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Analysis of Traffic Speed Variance on a Three Lane Urban Road due to Road Side Bus Station and Taxi Stand – A Case Study in WolayitaSodo Town, Ethiopia

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Speed is one of the most important traffic flow characteristics that affects the travel time. The management of traffic flow in urban areas is a challenging task for the planner as the flow is increasing day by day due to increase in human activities. The density of population increases in urban areas due to various employments, educational and business opportunities. The land use in the urban areas is so high that makes to increase the land value at a faster rate. This makes more attention for the urban people to settle in the urban areas. A study is conducted in WolayitaSodo town, Ethiopia at main bus station and taxi stand in CBD area to observe the variation of traffic speed during different traffic conditions. The width of the road is getting affected due to the occupancy of taxi stand at the kerb side and is varying from time to time. Huge number of pedestrians will be crossing the road continuously from one side to the other side to catch the bus at the bus station. A Multiple Non – Linear Regression Modal is developed to analyze the variation of traffic speed for various bus frequencies, taxi frequencies, pedestrian crossings and effective road widths. The results obtained from the modal are useful to find out the solutions to enhance the speed of through traffic at the bus stop location.

Introduction

Traffic flow characteristics in urban areas are the dynamic parameters and varies continuously based on the roadway and traffic conditions. The presence of various obstructions on the road will suffer the through traffic flow thus lowering the speed of the vehicles and increases the journey time. The speed of the ongoing vehicles is governed by various influencing parameters that exist on the road. Mobility has been increasing significantly in the last few decades in the urban areas and will continue to increase (Janssen, Okker& Schuur, 2006). The delay due to congestion on motorways is increasing day to day. The traffic delay will increase the journey time and affects the day to day activity of the people. Traffic Congestion has a negative impact on the economy by decreasing productivity and on the quality of living condition of the people. This will also increase the pollution and degrades the environment. The increase in Congestion due to various obstacles on the road will make the riders to select alternate routes which may again affect the safety of traffic on other roads. Hence it is important to gain a clear understanding of traffic flow process and to improve the traffic conditions from the existing hurdles on the road.

It is observed that the traffic is heavy in peak hours in WolayitaSodo bus station location causing lot of congestion and delays. WolayitaSodo town is one of the big towns in South Central of Ethiopia. Wolayita is one of the 13 zonal administrations of the Southern region in Ethiopia and is located 300 kms South of Addis Ababa. Wolayita zone has 358 kms of all-weather roads and 425 kms of dry weather roads with an average road density of 187 kms per 1000 square kms. WolayitaSodo has a population of 86,050 (2012 Census) in the town.

Need for the study

The main bus station in WolayitaSodo town is located at the CBD area. A taxi Stand also exists very near to the bus station at the kerb side. Moreover, huge volume of pedestrians crosses the road continuously from one side to the other side near the bus station. The location is so complex with lot of obstacles on the road that affects the speed of the vehicles. The analysis of variation of speed under these heterogeneous traffic and roadway conditions at the bus

station is highly essential for the planner to search the ways to solve the traffic problems and to smoothen the traffic flow. The present study is an attempt to fulfill the need.

Objectives of the study

The study is aimed to analyze the variation of traffic speed due to the presence of obstacles near the bus station. The following are the specific objectives of the study.

a) To observe the frequency of buses, taxis and pedestrians at the bus station location

b) To observe the variation of road width due to the occupancy of taxi stand at the kerb side near bus station

c) To quantify the variation of through traffic speed due to these obstacles for various roadway and traffic conditions

d) To evaluate different alternative solutions to improve the traffic flow rate at the location of bus station

Review of Literature

The impact caused by various influencing parameters on the road will change the Speed of the vehicles dynamically. The reduction in the Speed will affect the capacity of the road and declines the level of service of the road. It is hence essential to maintain better possible conditions on the road so as to minimize the travel time for the vehicles. A Study was conducted by Park, B-J, Zhang, Y and Lord, D (2010) to account for heterogeneity in Speed data and concluded that the Speed distributions might be more than two, depending on the time of analysis. Elhenawy, M and Rakha, H.A (2016) have conducted a study to estimate the expected travel time using Mixture Linear Regression. The study uses the mixture modal to estimate the speed distribution in order to describe the traffic conditions. The mean values of the two regimes i.e. Congested and Free flow conditions were described by a linear relationship with visibility and weather conditions. Lord, Manar&Vizioli (2005) studied the

influence of volume, density and V/C ratios on the occurrences of crashes on rural and urban motorways. The data was collected by using loop detectors located at various sections of the rural and urban motorways. The study concluded that as the density of traffic increases, Crash frequency increases, reaches a maximum and then decreases again. Golob, Recker &Pavlis (2008) presented a method that assesses the relationship between traffic flow parameters and the type of crash, severity, location and number of vehicles involved. Data on traffic volume and lane occupancy from six motorways was obtained from loop detectors during a six-month period. The study found that when the left and interior lanes are congested, the likelihood of severe crashes decreases. If all lanes have similar traffic volumes, then congestion reduces crash severity by more than half. It was also found that the effect of congestion on severity is offset by unstable flow conditions such as the change from free flow to congestion.

Data Collection at the study area

The traffic data such as traffic volume with composition, traffic speed, bus frequency, taxi frequency and pedestrian crossing are collected by manual methods. The effective road width is also measured at the location. The entire data are collected for about 12 hours in a day and for every 15-minute consecutive interval. The following methodology is adopted to collect the above data.

1. Traffic Volume: Classified traffic volume with composition is collected at the bus station location by drawing a reference line on the road and counting the number of vehicles that crosses the reference line as shown in the figure 1. The traffic volume data were later converted into Passenger Car Units (PCUS) by considering the equivalent PCU factors.

2. Traffic Speed: Traffic Speed is defined as the ratio of distance travelled by the vehicle to the travel time taken for the vehicle between the two sections. Two reference lines are drawn on the road at a distance of 30 meters as shown in the figure 2. The time of entry and time of exit of different types of vehicles are recorded for every 15-minute consecutive interval. The travel time is calculated by taking the difference of entry and

exit timings. The ratio of the distance travelled by the vehicle and travel time will give the traffic speed of the vehicles

3. Bus Frequency (BF): A reference line is drawn on the road near the bus stop location. The number of buses that crosses the reference line is recorded for every 15 minutes consecutive interval as shown in the figure 3, which gives the bus frequency.

4. Taxi Frequency (TF): A reference line is drawn on the road near the bus stop location. The number of taxis that crosses the reference line and are arriving to taxi stand are recorded for every 15 minutes consecutive interval as shown in the figure 3. This gives the taxi frequency.

5. Effective Road Width (ERW): Effective road width is defined as the available road width at the bus station location after the taxis arrive to the taxi stand and occupy the road. The occupancy of road by different taxis varies from time to time and depends upon the driver behavior and road condition. The effective road width is measured for every 15-minute consecutive interval as shown in the figure 3. For this purpose, reference lines are drawn perpendicular to the roadway at an interval of 1 meter from the center line of the road up to the kerb at the bus station location. As soon as any taxi arrives to the taxi stand, the available road width is measured by observing the position of the wheels of the taxi. This available road width is considered as the effective road width. The data is collected for number of samples for every 15 minutes consecutive interval.

6. Pedestrian Crossing (PC): Pedestrian Crossing is the number of pedestrians that will cross from one side to the other side of the road at the bus station location to reach the bus station. The data is collected manually at the bus stop location for every 15-minute consecutive interval.

Development of Multiple Non – Linear Regression Modal

A Multiple Non-Linear Regression Modal is developed from the data collected at the bus station location. The traffic speed is considered as the dependent variable and all other influencing parameters such as traffic volume,

bus frequency, taxi frequency, pedestrian crossing and effective road width are considered as independent variables. The regression modal developed is as follows:

Speed = $2.946804 - 0.227424 * e^{vol} - 0.256311 * e^{BF} - 0.283754 * e^{TF} - 0.387598 * e^{PF} + 0.436285 * e^{ERW}$

$R^2 = 0.9271$ $\qquad\qquad$ $R = 0.9635$

Validation of the Modal

The developed regression modal is validated by plotting a graph between the observed speed values and predicted speed values as shown in the figure 4. The predicted speed values are close to the observed speed values as represented in the figure 4, which indicates that the developed modal is validated.
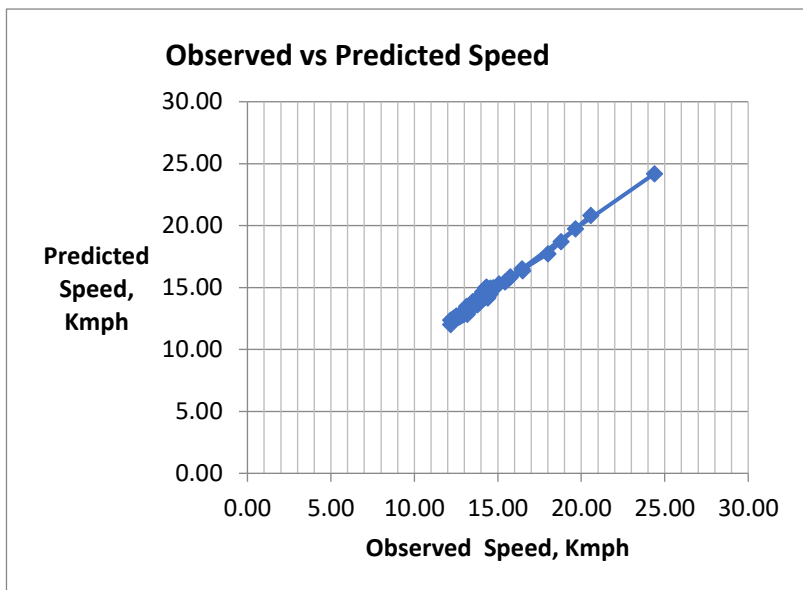
Analysis of data from the developed Multiple Non – Linear Regression Modal:

In order to understand the variation of Traffic Speed at the selected bus stop location for various influencing parameters, the data is analyzed for different cases. The predicted traffic speed for all the cases considered is evaluated from the developed modal and is indicated as shown in the table 1.

