404 000.00      | 0                        | 1 404 000.00           |
| Car wash               | 6 120 000.00      | 1 560 000.00             | 4 560 000.00           |

**Table 9. Factors influencing dependency of urban community to Pangani river basin, Tanzania**

| Factors                        | B     | t-value | p-value |
|--------------------------------|-------|---------|---------|
| Constant                       | 2.83  | 3.959   | 0.05    |
| Soil fertility                 | 0.28  | 2.956   | 0.004** |
| Water potential                | 0.26  | -3.022  | 0.003** |
| Land availability              | 0.19  | 2.21    | 0.03*   |
| Access to Market               | 0.09  | 1.077   | 0.01*   |
| Access to means of Transport   | 0.02  | 0.228   | 0.82    |
| Conducive climatic condition   | -0.264| -3.011  | 0.003** |
| Vicinity to new construction area | -0.204| -2.054  | 0.043*  |

Note: Number of cases, n = 90, β = regression coefficients, Figure with * and ** are statistically significant at 5% and 1% probability levels respectively.

**Table 7. Identified Socio-economic activities along the Pangani river basin, Tanzania**

| Name of Street | Crop cultivation | Sand mining | Brick making | Car wash | Gardening | Total |
|----------------|------------------|-------------|--------------|----------|-----------|-------|
| Kwanduli       | 10               | 4           | 12           | 2        | 10        | 38    |
| Majengo        | 5                | 0           | 3            | 2        | 4         | 14    |
| Mgombzei       | 9                | 4           | 9            | 0        | 16        | 38    |
| Total          | 24               | 8           | 24           | 4        | 30        | 90    |
| %              | 26.7             | 8.9         | 26.7         | 4.4      | 33.3      | 100.0 |
Soil fertility
The result shows that, soil fertility is strongly positive significant influencing the urban community to depend on river basin as a result the majority of the respondent are dependant on farming related activities (crop cultivation 26.7%, and gardening 33.3%). The finding in line with the result obtained by Yamano and Kijima (2009) who conducted the research on associations of soil fertility and market access with household income. They found that, soil fertility is positively associated with crop income. Moreover, Ochilo et al. (2013) described improved soil fertility influences crop yield such as for legumes such as beans. Therefore, soil fertility has a positive association with the livelihood improvement due to high farm yields.

Water availability
Water availability throughout the year at Pangani river basin is positive significant influencing the urban community to depend on the river resources. Water is one of the most important agents to enable Tanzania achieve its development vision objectives (both social and economic), such as eradicating poverty, attaining water and food security, sustaining biodiversity and sensitive ecosystems (URT 2002). The availability of enough water supply throughout the year makes Pangani river basin to be a reliable source of various water based socio-economic activities.

Land availability
The result from this study has indicated a significant positive relationship between land availability and dependence of urban community along the Pangani river basin. This phenomena may be due to the fact that many activities observed during the field study depends direct to land for cultivation and brick making. Adequate land available is significantly related to farmers’ income (Safa 2005). Also Yamano and Kijima (2009), found that by maintaining the soil fertility constant, the land size is positively correlated with the crop income. When the land size is increased by one hectare, the crop income is 7.7% higher, which is about USD 29 because the average crop income is about USD 382.

Vicinity to District market
Vicinity to market has a positive significance influence on the dependence of urban community to Pangani river basin. Access to market enables the farm related products and other products along the river basin to be sold easily to customer. At Korogwe town council, the District market is located close to to the river basin, enabling easy access to the District market and to other markets found in Tanga city, Dar es Salaam, Kilimanjaro and Arusha Regions at a low transportation cost. Poor market access, for example, increases input costs and reduces the selling prices of farm products and, hence, discourages farmers from participating in markets (de Janvry et al. 1991).

Availability of transport
Availability of transport at Korogwe town along the Pangani river basin was insignificantly influencing the urban community to depend on Pangani river basin. This ight be attributed to the low transportation cost as compared to the remote area. Therefore, the respondents are not feeling any influence from availability of transport as their factor for dependency. This finding corresponds to the Yamano and Kijima (2009), where they came also to find that crop income is lower in remote areas, especially when the road quality is poor, than in areas close to urban centers.

Conducive climatic condition
Conducive climatic condition was a strong positive influence. Favorable amount of rainfall and temperature have attracted people to engage in farm related socio-economic activities along the Pangani river basin. The result obtained by Molua et al. (2010) indicates that, there is a non-linear relationship between temperature and crop revenue on the one hand and between precipitation and crop revenue on the other and they hence suggested that, climate affects agricultural returns. This indicates that,
under favorable climatic condition there is high yield, thus contributing to high household income.

Vicinity to new construction areas
Vicinity to new construction areas has been observed as positive significant factor influencing people to depend on river basin especially in brick making activities. Construction of new houses and rehabilitation of old buildings increased demand on bricks. Generally, urbanisation results to more requirement of material required for construction for example sand, water, and bricks. PBWO/IUCN (2007) have stated that, among other services provided by the Pangani river basin, it also used as source of building materials like thatch, sand and stones. Moreover, river basins provide river gravel, larger aggregates which are dredged from river bottoms, banks, and flood plains.

Conclusion
Pangani river basin serves as the source of various socio-economic activities where the community at Korogwe township council rely on it for income generation, thus improving their livelihoods. The study showed various activities undertaken by the community, including 33.3% of the respondents are conducting gardening activities along the PRB, 26.7% crop cultivation eg. maize, 26.7% brick making, 8.9% sand mining and 4.4% deals with car wash activity. It can be concluded that in urban area there is high utilisation of river basin resources by conducting different activities as compared to that in the rural area. The gardening has an average gross profit of TZS 14 108 340.00 per year, crop cultivation TZS 1 581 340 per year, brick making TZS 4 665 000.00 per year, sand mining TZS 1 404 000.00 per year and car wash TZS 4 560 000.00 per year. The overall average gross profit per household/year is TZS 5 263 736.00 which is greater than that recorded in previous research conducted in rural areas. This calculated gross profit indicates that Pangani river basin plays an economic role in improving rural areas. This calculated gross profit indicates that in urban area there is high utilisation of river basin resources by conducting different activities as compared to that in the rural area. The gardening has an average gross profit of TZS 14 108 340.00 per year, crop cultivation TZS 1 581 340 per year, brick making TZS 4 665 000.00 per year, sand mining TZS 1 404 000.00 per year and car wash TZS 4 560 000.00 per year. The overall average gross profit per household/year is TZS 5 263 736.00 which is greater than that recorded in previous research conducted in rural areas. This calculated gross profit indicates that Pangani river basin plays an economic role in improving urban community to depend on river basin as their source of income at a 5% probability level. These factors are soil fertility, land availability, water availability, access to market, conducive climatic condition and vicinity to new construction area.

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