Table - 1

Case	Volume PCUS	BF	TF	PC	ERW, Meters	Predicted Speed,Kmph
1	500	20	40	50	8	19.07311
2	500	20	40	50	12	22.76394
3	500	30	40	50	8	17.19045
4	500	30	40	50	12	20.51697
5	500	20	80	50	8	15.66762
6	500	20	80	50	12	18.69946
7	500	20	80	100	8	11.97635
8	500	20	80	100	12	14.29389
9	500	30	80	50	8	14.12111
10	500	30	80	50	12	16.85368

Analysis of Traffic Speed Variance

11	500	30	80	100	8	10.79419
12	500	30	80	100	12	12.88298
13	1000	20	40	50	8	16.29146
14	1000	20	40	50	12	19.44402
15	1000	30	40	50	8	14.68337
16	1000	30	40	50	12	17.52475
17	1000	20	80	50	8	13.38263
18	1000	20	80	50	12	15.9723
19	1000	20	80	100	8	10.2297
20	1000	20	80	100	12	12.20925
21	1000	30	80	50	8	12.06167
22	1000	30	80	50	12	14.39572
23	1000	30	80	100	8	9.219955
24	1000	30	80	100	12	11.00411

Table 1 clearly indicates the variation of traffic speed under the influence of various parameters such as traffic volume, bus frequency, taxi frequency, pedestrian crossing and effective road width. The influence of each parameter on the traffic speed is unique and varies based on the roadway and traffic conditions in the field. In all the above cases, the traffic speed is observed to be declined more for higher bus frequencies, taxi frequencies and pedestrian crossings and is increasing rapidly for every incremental increase in the effective road width. Therefore, the speed of through traffic at the bus station location is proved to be affected with the presence of various obstacles at the location.

Recommendations made to improve the traffic conditions at the selected bus station:

In order to improve the traffic flow characteristics at the selected bus stop location, three alternative measures are proposed.

Alternative 1

Recommended to shift the bus station from the existing location to any arterial road. This will reduce the impact of bus frequency at the bus stop location. It is observed that 50% of the pedestrian crossings at the bus stop location are only towards the bus station. Hence by shifting the bus stop from that location, 50% impact of pedestrian crossing at the location will be reduced.

Alternative 2

Recommended to shift the taxi stand from the bus stop location to any other part of road. This will reduce the impact of taxi frequency at the bus stop location.

Alternative 3

Recommended to erect an over bridge at the bus stop location for the pedestrians to cross the road from one side to the other side. This will reduce at least 50% impact of the pedestrian crossings.

The predicted traffic speed at the bus stop location is further evaluated for the above three alternatives for the above cases considered using the developed Multiple Regression Modal and the results are indicated as shown in the table 2

Analysis of Traffic Speed Variance

Table - 2

Case	Volume PCUS	BF	TF	PC	ERW Meters	Predicted Speed for existing conditions, Kmph	Predicted Speed for Alternative 1, Kmph	Predicted Speed for Alternative 2, Kmph	Predicted Speed for Alternative 3, Kmph
1	500	20	40	50	8	19.073	87.730	54.326	40.708
2	500	20	40	50	12	22.763	104.70	64.839	48.585
3	500	30	40	50	8	17.190	87.730	48.964	36.689
4	500	30	40	50	12	20.516	104.70	58.439	43.789
5	500	20	80	50	8	15.667	72.065	54.326	33.439
6	500	20	80	50	12	18.699	86.011	64.839	39.910
7	500	20	80	100	8	11.976	63.007	41.527	29.236
8	500	20	80	100	12	14.293	75.199	49.563	34.893
9	500	30	80	50	8	14.121	72.065	48.964	30.138
10	500	30	80	50	12	16.853	86.011	58.439	35.971
11	500	30	80	100	8	10.794	63.007	37.428	26.350

12	500	30	80	100	12	12.882	75.199	44.670	31.449
13	1000	20	40	50	8	16.291	74.935	46.403	34.771
14	1000	20	40	50	12	19.444	89.436	55.383	41.499
15	1000	30	40	50	8	14.683	74.935	41.823	31.338
16	1000	30	40	50	12	17.524	89.436	49.916	37.403
17	1000	20	80	50	8	13.382	61.555	46.403	28.562
18	1000	20	80	50	12	15.972	73.467	55.383	34.089
19	1000	20	80	100	8	10.229	53.818	35.470	24.972
20	1000	20	80	100	12	12.209	64.232	42.334	29.804
21	1000	30	80	50	8	12.061	61.555	41.823	25.743
22	1000	30	80	50	12	14.395	73.467	49.916	30.725
23	1000	30	80	100	8	9.2199	53.818	31.969	22.507
24	1000	30	80	100	12	11.004	64.232	38.156	26.862

Table 2 clearly indicates the impact of bus frequencies, taxi frequencies and pedestrian crossings on the traffic speed for various traffic volumes and effective road widths. The results obtained in table 2 shows the improvement of traffic speed at the bus station location for various proposed alternatives. A graph is plotted between the Predicted Speed obtained from the modal for the

existing conditions and the Predicted Speed evaluated for various proposed alternatives and is as shown in the figure 5.
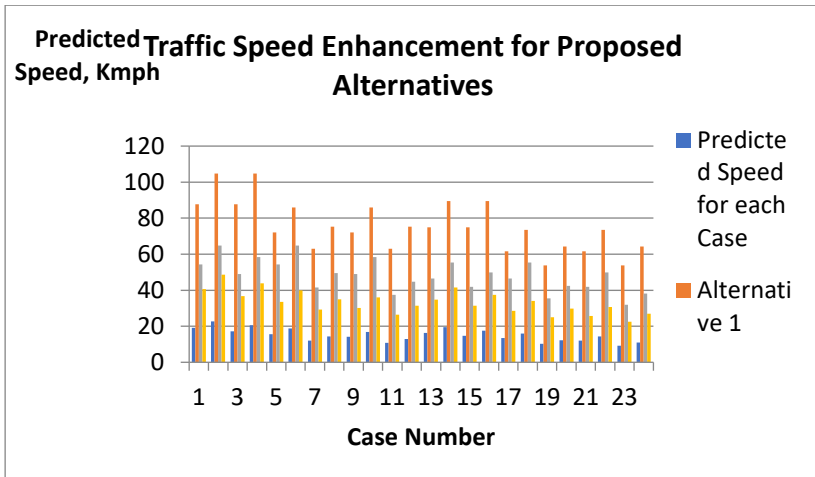
Figure 5

It is observed from the figure 5 that the traffic speed at the bus station location is increasing at a higher rate with alternative 1 followed by alternative 2 and alternative 3 in all the cases. Hence it is recommended to shift the bus station from the existing location at CBD area to any arterial road.

Summary and Conclusions

The traffic in urban areas is highly congested due to the presence of various obstacles on the road. The traffic speed on the road is a function of these obstacles and is varying from time to time based on the roadway and traffic conditions. A study is conducted at the bus station location in CBD area at WoliataSodo town, Ethiopia to evaluate the variation of traffic speed for various influencing parameters. A taxi stand exists very near to the bus station and huge pedestrians will be crossing the road continuously from one side to the other side to reach the bus station and taxi stand. The traffic speed at the

bus station location is getting reduced from time to time due to the impact of bus station, taxi stand and pedestrian crossing.

In order to observe the variation of traffic speed at the bus station location and to evaluate the possible alternative solutions to improve the traffic speed at the bus station location, the traffic data is collected at the bus station location for about 12 hours in a day at every 15 minutes consecutive intervals. The traffic data includes traffic volume, traffic speed, bus frequency, taxi frequency, pedestrian crossing and effective road width. A Multiple Non-Linear Regression Modal is developed by considering the traffic speed as dependent variable and the influencing parameters such as traffic volume, bus frequency, taxi frequency, pedestrian crossing and effective road width as independent variables. The modal developed is validated and is used to evaluate the predicted traffic speed at the bus station location for various influencing parameters. The analysis is carried out by considering different cases.

Three alternatives are proposed to improve the traffic speed at the bus station location. Alternative 1 is proposed to shift the bus station location from the existing CBD area to any arterial road. Alternative 2 is proposed to shift the taxi stand from the bus station location to any other part of road, where as Alternative 3 is proposed to erect an over bridge at the bus station location to facilitate the pedestrians to cross the road from one side to the other side. It is observed that 50% of the pedestrians are crossing the road from one side to the other side to reach the bus station and taxi stand. The predicted traffic speed for all the three proposed alternatives is evaluated by using the developed Multiple Non- Linear Regression Modal and the results are obtained. The results indicate that the traffic speed at the bus station location is increasing at a higher rate with alternative 1 as followed by alternative 2 and alternative 3. From the analysis, it is hence recommended to shift the bus station from the existing CBD area to any arterial road of the town.

References

Park, B-J, Zhang, Y and Lord, D (2010), *"Bayesian Mixture Modeling Approach to account for Heterogeneity in Speed data"*, Transportation Research Part B: Methodological, 44, 662-673.

Elhenawy, M and Rakha, H.A (2016), *"Expected Travel Time and Reliability Prediction using Mixture Linear Regression",* Proceedings of the Transportation Research Board, Annual Meeting, Washington DC, 10-14 January 2016, 17.

Leong, H.J.W (1968), *"The Distribution and Trend of Free Speeds on Two-Lane Two-Way Rural Highways in New South Wales",* Proceedings of the 4th Australian Road Research Board Conference, Part 1, Australian Road Research Board, Vermont South, Victoria, Australia.

KO, J and Guensler, R.L (2005), *"Characterization of Congestion based on Speed distribution: A Statistical Approach using Gaussian Mixture Modal",* Proceedings of the 84th Annual Meeting of the Transportation Research Board Annual Meeting, Washington, DC, 9-13 January 2005,19.

Shi, Q and Abdel- Aty, M (2016), *"Evaluation of the impact of Travel Time Reliability on Urban Expressway Traffic Safety",* Journal of the Transportation Research Board, 2582, 26-33.

Mclean, J (1978), *"Observed Speed distributions and Rural Road Traffic operations",* Proceedings of the 9th Australian Road Research Board Conference, Part 5, Australian Road Research Board, Vermont South, Victoria, Australia, 235-244

Darbera, R (2010), *"Taxicab Regulation and Urban Residents use and Perception of Taxi Services: A Survey in Eight Cities",* 12th World Conference on Transport Research, Lisbon, July 2010.

Abbas, K.A (2016), *"Estimation of Taxi Fleet size"* A generic Algorithm, SIGMA Journal of Engineering and Natural Sciences, 7, 21-29.

English Language Teachers' and Students' Perceptions of Teacher Interpersonal Behavior in Ethiopian Context

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The purpose of this study is to examine the accords and discords between English language teachers' and students' perceptions of teacher interpersonal behavior in four selected secondary schools in Ethiopia. The samples of the study were 48 English language teachers and their respective 420 students. In order to collect data, questionnaires were administered to both students and teachers. To analyze and interpret the data, a two-tailed independent sample t-test was used. Accordingly, the findings revealed that teachers rated themselves considerably higher than their students' rating of them for helpful/friendly, leadership, and strict behaviors. Conversely, the students rated their teachers displayed considerably uncertain, admonishing, student freedom/ responsibility and dissatisfied behaviors as compared to their teachers'. However, no significant difference was found between the two bodies for understanding interpersonal behavior. Similarly, teachers notably felt they were in control of classroom communications and had more affiliation/ connection with the students in the process of communication than their students' perceptions of them. Hence, there were many discords between English language teachers' and students' perceptions of teacher interpersonal behavior. Following the findings, some recommendations were forwarded.

Keywords: Accord, Interpersonal Behavior, Perception, Teacher and Ethiopia.

In order to communicate meaningfully with each other and learn sufficiently, establishing dependable relationship between teachers and students is paramount important. Particularly, in EFL settings where the learning of English language takes place in the classrooms with no much outside environmental support, optimal teacher-student interpersonal communication is not optional. At the onset, good teacher–student interpersonal relationship is believed to provide a favorable classroom environment for students' engagement in learning activities (Wubbels, Creton, & Hooymayers, 1985; Smith, 1998; Brakeman, Sleegers& Fraser, 2000; Knapp &Antos, 2009; Opdenakker, Den Brok& Bosker, 2011). Moreover, studies pointed out that the way teachers affiliate with students and control classroom process are linked with the cognitive and affective development of students (Wubbels, Creton, & Hooymayers, 1985; Smith, 1998; Den Brok, Brekelmans & Wubbels, 2004; Lourdusamy & Khine, 2005; Akbari &Allvar, 2010).

It is palpable that classroom interaction is a reciprocal process that the behavior of the teachers and students influence each other mutually (Wubbels, Creton, & Hooymayers, 1985; Wubbels & Levy, 1993). To acquire balanced view and get comprehensive image of teacher interpersonal behavior, both teachers' perception of themselves and students' perception of the teachers appear to be necessary. Besides, considering the perceptions of both bodies on teacher interpersonal behavior proffer careful and reflective understanding of the teaching-learning situation in the classrooms (Lourdusamy & Khine, 2005). Furthermore, Bell (2005) as in Hidayet (2010) claims that a study that would compare teacher and student belief systems would elucidate effective foreign language teaching behaviors. To this effect, studies have been conducted on teachers' interpersonal behavior in many parts of the world although most of them concentrate either on students' or teachers' perceptions alone.

The communication between teachers and students is determined on how cooperative (proximity) they are with each other and the amount of control (influence) in the interaction. Accordingly, studies on students' and teachers' perceptions of influence and proximity dimensions of teacher interpersonal behavior indicated that students' perception of the two dimensions were found to be lower than teachers' perception of their own behaviors (Brekelmans & Wubbels, 1991; Wubbels & Brekelmans, 1997; Rickards & Fisher, 1998; Den Brok, 2001; Brekelmans, Wubbels, &Den Brok, 2002). Nevertheless, few studies revealed that there were no significant differences between students' and

teachers' perceptions of the two dimensions of teacher interpersonal behavior (Wubbels & Levy, 1991; Fisher & Rickards, 2000; Ben-Chaim & Zoller, 2001).

Specific to the sub-dimensions of the interpersonal behavior, studies depicted that teachers reported higher ratings of their own leadership, helpful/friendly, strict and understanding behaviors as compared to their students. In contrast, the same teachers reported lower perceptions of their own uncertain, dissatisfied, student freedom and admonishing behaviors than their students (Wubbels, Brekelmans & Hooymayers, 1992; Fisher & Rickards, 1999; Rickards & Fisher, 2000). In addition, statistical tests indicated significant differences between teachers' perception of themselves and that of students' (Lourdusamy & Khine, 2005). Accordingly, teachers perceived themselves more helpful/friendly, understanding, admonishing and strict in their interpersonal behavior than their students rating of them.

Few but significant implications can be drawn from studies made above. Consequently, most of the studies on students' and teachers' perceptions with respect to influence and proximity dimensions of teacher interpersonal behavior showed that teachers rated themselves more favorably than their students. In other words, most studies pinpointed discords between these two bodies on teacher interpersonal behavior despite few accords. Specific to the sub-scales, the preceding studies disclosed that teachers largely considered themselves more leaders, helpful/friendly, strict and understanding in their behaviors than their students' perceptions of them. Nonetheless, these teachers reported lower perceptions of their own uncertain, dissatisfied, student freedom and admonishing behaviors as compared to their students' ratings of them. Thus, teachers inflated their positive interpersonal behaviors while deflate their negative behaviors as compared to their students' ratings. This implies that teachers' perceptions of their own interpersonal behaviors and their students' rating of them are conflicting with each other.

Studies on the correspondence between teachers' and students' perceptions of teacher interpersonal behavior are regarded as important for various reasons. At the onset, the accord between teachers and student's perceptions could be an indicator of the teachers' understanding of their students' perception of them and the consequent changes made on their behavior to optimize the quality of teacher–student relationships (Wubbels et al., 1992). In addition, the accord between students and teacher's belief systems signifies the effectiveness of

instruction (Hidayet, 2010). Moreover, accord between the two bodies on teacher interpersonal behavior has been argued to enhance students' learning outcomes (Adderley, 1987; Malinsky, 2001; Zhang, 2006). Conversely, discord is regarded as one of the most serious impediments to learning (Brekelmans & Wubbels, 1991; Nunan, 1987 as in Hidayet, 2010). Furthermore, it has also been claimed to influence students' learning outcomes negatively (Adderley, 1987; Malinsky, 2001; Zhang, 2006). Finally, discords in expectations in classroom teaching are thought as real gaps upon which reflection should be made in order to improve teacher-student relationship (Brekelmans & Wubbels, 1991; Brown, 2009 as in Hidayet, 2010).

Despite the fact that many studies have been carried out elsewhere on teacher interpersonal behavior, to the best of the researcher's knowledge, no local study has been carried out on EFL teachers' interpersonal behavior in Ethiopia. Consequently, English language teachers' interpersonal behavior from the perspectives of teachers and students is still unknown. Moreover, the findings made elsewhere may not be applicable to Ethiopian situation as perception and communication are sensitive to the perceivers' cultural background (Grossman, 1995; Levy, Wubbels, Brekelmans, & Morganfield, 1997; Rickards & Fisher, 2000). Therefore, this study compared English language teachers' perceptions of themselves and their students' perceptions of them pertaining to teacher interpersonal behavior at some selected secondary schools in Ethiopia. More specifically, the study intended to address the following two specific objectives: (1) to examine the accords and discords between students' and teachers' perceptions of influence and proximity dimensions of teacher interpersonal behavior, and (2) to scrutinize the accords and discords between students' and teachers' perceptions of teacher interpersonal behavior with reference to the eight sub- scales. It is hoped that the results of this study may provide English language teachers with reflective feedback on how they perceived their behavior vis-a-vis their students' perceptions of them with regards to interpersonal behavior. In other words, the result of the study may let teachers to see themselves critically and reflect on their own behavior and be aware of the discrepancy between their own and their students' perceptions of them on interpersonal behavior. This awareness may provide them with opportunities to improve their interpersonal behaviors which in turn affect their students' cognitive and affective learning. Moreover, the finding may provide teacher education institutions with points to tackle in the preparation of English language

teachers on teachers' interpersonal behavior. Furthermore, this study may instigate others who wish to investigate on the same or similar area.

Theoretical Framework

The communication between teachers and students depends on the kinds of relationship between them. To characterize the types of communication between them, Leary's (1957) communication model which had dominance/submission and cooperation/opposition dimensions was extended to accommodate eight sub-dimensions to map teacher-student interpersonal behaviors better (Wubbels, Creton, Levy & Hooymayers, 1993). Accordingly, the communication between teachers and students is determined on how cooperative (proximity) they are and the level of control (influence) in the interaction. The two dimensions principally constitute every teacher's behavior and can be used to subdivide interpersonal behavior in eight sectors, each describing different aspects of interpersonal behavior (Wubbels, Creton, & Hooymayers, 1985; Wubbels, Creton, Levy & Hooymayers, 1993). The sections are labeled as DC, CD, CS, SC, SO, OS, OD and DO according to their positions in the coordinate system. For instance, the two sectors DC and CD are both characterized by dominance and cooperation. In the DC sector, however, the dominance feature prevails over the cooperation aspect while cooperation takes over the dominance aspect in the adjacent sector CD (Creton, Levy & Hooymayers, 1993). The eight coded sectors are labeled as leadership, helping/friendly, understanding, students' responsibility/freedom, uncertain, admonishing, dissatisfied, and strict behaviors respectively.
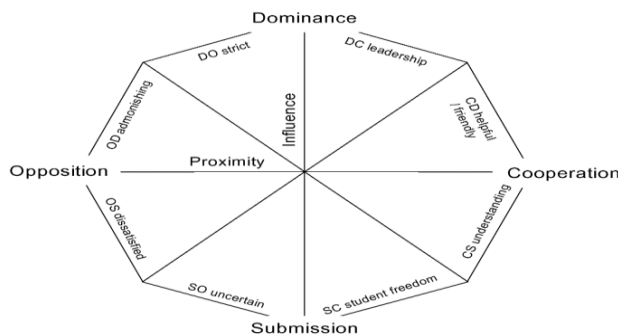
*The Wubbels model for teacher interpersonal behavior as in Fisher and Rickards (1998)*Wubbels, Creton, Levy and Hooymayers (1993) provided a description of typical teacher behaviors belonging to each of the eight sectors. Accordingly, teachers with leadership (DC) behavior notice what is happening, lead, organize, give orders and determine procedure, and structure the classroom situation, explain and hold attention. On the contrary, the uncertain (SO) teachers behave in an uncertain manner and keep a low profile, apologize, wait and see how things go in the classroom. On the other hand, the strict (DO) teachers keep the reins tight, get the class silent, maintain silence, and set rules while teachers who give responsibility/freedom (SC) to their students' offer opportunity for independent work; give freedom and responsibility to the students. Similarly, teachers characterized with helpful/friendly (CD) behavior show interest, behave in a friendly or considerate manner and inspire confidence and trust their students whilst dissatisfied (OS) teachers express dissatisfaction, look unhappy, criticize, consider pros and cons, look glum, question and wait for silence. By the same token, teachers with understanding (CS) behavior are thought to show confidence and understanding and are open with students. Moreover, the teachers listen with interest, empathize, accept apologies, look for ways to settle differences and be patient. As opposed to this, teachers in admonishing (OD) sector get angry, express irritation and anger, forbid and punish. It has been discussed that classroom interaction is a reciprocal process that the behaviors of the teachers and students influence each other mutually (Wubbels, Creton, & Hooymayers, 1985; Wubbels & Levy, 1993).Thus, to acquire balanced view and observe the comprehensive image of teacher interpersonal behavior, both teachers' perception of themselves and students' perception of their teachers appear to be necessary. Besides, considering the perceptions of both bodies on teacher interpersonal behavior would provide reflective understanding of the teaching-learning situation in the classrooms (Lourdusamy & Khine, 2005). Furthermore, Bell (2005) as in Hidayet (2010) claims that a study that would compare teachers' and students' belief systems would elucidate effective foreign language teaching behaviors. To this effect, both teachers' and students' perception of teacher interpersonal were considered in the study; and hence teacher interpersonal behavior of Wubbels, Creton, Levy & Hooymayers (1993) model was adopted.

Methodology

The purpose of this study was to compare English language teachers' perceptions of themselves with their students' perceptions of them pertaining to teacher interpersonal behavior in some selected secondary schools in Ethiopia. To this effect, cross-sectional descriptive survey design was adopted as it enables to collect data from large sample, compare and describe groups with regard to their beliefs, opinions, or practices (Creswell, 2002).

Participants

Participants of this study were English language teachers and their students at four Secondary schools in Arba Minch and surrounding districts of south regional state, Ethiopia. The schools selected for the study were found in Arba Minch, Gumayede, Konso and Gidoletowns. All available English language teachers who were teaching in grades 9-12 in the four schools listed above in 2016 academic year were considered in the study due to the fact that survey study requires large sample. Accordingly, 48 English language teachers took part in the study. corresponding to the sample teachers, 10% of the students were selected on stratified random sampling technique taking grade as strata. Accordingly, 440 students took part in the study though only 420 responded properly to the questionnaire.

Data Collection Instruments

In order to gather data from both students and teachers on their perceptions of teacher interpersonal behavior, student and teacher versions of Questionnaire on Teacher Interaction QTI (Wubbels et al., 1993) were adopted. This questionnaire consisted of 48 items. The items were divided into two major dimensions - influence and proximity and eight sub-scales that conformed to the sectors of the model. The eight domains were: leadership, understanding, helpful/friendly, dissatisfied, admonishing, strict, uncertain, and student/responsibility/freedom. Each domain had six items to be responded on a five-point scale (1-5) with the extreme alternatives of Never-Always.

The QTI has been shown to be a valid and reliable instrument (Wubbels et al., 1993; Den Brok, 2001; Den Brok, Wubbels & Rodriguez, 2003). These scholars

reported that the internal consistency reliabilities for QTI scales range from 0.76 to 0.84. Moreover, it has been proved to be valid for mapping teachers' interpersonal behaviors that are transferable to different cultural settings (Wubbels et al., 1993; Opdenakker, Den Brok& Bosker, 2011). However, in order to let the students, fill the questionnaires easily, the English version of student questionnaire was translated into Amharic by translation experts. Furthermore, the translation was checked by two Amharic instructors to ensure that each item retained its original meaning. Scale scores were scored on the basis of eight sectors and two summarized dimensions of Influence (DS) and Proximity (CO). The Dominance/Submission (DS) dimension is primarily comprised of behaviors in the sectors closest to the DS axis - strict, leadership, uncertainty and student responsibility/freedom. The sectors that mostly make up the Cooperation/Opposition (CO) dimension are helpful/friendly, understanding, dissatisfied and admonishing.

Data Analysis

The aim of this study was to examine whether there were significant differences in the perceptions of teachers and students on the different aspects of teacher interpersonal behavior. To this effect, data analysis was carried out on the basis of dimension scores using the individual participants' perception mean scores as the unit of analysis. To address each specific objective, independent sample t-test was employed at ($p<0.05$) level of significance. However, it should be noted that skewness and kurtosis of data were checked for normality. In addition, unequal variances were assumed throughout the analysis.

Results

This study intended to examine the accords and discords between students' and teachers' perceptions of influence and proximity dimensions of teacher interpersonal behavior. Moreover, it was to scrutinize the accord and discord between the two bodies perceptions of teacher interpersonal behavior with reference to the eight sub-scales. The tables below depict these two issues.

Table 1 : Comparison between teachers' perceptions of themselves and students' perceptions of their teachers on teacher interpersonal behavior sub-scales

Teacher Behavior	*Group*	*Mean*	*Std.*	*t-value*	*p*
Leadership	Teacher	4.73	0.25	11.54	0.000
	Student	3.97	1.10		
Helpful/Friendly	Teacher	4.25	0.17	14.69	0.000
	Student	3.32	1.18		
Understanding	Teacher	4.53	0.14	0.21	0.83
	Student	4.53	0. 53		
Student Freedom	Teacher	2.17	0.159	-9.95	0.000
	Student	2.87	1.36		
Uncertain	Teacher	1.81	0.20	5.07	0.000
	Student	2.20	1.42		
Dissatisfied	Teacher	1.44	0.16	-8.5	0.000
	Student	1.86	0.90		
Strict	Teacher	4.03	0.20	17.83	0.000
	Student	3.04	0.96		
Admonishing	Teacher	2.21	0.16	-5.36	0.000
	Student	2.56	1.25		

Table 1 above shows statistically significant differences between English language teachers' perceptions of themselves and their students' perceptions them with regards to the sub-scales of teacher interpersonal behavior except for understanding one. Accordingly, teachers rated themselves significantly higher than their students' rating of them for leadership, helpful/friendly and strict behaviors. Divergently, the teachers rated themselves considerably lower than their students' rating of them for uncertain, student freedom, dissatisfied and admonishing sub-scales. Nevertheless, there was no difference between teachers' perceptions of themselves and that of the students' views of the teachers on understanding sub-scale of teacher interpersonal behavior.

Table 2: Comparison between teachers' perceptions of themselves and students' perceptions of their teachers on influence and proximity dimensions

Dimension	Group	Mean	Std.	t-value	p
Influence (DS)	Teacher	1.30	0.11	42.56	0.000
	Student	0.36	0.31		
Proximity (CO)	Teacher	1.54	0.080	9.22	0.000
	Student	1.26	0.57		

The second issue was to examine the accords and discords between students' and teachers' perceptions of influence and proximity dimensions of teacher interpersonal behavior. As shown in table 2 above, significant differences were found between teachers and students with regards to both influence and proximity dimensions of interpersonal behavior. In other words, teachers rated themselves significantly higher in amount of control and affiliation they had with their students than their students' perceptions of them.

Discussions

Concerning the differences between English language teachers' perceptions of themselves and their students' perceptions of the teachers with regards to the sub-scales of teacher interpersonal behavior, the results revealed discords between the two bodies in all sub-scales except for understanding one. Accordingly, teachers rated themselves considerably higher than their students for leadership, helpful/ friendly and strict sub-scales. Conversely, the study indicated that the teachers rated themselves significantly lower than their students' perceptions of them for uncertain, student freedom, dissatisfied and admonishing behaviors. Studies disclosed that the earlier sub-scales were found positively related to students' achievement while the later sub-scales were negatively related to cognitive development of students (Wubbels & Levy, 1993; Rickards & Fisher, 1996; Smith, 1998; Fraser, Aldridge & Soerjaningsih, 2001). Nevertheless, accord was found between the two bodies for understanding behavior which implies that both bodies agreed that teachers exhibited understanding behavior- confidence, understanding and openness

with students. It seems apparent to conclude that there were significant discords in how English language   teachers see themselves with the way students viewed them except for understanding behavior. This implies that teachers viewed themselves favorably high for positive behaviors and low for negative ones as compared to their students' perceptions of them for most of the interpersonal behaviors. This finding is more or less consonant with other works which portrayed teachers' inflated rating of their behavior as compared to their students (Den Brok, Levy, Rodriguez & Wubbels, 2001; Lourdusamy & Khine, 2005).

The second aspect of the study was to see students' and teachers' perceptions of influence and proximity dimensions of teacher interpersonal behavior. Influence (dominance–submission) dimension designates the degree of dominance or control displayed by the teacher or students, while proximity (cooperation–opposition) describes the level of cooperation/connectedness between teachers and students in the process of communication (Wubbels et al., 1992; Den Brok, Levy, Rodriguez & Wubbels, 2001). Accordingly, the result indicated significant differences between the two bodies with regards to both influence and proximity dimensions of interpersonal behavior. In other words, teachers rated themselves significantly higher in the amount of control and affiliation/connectedness than their student' perceptions of them in the process of communication. This finding is harmonious with some previous studies which indicated teachers' higher rating of themselves than the students' perceptions of them on these two dimensions (Rickards & Fisher, 1998; Den Brok, 2001; Van Oord &Den Brok, 2004).

Though there could be various reasons for differences between the two bodies in the ratings of teacher interpersonal behavior, one possible reason could emanate from teachers' failure to see themselves to reflect accurately on their behaviors (Dunning, Johnson, Erlanger & Kruger, 2003). Furthermore, other potential variables such as gender, ethnic background/culture, age of students and teachers and experiences of teachers could bring differences to the perceptions of teacher interpersonal behavior (Fisher & Rickards, 1997; Levy, Wubbels, Brekelmans & Morganfield, 1997; Den Brok, Fisher & Rickards, 2004; Den Brok, Bergen & Brekelmans, 2004).

Conclusion

This study found significant discords between how English language teachers perceived themselves and the way students viewed them except for understanding behavior. Therefore, teachers viewed themselves favorably high for some behaviors (leadership, helpful/friendly and strict) and low for other behaviors (uncertain, student freedom, dissatisfied and admonishing) as compared to their students' perceptions of them. This implies that teachers argued they demonstrated leadership, helpful/friendly and strict behaviors while their students claimed their teachers displayed uncertain, student freedom, dissatisfied and admonishing behaviors. However, the two bodies agreed teachers exhibited understanding behavior. Concerning the two dimensions, teachers notably felt they had high amount of control and affiliation/ connectedness in the process of communication in contrast to their students' perceptions of them. In summing up, it seems evident to conclude that there were discords between the two bodies almost in all behaviors except for understanding one. In addition, teachers felt that they had more affiliation/ connectedness with students and in control of the classes in the process of communication in contrast to their students' perceptions of them. This implies that teachers did not make critical reflections of themselves on their interpersonal behaviors. Consequently, English language teachers should take the issues of discords as potential impediments of teaching-learning up on which they should see themselves critically to improve their interpersonal behaviors (Brekelmans & Wubbels, 1991; Bergen, 1999; Brown, 2009 as in Hidayet, 2010). By the same token, teacher education institutions should take the interpersonal behavior as essential point and consider it in their curricula.

This study has some limitations to mention. The sample size of this study was small and was limited to English language teachers and students in four secondary and preparatory schools in Ethiopia. To this effect, it is difficult to make generalizations. In addition, only questionnaires to both teachers and students were used to elicit teacher interpersonal behavior. Qualitative data like interviews with teachers and students, which might have come up with in-depth behaviors of teachers, were not used.

References

Akbari, R &Allvar, N (2010). L2 teacher characteristics as predictors of students' academic achievement. *The Electronic Journal for English as a Second Language*,13(4).

Aldridge, J., Fraser, B., & Soerjaningsih, W. (2001). *Teacher-student interpersonal behavior and student outcomes among university students in Indonesia.* Paper presented at the annual conference of the Australian Association for Research in Education, Fremantle, Australia.

Ben-Chaim, D., & Zoller, U. (2001). Self-perceptions versus students' perceptions of teacher interpersonal style in college science and mathematics courses. *Research in Science Education,* 31, 437-454.

Brekelmans, M., Sleegers, P., & Fraser, B. (2000). Teaching for active learning. In P. R. J. Simons, J. L. van der Linden, & T. Duffy (Eds.), *New learning* (pp. 227-242). Dordrecht: Kluwer.

Brekelmans, M., & Wubbels, T. (1991). Student and teacher perceptions of interpersonal teacher behavior: a Dutch perspective. *The Study of Learning Environments*, 5, 19-30.

Brekelmans, M., Wubbels, T., &Den Brok, P. (2002). Teacher experience and the teacher-student relationship in the classroom environment. In S.C. Goh & M.S. Khine (Eds.). *Studies in learning environments: An international perspective.* pp, 73-99. Singapore: World Scientific.

Creswell, J. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* Upper Saddle River, N.J: Merrill.

Den Brok, P. (2001). *Teaching and student outcomes. A study on teachers' thoughts and actions from an interpersonal and a learning activities perspective.* Utrecht: W.C.C.

Den Brok, P., Brekelmans, M., & Wubbels, Th. (2004). Interpersonal teacher behavior and student outcomes. *School Effectiveness and School Improvement*, 15, 407-442.

Den Brok, P., Levy, J., Wubbels, Th., & Rodriguez, M. (2003). Cultural influences on students' perceptions of videotaped lessons. *International Journal of Intercultural Relations*, 27, 355–374.

Den Brok, P., Fisher, D., & Rickards, T. (2004). *Predicting Australian Students' Perceptions of Their Teacher Interpersonal Behavior.* Paper presented at the annual meeting of the American Educational Research Association, San Diego.

Den Brok, Bergen, T., Stahl, R., & Brekelmans, M. (2004). Students' perceptions of teacher control behaviors. *Learning and Instruction*, 14 (4), 425-443.

Fisher, D., Fraser, B., & Rickards, T. (1997). *Gender and cultural differences in teacher-student interpersonal behavior.* Paper presented at the annual meeting of the American Education Research Association, Chicago.

Fisher, D., & Rickards, T. (1999). *Teacher-student interpersonal behavior as perceived by science teachers and their students.* Paper presented at the second international conference on Science, Mathematics and Technology Education, Taipei, Taiwan.

Grossman, H. (1995). *Teaching a Diverse Society.* Boston, MA: Allyn and Bacon. Hidayet, T.(2010). *Comparing Teachers' and Students' Perceptions of Effective Foreign Language Teaching: A case study in Turkey.* International Conference on New Trends in Education and Their Implications, 11-13 November, 2010 Antalya-Turkey ISBN: 978 605 364 104 9.

Knapp, K., &Antos, G. (2009). *Handbooks of Applied Linguistics, Communication Competence, Language and Communication.* Berlin, Walter de Gruyter GmbH & Co.

Levy, J., Wubbels, T., & Brekelmans, M. (1992). Student and teacher characteristics and perceptions of teacher communication style. *Journal of Classroom Interaction*, 27, 23–39.

Levy, J., Wubbels, T., Brekelmans, M., & Morganfield, B. (1997). Language and cultural factors in students' perceptions of teacher communication style. *International Journal of Intercultural Relations*, 21, 29-56.

Lourdusamy, A., & Khine, M.S. (2001). *Self-evaluation of interpersonal behavior and classroom interaction by teacher trainees.* A paper presented at the International Educational Research Conference, University of Notre Dame, Fremantle, Western Australia.

Malinsky, M. (2001). Matched learning styles of teacher and student: A study of its relationship to achievement and self-esteem. *Dissertation Abstracts International, Section A: Humanities and Social Sciences*, 62(3-A), 901.

Opdenakker, M., Den Brok & Bosker, N. (2011). Teacher–student interpersonal relationships in Indonesia: profiles and importance to student motivation. *Asia Pacific Journal of Education*, *31 (1)*: 33–49.

Rickards,T.& Fisher, D. (1996). *Associations between teacher-student interpersonal behavior, gender, cultural background and achievement.* Proceedings of Western Australian Institute for Educational Research Forum.

Rickards, T., Fisher, D., & Fraser, B. (1996). *Gender and Cultural Differences in Teacher-Student Interpersonal Behavior.* Paper presented at the Conference of the Educational Research Association, Singapore and the Australian Association of Research in Education. Singapore.

Rickards, T. & Fisher, D. (1998). *Teacher-student interactions in science classes: Differences between the perceptions of teachers and their students.* Proceedings of Western Australian Institute for Educational Research Forum 1998.

Rickards, T., & Fisher, D. (2000). *Three perspectives on perceptions of teacher-student interaction: A seed for change in science teaching.* The annual meeting of the National Association for Research in Science Teaching, New Orleans, Louisiana.

Smith, W. (1998). *Student Perceptions of their Biology Teachers' Interpersonal Teaching Behaviors and Students Achievement and Affective Learning Outcomes.* Unpublished Ph.D. dissertation.

Van Oord, L. & Brok, Den. (2004). The international teacher: students' and teachers' perceptions of preferred teacher–student interpersonal behavior in two United World Colleges. *Journal of Research in International Education, 3(2):* 131–55.

Wong, K. & Wong, R. (1998). *How to be an effective teacher: The first days in school.* Mountain View, CA: Harry K. Wong Publication Inc.

Wubbels, T., Creton, H., & Hooymayers, H. (1985). *Discipline problems of beginning teachers: Interactional teacher behavior mapped out.* Paper presented at the Annual Meeting of the American Association Research.

Wubbels, T., & Levy, J. (1991). A comparison of the interpersonal behavior of Dutch and American teachers. *International Journal of Intercultural Relations*, 15, 1-18.

Wubbels, T., & Levy, J. (1993). *Do you know what you look like*? London: The Falmer Press. Wubbels, T., & Brekelmans, M. (1997). *Journal of Research in Science Teaching*, *34*, 447-466.

Wubbels, T., Levy, J. & Brekelmans, M. (1997). Paying Attention to Relationships. *Educational leadership*,*54(7)*, 82-85.

Zhang, L. (2006). Does Student-Teacher Thinking Style Match/Mismatch Matter in Students' Achievement? *Educational Psychology*, *26 (3)*, 395-409.

Farmer's Indigenous Agricultural Knowledge in Gamo Highlands, South Western Ethiopia: Characteristics and Sustainability

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As part of government policy to curve food insecurity and bring sustainable livelihood to smallholder agricultural communities, the contribution of indigenous agricultural technologies is undeniable. This research uncovers the indigenous agricultural technologies that need promotion and support, to achieve the intended food security in densely populated highlands of Ethiopia in general and the Gamo Highlands in particular. This study is, therefore, intended to assess the status and sustainability of indigenous agricultural knowledge in Gamo Highlands. The research depended on data collected from 193 sample farm households through intensive household survey, focus group discussion, participant observation and key informant interview. The results indicate that crop production and animal husbandry are the major occupations of the Gamo people in the Gamo Highland. Indigenous soil fertility management techniques such as organic manure, application of tree leaf (mulching), crop rotation and indigenous cultivation mechanisms were still utilized to improve production.

Keywords: Agriculture, Indigenous Knowledge and Soil conservation.

Introduction

In Ethiopia, agricultural policies are largely focus on increasing food production by introducing modern inputs such as improved seeds, chemical fertilizer, pesticides and related inputs. It is testified that there have been improvements achieved in areas of good soil and favourable climatic condition (Dasalegne, 2009). These modern agricultural inputs are purchased and need some money to invest (Abera, 2014). On the other pole, there is little or no attention has been given to local agricultural practices, which can easily be improved without large investment. Although improved agricultural technologies are essential to enhance production in order to satisfy the needs of rapidly increasing population with the annual growth rate of 2.6 (CSA, 2007), it is wise to conduct extensive research at such instances to improve the indigenous agricultural knowledge side by side to the expanding modern agricultural technologies. This in general will help to recognize and/or incorporate the indigenous knowledge with the introduced scientific agricultural technologies.

Static agricultural systems with declining landholdings due to land transfer from father to sons created indigenous agricultural practices unsatisfactory. Moreover, the number of domestic animals whose waste product is significant to organically fertilize the farmland is also declined to the point that some poor farmers are none of them. As a result, not only average output per unit of input is very low but also the farming practices applied contribute to the soil degradation that seriously affects sustainability. Although traditional technologies may have, their values under subsistence conditions, most of the indigenous practices applied on very small plots of land are definitely not adequate for increased production to meet the food needs of the rapidly growing population. Therefore, it is not too late to improve the indigenous agricultural technologies to enhance productivity.

Like most other rural areas of Ethiopia, the prevailing farming system in Gamo Highlands is dominantly traditional small scale with no significant change over times. The rapid population growth added on to the already existing small landholding made life challenging for the rural households. They found it difficult to feed themselves and their families depending on indigenous agricultural practices. Mixed farming, crop production using livestock manure and homemade compost and livestock rearing, is the major livelihood strategy of the Gamo people to sustain their families. The two sub-systems support each other in order to supplement the livelihood of the rural household.

Therefore, this research assesses the status and sustainability of indigenous agricultural knowledge in Gamo Highlands, South Western Ethiopia.

Materials and Methods

This study was conducted in Southern Nations Nationalities and Peoples Region (SNNPR), South-western Ethiopia. Similar to that of the federal division, the SNNPR is divided into 14 administrative zones and three special districts (*woredas*) based on ethnic and language identities. Gamo Highland is located in Gamo Goffa administrative zone, which is the third largest zone in the region in terms of area, with its administrative centre at Arba Minch Town. The Gamo Highland lies within eight districts, namely Chencha, Dita, Doroda, Mirab Abaya, Daramalo, Bonke, Arba Minch Zuriya and Gerese. Specifically, this study was conducted in Chencha, Dita and Bonke

(Figure 1).
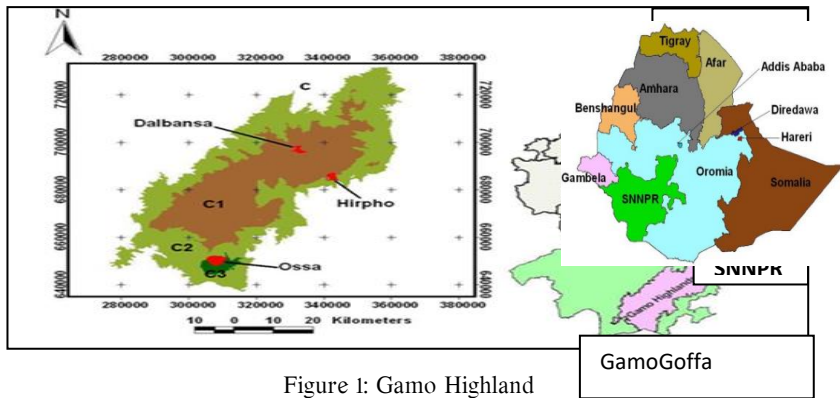
Figure 1: Gamo Highland

Methods of Data Collection

All rural Peasant Administrations (PAs) that fall within the defined territory of Gamo Highlands were identified and stratified into three agro-climatic zones based on their previously recorded climatic data. These are, *Dega* (highland) constitutes an area above 2200 meters above sea level, *woynadega* (midland), areas between 1500-2200 meters above sea level and *qolla* (lowland) areas below 1500 meters above sea level (Woldeamlak, 2007;

Alemneh, 2003; Shiferaw and Holden, 1998). Selection of sample PAs considered basic criteria: homogeneity of economic activities, geographic location, and distance from urban centres and placement of almost all boundary of the PA at the same agro-climate. Accordingly, one PA was selected from each agro-climate. Therefore, three PAs were purposely selected for this study.

List of all household head names of each category was obtained and alphabetically arranged. 20% of the total household heads were taken by using random numbers table, which according to Creswell (2009) is the most rigorous method for selecting the sample. The research depended on data collected through intensive household survey, focus group discussion, participant observation and key informant interview.

Data Analysis

Qualitative data generation of this study involved ethnographic approach through the understanding of everyday life of the respondents establishing a genuine trusting relationship (Kitchin and Tate, 2000). Firstly, all interviews and points in the group discussion that were tape-recorded were transcribed and documented in a notebook to link with the observation and household surveys. Specific focus was given to the observation by jotting down issues that are related to the day-to-day life setting of the community. Secondly, verbal responses, discussion results and observation memos, which were gathered during daytime, were carefully transcribed. The data were annotated immediately while both the interview and observations are still fresh in mind, which helped to categorise and connect to similar ideas. Sketches by participants and photographs were coded and categorized based on the issues they represented. Depending on the relationship, the sorted and categorized data were linked and connected to the contents they belonged to. Quantitative data gathered through structured household surveys were coded, sorted, classified into themes and analyzed.

Results and Discussion

The type of crops produced in Gamo Highlands varied from cereals and root crops specifically, barley, *enset (enseteventricosum)* and potato as the major food crop in the upper limit of the highland to Maize and *tef* in relatively lower

agro-climatic zone. The temperate agro-climatic zone locally known as *dega* produces additional crops such as wheat, beans, pea, lentils, and oats in smaller amounts. The entire crops produced in this agro-climate were annual crops except *enset*. There was crop rotation in order to produce twice a year. For example, after harvesting barley, farmers prepared the land for potato. A bit different seasonal crop that grew as weedy in all over the *dega*agro-climate was *Qoltso (Arisaemaschimperianum).* It is a root crop that grows and used as a food only in Gamo Highland. It grows as a weedy root crop where the land is often cultivated. The root is cut-off and purposely buried while plowing the land for barley, wheat or other cereals. It stays dormant for several months and starts to grow in mid-February and it is harvested from the beginning of July to the end of September. Very recently, the amount of *Qoltso* production has been observed remarkably declining. According to observations, *Qoltso* was very sparse in the farm plots.

Figure 2. While men were plowing collecting *Qoltso*,women were separating the edible bottom (left) from the top root part (right), photo, 2016

Another important crop produced in the Gamo Highlands is *enset,* a perennial crop which supports the survival of all households during food shortage. *Enset* could be harvested and consumed at any stage of 4-6 years of its maturity stage. Farm households at *dega* saw *enset* as backbone of their life though it occupies land for several years. Farmer's attitude toward *enset* was twofold. Primarily, *enset* was a crop to rely on in times of food crises. The availability of *enset* at a reasonable number and in a good stage (at least more than 4 years of age) indicates that the household might not face serious food shortage although it was difficult to confidently say such household might be food secure.

The very importance of *enset* was its availability as food item at any season and at any stage of development. At its very smaller stage, *enset* was simply chopped and cooked with cabbage to appear as a delicious food, which is

locally called *chadhe*. However, it was considered as the food of the poor when it was consumed during harvest season of other crops such as barley. This indicates that *chadheenset* was reserved to be consumed during the time` of scarcity of other food items, particularly from April to November. Most of the time, *Chadheenset* was cultivated at a separate plot of land either along the house next to the main *enset* plantation or in a specific land far away from home. Cabbage was usually planted along with *chadheenset,* perhaps to use the land for dual purpose.

Figure 3. *Chadhe* (chopped *enset)* at Dalbansa was spread-out on sun to dry to decrease water   holding during cooking: photo, 2016

The major constraint of *enset* production was bacterial infestation that caused wilt and root rotting of the plant. The problem was very serious at Hirpho where almost about 17% of the farm households reported that they lost their plantation. This was raised as one issue of a group discussion, which concluded that the life of any farm household was at risk at any time with the limited availability of *enset* around his/her house. Several measures that have been taken by farmers to solve the problem such as uprooting the attacked *enset* including its root and burying it including the instrument used to uproot it, was fruitless. What one can argue in this case is that although farmers' knowledge can be appreciated and acknowledged, it could not have prevented the distribution of the bacteria all over the locality and still needs scientific solution and political attention as the crop has considerable value in tackling food insecurity. Furthermore, the severity of the problem needs not only further study but also screening of promising tolerant clones.

Considering the amount of land covered, maize and *tef* were the main annual crops at Ossa. In this specific area, maize is cultivated in *belg* (short rainy season, late February to end of May) season and harvested in the summer to leave the land for *tef*, which was cultivated from mid-July to the start of September. This was also the time to sow *sila* (crops cultivate during the main cropping season (July – September) maize immediately after the harvest of the *gaba* (crops crop cultivation between   March- April) maize. However, farmers learned that the erratic nature of rainfall affected the effectiveness of the production of this season. According to the interview results, the main objective of *sila* maize was not to collect good harvest but simply to collect feed for the oxen and cows for the coming dry season. One of the challenges of Ossa farmers was the animal fodder during the time of dry season from November to February. Farmers with reasonable landholding had the chance to do this but the poor households could not misuse the land and/or the maize seed for such purposes. After maize the next important was *tef* which occupied the peripheral and relatively sloppy farm grounds due to the fact that the soil in the flat grounds log water during excessive rains. According to the survey data, *tef* was produced not for home consumption but for market purpose to fulfill household needs such as children's clothes, pay land tax, cover schooling costs, pay fertilizer debt, and other home consumption needs such as salt, oil, gas etc.

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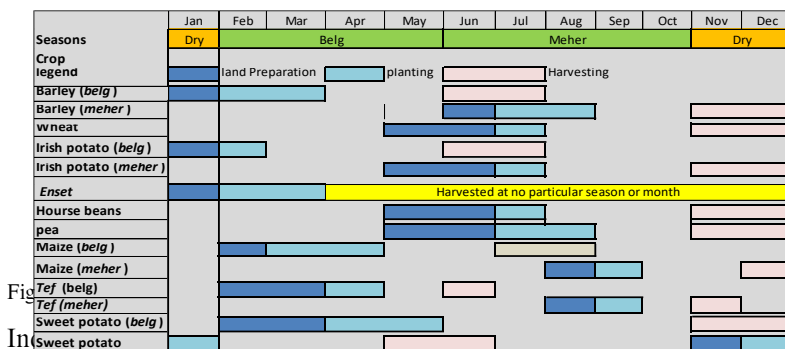
Most of the cultivated soils in Gamo Highlands experience high degradation, which resulted in loss of primary micronutrients: nitrogen, phosphorus and potassium (Abren and Abera, 2010). Limited crop diversification combined with low or non-fallow period contributed to the decline of organic matter contents. Farmers of the highlands sustained

permanent crop cultivation on these soils because there has been an effective indigenous soil fertility management practice in maintaining a reasonable level of organic matter and primary nutrients (Belay, 1998b). The physical set up of the farmland at Gamo Highland is characterized by ups-and-downs with steep slopes in its northeast direction. About 88% of the sample households had at least one plot of farmland in this step slope. Soil erosion happened to be common phenomena in this part of the study area, where there were few scattered transhumance houses constructed for two purposes primarily, to feed livestock on the upper part of the mountain that is a communal grazing land and secondly to store manure to apply on the nearby plots. The main indigenous soil fertility management practices applied in Gamo highlands are discussed as follows.

Organic manure

This is a kind of fertilizer applied on cultivated fields to improve both physical and chemical fertility of the soils. There are two types of organic manures: fresh manure and compost manure. According to the farmers' accounts, fresh manure *(Ho'opitho* or in some localities called *Igisa*) is prepared by mixture of dung, urine and straw or leaf litter that was purposely strewn to feed animals during night time as a dinner and/or to prepare a good and safety sleeping place. After several weeks or few months of storage, the hot manure directly put in a large basket from its original place to be transported by human power (usually women) or in rare cases by horses and directly applied on the field. Such application was mostly practiced on potato fields.

On the other instance, compost manure was prepared outside the house to provide enough time for the mixture of cattle dung, urine, and strew together with some ash, kitchen waste and household rubbish. As it was stored outside the house, it was exposed to sunlight and rainfall, which altogether helped to ferment and made it ready to use during *belg* cropping. This type of manure is applied on barley and sometimes on wheat fields. All of the surveyed farm households prepared this manure to apply on the cereal fields. In both cases, the transported manure is dropped at a considerable distance, throughout the field and manually spread on the field as evenly as possible.

Figure 5. Preparing compost manure to carry to the field: photo, 2016

From their long experience, farmers knew that there are differences among the livestock manure. According to farmers account, sheep dung is the best manure for a good yield of barely, potato, and for other few crops produced in the area. This is scientifically supported, as phosphorous requirement level of cereals, including barely is low; but the optimum amount of phosphorous needed for better growth and productivity of potato is higher (FAO, 1990). The same document explains that other conditions being satisfied, maximum productivity of barely, one of the major crops at Dalbansa and Hirpho, would be attained if nitrogen content of the soil is "high," but the best potato yield can be obtained with "medium" level of nitrogen supply. In contrast, the cultivation of potato requires high amount of exchangeable potassium in the soil (Booker Tropical Soil Manual, 1991).

However, the number of sheep was significantly declined due to lack of grazing land. On the other hand, cattle or dairy dung was perceived less important for barley because of its lower content of primary nutrients compared to that of sheep and horse. Farmers, therefore, mostly used dairy manure at *enset* fields. As a result, *enset* crop was usually planted around the house where there is cow or horse manure to help *enset* mature timely with a

considerable thickness and height. That is one of the reasons why all the houses were observed surrounded by *enset* plantation almost throughout Gamo Highland. Farmers were well aware of the longtime effect of organic manure and hence used two crops; barley followed by potato or vice versa continuously using manure applied once.

Crop production in Gamo Highlands has also been depended on fertilizing the soil by leaf litter (green manure of mulching). Trees are purposely left to grow around or at the boarder of farm field for their branches to be cut and thrown on the newly cultivated wheat, barely or any other cereal crop. Until the crop will have two or three leafs, the tree leaf starts to decompose as intensive rain facilitates the process more quickly. This is the way how to keep the soil fertile in this part of the Gamo highland.

Another major organic fertilizer that has been used to restore soil fertility in Gamo Highlands is traditional compost. The preparation of this type of fertilizer is similar in all sample PAs leaves and grass are raw materials added up on the livestock dung and urine to be combined with other household wastes. Farmers applied this fertilizer to wheat and barley fields near and around the house whilst they adapted the application of artificial fertilizers on relatively far fields. Moreover, weeds and other plant remnants were widely used at the time of pre-preparation (*shalame*) period by which the land is thoroughly tilled at a considerable depth to bury what are found on the ground. After two weeks, the buried material is changed into humus and the land would be ready for final preparation. Minimum amount of animal manure is added if available on such a plot of land while preparing land to complete the soil fertility management process.

From farmers' point of view, indigenous soil fertility management has two strong positions. Firstly, if organic manure is applied in a specific plot of land, it would serve for two-term cultivation. For example, if potato is cultivated by applying manure then there is no need of adding manure for the next barley cultivation. This gave more time to store organic manure for further application. Secondly, the preparation of organic compost requires no financial expense because the raw materials needed for its preparation were obtained from domestic animal wastes, grass and leaf from surrounding environment and all unnecessary but decomposable trash of the house. Finally, applying

manure helps to enhance the productivity of Qoltso, which depends on the manure applied for other cereal crops.

Crop rotation

This is a mechanism by which nitrogen can be restored by crop types on the same cultivated field (Belay, 1998). Farmers' knew that including leguminous plants would recharge fertility to the soil. Having this knowledge in mind, therefore, farm household throughout Gamo Highlands cultivated barely, potato and horse bean sequentially. With regard to using the land twice a year, farmers regularly cultivate potato and barely interchangeably in a year which results in soil fertility depletion in terms of primary nutrients. Crop rotations were practiced only on annual crops, while *enset* fields most of the time did not have any of these activities.

Moreover, at Hirpho where the altitude is lower than that of Dalbansa, crop rotation was a common phenomenon. According to farmers report their small landholding and shortage of water during dry seasons not only forced them to rotate crops and vegetables but also mixing, that is cultivating different crops and vegetables and spices on one field at a time or continuously at different time. Harvesting a type of vegetable, for example green pepper, would not affect the life of cabbage or onion; and also planting garlic and potato at the same field would not affect the life of cabbage or onion. Hence, the entire homestead farm fields in this *PA* were occupied all the year round providing a diversified production at different time. Such type of agricultural activity was believed to be a good mechanism to avoid the risk of complete crop failure and to guarantee food and household income through purchase of varieties of agricultural products. However, the production of single food item was very small and results in earning of very small amount of money.

Soil fertility management practice undertaken in Gamo Highland showed a slight variation in different agro-ecological zone. It is important to note here that the types of crops produced have their impact on soil fertility management. At Ossa where maize and *tef* were the major crops that interchangeably cover the land, manuring by animal waste had low importance. According to farmers' explanation and our observation, in order to restore soil fertility, farmers depended on the residue and remnants of previous harvest. Normally, crop rotation at Ossa was in between maize and *tef*. As a staple food, maize was cultivated during *belg* seasons of March, April and May

(Figure 4.). Majority of the farm households at this PA (62%) cultivate *tef* immediately after harvesting maize while some farmers (18%) reserved *tef* field and cultivate only *tef* that result in relatively better yield. Farmers in this case stressed the fact that their soil has exhausted due to over cultivation because of small landholding. Inspite of this, farmers were inclined towards the use of chemical fertilizer to restore fertility of their soil.

The survey result indicates that fallowing had become a history at Dalbansa where land scarcity was at its peak. All sample household heads responded that they never fallowed any piece of land in any season. On the other hand, we observed some pieces of land have been left uncultivated in different parts of Hirpho. According to informants and development agents, such land belongs to migrants to Addis Ababa for weaving because of very small landholding.

One-season fallow was a common activity at Ossa. After harvesting the *belg* maize on July and August, the land is kept free until the next *belg* cropping period comes. Farmers thought that during that time gap the land became free enough for the soil to restore itself back to its fertility. Of course, excessive temperature due to high solar radiation at one season and excessive rainfall at the other season might have facilitated the decomposition of materials on the surface to change into humus while the top soil was turned during tillage. However, such practices were restricted to those households who have relatively larger holdings.

Cultivation Procedure

Indigenous cultivation mechanisms that have been practiced through centuries creating production adaptive to local environment and apply ecological approaches to enhance agricultural production (UNEP-UNCTAD, 2008) are still important along the holdings at the Gamo Highlands. The preparation and use of organic manure and the practices of rotational cropping depended on indigenous knowledge rather than training and imports. Such practices, which were not guided by external experts, were cost effective, simple, easily implemented by farmers; and could be applied and suitable for any type of soil.

Farmers' Knowledge of Soil Conservation

In Gamo Highlands, in general, different land management practices that were well adapted to local ecological conditions have been developed through generations. Individual farm households practiced suitable measures that fit a specific plot of land at different locations with different biophysical characteristics such as soil type, slope and agro-climate. In light of this, indigenous land management practices that have been practiced in this highland can be seen within the framework of indigenous soil conservation (mechanical/ biological) methods.

Indigenous Soil Conservation Methods

Farmers in Game Highlands have been practicing combinations of mechanical strategies of soil conservation. This method has gained primary attention by farmers of all sample households. This was due to the fact that these methods basically protect the washing away of the upper soils including agricultural inputs such as seeds, manure and chemical fertilizers. It is also critical to note that these strategies created a better opportunity for the soil to hold moisture as the rainwater is prevented to run; and it is made widely practical structural soil conservation method in Gamo Highlands.

Stone Terracing (*Keela*): Farm households throughout the Gamo Highlands where the raw material (stone) is available, practice stone terracing. Farmers' perception of *keela* reveals that it had two purposes. Firstly, it protects the top soil from being washed away and secondly, it restores soil fertility by conserving water and hence creating soil moisture ability. However, its construction as well as maintenance requires physical strength, much input of family labor and construction and maintenance skills.

Figure 6. Stone bunds at difficult landscape, Hirpho: photo, 2016

As observed during survey, lack of raw material (stone) was taken as a problem of *keela* by about 18% and 4% of the households at Dalbansa and Hirpho, respectively. Farm households explained that sometimes in case of serious degradation they collect stones from river ways and carry it to the affected site to construct or maintain the structure. It appears important to add that *keela* has to be weeded and maintained every two to three years to control the proliferation of dangerous running weeds such as *phedha* that may creep into the soil particles stored in the form of silt.

Soil Bunds

Soil bunds are structures constructed at higher altitudes and more steep slopes. According to owners of farmland with soil bunds, lack of stone was the main reason to construct soil bunds. At steeper slopes, permanent soil bunds were constructed because of the fear of landslide, while at relatively gentile slopes soil bunds were changed annually to use the fertile soil stored at the structures. All steeper slopes in the study area are structured by soil bunds; especially at Dalbansa soil bunds supported much soil at very steep slopes from degradation.

Contour Plowing

Plowing the land horizontally was a common practice at all sample PAs. At steep slopes, farmers were forced to plough horizontally to avoid small landslide and gullies. However, farmers complained that cultivating horizontally using hoe results in back pain.

Farmers' perception on the Causes of Soil Erosion

In Ethiopia, under conditions of peasant subsistence agriculture in densely populated highlands, survival in the rural areas is solely linked to the exploitation of land-based resources resulting in the over exploitation beyond their capacity to regenerate (Belay, 2003). In the present study area, the levels of erosion whether it is very severe, sever or minor is determined by farmers' experience and perceptions and is therefore a relative term. The underlying issue in posing these questions is to ascertain the farmers' awareness of soil erosion. During the interviews, the farmers' view on the level of erosion was

first raised and subsequently verified by observation of the farming plots. Farmers were also asked to express their views about environmental degradation and the level of erosion on their main cropland. It was easier for farmers to remember the conditions on the cropland and other areas such as grazing areas, bare land and other small plots. It was also easier for us to verify the status of soil erosion through other indicators of degradation, such as soil depth and the level of stoniness, which were more easily observed on cropland. Therefore, farmers at the three sites seemed to be frank in expressing the incidence of erosion. Accordingly, soil erosion was observed to be the problem with more than half of the respondents suffered severe soil erosion. At Dalbansa, more than 80% of the studied households found soil erosion out of their control as the indigenous soil conservation structures at steep slopes always damaged due to heavy rain. Farmers at Hirpho had similar problems although their traditional soil conservation stricture (*keela*) was far better and stronger than that of soil bunds of steep slopes of Dalbansa. On the other hand, only 5.5% and 32.9% of the respondents at Ossa expressed that soil erosion is severe and minor on their farm plots, respectively.

The soil erosion problem was perceived by the majority of the respondents in terms of decrease in the capacity of soil to grow a variety of crops, decrease in the depth of topsoil, decline in yield and decline in the water holding capacity of soils. About 51.8% of the respondents reported during survey that soil erosion is increasing on the farm plots either due to heavy rains, overgrazing or heavy sunshine that made the soil of the farm plot fracture and susceptible to erosion. Therefore, the major causes of erosion perceived by farmers were topography, high rainfall rates, and overgrazing. The rugged topography with steep slope farm plots facilitated high erosion rates at the seasons of torrential rains in the Gamo Highlands. Moreover, scarcity of grazing area forced farmers to graze their livestock on the farm plot immediately after harvest. The land was open for grazing for the long dry season until land preparation period (start of the rainfall). Livestock roam everywhere feeding on crop residues creating enormous stress on most fertile agricultural lands. This grazing results in soil breaking, which reduces infiltration and the ability of the soil to absorb moisture that ends up in soil erosion. According to the group discussion, this was one of the major causes of soil erosion in Gamo Highland though massive soil conservation practices have been taking place by the government.

As an additional experience, farmers evaluated soil fertility of each parcel before deciding to start conservation measures. Primarily, individual households categorized each plot of land into three fertility levels; *tolso* (very fertile), *modho* (fertile) and *tsalla* in some place also called *mela* (less fertile). Obviously, farmers expressed soil fertility in association with soil type. For example, if the soil type is *gobo* and the fertility level is *toltso*, then it is expressed as *tolso gobo*, *modho gobo,* etc.

Conclusion

Crop production and animal husbandry are the major occupations of the Gamo people in the Gamo Highland. Barley, potato, wheat and *enset* are the major crops produced at *dega* and *woynadega* agro-climate while maize and *tef* are the staple foods produced at *qolla.* As far as livestock is concerned, cattle and sheep are the dominant at *dega* and *woynadega* while only cattle dominate at *qolla* areas. Farmers developed their own strategies to respond to the production constraints. To maximize crop production by reversing soil fertility, farm households in Gamo Highlands use indigenous soil fertility management techniques such as organic manure, application of tree leaves (mulching), crop rotation and different cultivation mechanisms. All of these strategies are under pressure due to observable constraints to achieve: small number of livestock, deforestation and the use of tree branches and leaves for fuel, weather variability, lack of labor and encouragement of government development agents to use introduced agricultural inputs were the confronting ones. Indigenous soil conservation strategies are also the most appreciable mechanisms used by the Gamo community to enhance production. Some of the effective strictures that have been used mostly to protect soil erosion were stone bund (*keela*), soil bund *(pore)* and drainage ditches *(zara).* Stone bunds were the most effective structures applied by all households at Dalbansa and Hirpho PAs (dega and woynadega agro-climate) while drainage ditches were common at Ossa PA (lowland) due to the influence of physical landscape and the availability of raw materials for the construction of structures. However, massive introduction of experimental soil conservation structures swallowed the indigenous soil conservation practices, which were affordable, simple and effective. Therefore, rural development agents as well as district agricultural

experts who are the key player can reverse the limited use of indigenous agricultural technologies in Gamo highlands.

References

Abren Gelaw and Abera Uncha (2010).The status of soil quality and indigenous management practices towards the sustenance of soil resource in Gamo Highlands, *South Western Ethiopia, Arba Minch University research report.*

Alemneh Dejene (2003). Integrated natural resource management to enhance food security: The case for community-based approach in Ethiopia. Environment and *Natural Resources Service Research, Extension and Training Division Food and Agriculture Organization of the UN, Rome, Italy.*

Belay Tegene (2003). Combining land capability evaluation, geographic information systems, and indigenous practices for soil conservation in North Ethiopia. *Eastern Africa Social Science Research Review, Vol.19(2),* 23-53.

Belay Tegene (1998), Indigenous soil knowledge and fertility management practices of South Wollo Highlands, Northern Ethiopia, *Ethiopian Journal of Development Research 14,* 31-58.

Booker Tropical Soil Manual (1991). A handbook for soil survey and agricultural land evaluation in the topics and sub tropics. In: J.R. London (Eds.). Booker Tate Limited Corbeels, M. Abebe, S. &Mitiku, H. (2000). *Farmers knowledge of soil fertility and local management strategies in Tigray, Ethiopia. Managing Africa's Soils No.10.*

Creswell, J. W. (2009). *Research design qualitative, quantitative, and mixed methods approach.* (3rd ed.), Sage Publications Ltd, London.

CSA (2007). Summary and statistical report of the 2007 population and housing census; *Federal Democratic republic of Ethiopia population census commission, Addis Ababa Ethiopia.*

Desalegn Rahmato (2009). *The peasant and the state: Studies in agrarian change in Ethiopia 1950s-2000s.* Addis Ababa University Press.

Ellis, F & Tasew, W. (2004). Ethiopian participatory poverty assessment (2004-2005) PPA Manual, Addis Ababa.

FAO (1990). Guidelines for soil description: Soil resources, management and conservation; *Food and Agricultural Organization of the UN, Rome, Italy.*

Kitchin, R& Tate, J. N. (2000). *Conducting research in human geography: Theory, methodology and practice.* Pearson Education Ltd, United Kingdom.

Shiferaw, Bekele. and Holden, S. (1998). Resource degradation and adoption of land conservation technologies in the Ethiopian Highlands. *Agricultural Economics 18,*233-247.

Woldeamlak Bewket (2007). Soil and water conservation intervention with conventional technologies in North Western Highlands of Ethiopia: Acceptance and adoption by Farmers. *Land Use Policy 24, 404-416.*

UNEP-UNCTAD (2008). Capacity building task force on trade, environment and development. *Organic agriculture and food security in Africa. United Nations, New York.*

Alternative Energy Source for Self-Reliant in Ethiopia

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Ethiopian Self-reliance in energy sources will result in the de-escalation of transport charges of food commodities and mitigate the difficulty arises out of escalation of import charges of petroleum due to devaluation of the Ethiopian Birr. Not achieving self-reliance in energy sources directly affects the common man's living. Similarly, many more examples which directly affect industries, public administration, states and the nation as a whole would be enumerated within moments. Most ethical ways of achieving and utilizing the full benefit of overall self-reliance is planning and achieving self-reliance in energy sources also. The task of achieving self-reliance in energy sources could be initiated by identifying waste land for non-edible oil grain cultivation like Jatropha Curcas resulting in non-edible vegetable oil production. Arithmetic behind this over all self-reliance ratio ensuring concurrent production of food and energy sources would ultimately lead a particular area towards achieving and utilizing full benefit of self-reliance as far as common man concerned. The energy source identified in this paper to achieve self-reliance in energy sources is one of the bio-fuel commonly known as Biodiesel because it is used in transport vehicle engines as well as electricity producing generator set engines.

Keywords: Bio-Diesel, Transesterification, Hydrogenation and Energy.

Introduction

Most of the places in Ethiopia do not have proper transportation facility. Achieving over all self-reliance that is self-reliance in energy sources along with food commodities will definitely bring food and transportation to all places of Ethiopia. Biodiesel is identified as one of the alternate energy source substitute for fossil diesel. Biodiesel can be used as fuel in diesel engines in blends as well as full substitute. Similarly, Biodiesel can be used in diesel power plants and diesel generators instead of fossil diesel.

First generation Biodiesel called as Bio-Transesterified Diesel (BTD) is produced by Transesterification process whereas second generation Biodiesel called as Bio-Hydro fined Diesel (BHD) is produced by Hydrogenation process from non-edible vegetable oils. The transesterification process needs catalysts potassium hydroxide or sodium hydroxide as well as ethanol or methanol in small quantities. BTD and BHD produced in this way have properties almost equivalent to fossil diesel and substituted in full or in part as blend with fossil diesel in diesel engines used in transport vehicle and electricity generating sets as well as in fossil diesel power plants. The cold flow property and oxidation stability of Biodiesel are improved better in the hydrogenation process than that in the transesterification process of vegetable oils.

The wonderful outcome of self-reliance in energy sources by the Biodiesel is the million dollars' worth healthiness of citizens of Ethiopia as a result of pollution free atmosphere. Carbon monoxide, Hydrocarbon and Particulate Matter emissions from transport vehicles and fossil diesel power plants are reduced to 60% to 80% by Biodiesel depending upon the operating conditions. The chief advantage of this energy source is the carbon di-oxide neutrality with atmosphere in principle. The neutrality is derived from the cyclic nature of absorption and emission of carbon di-oxide by the plants and engines respectively. Usage area under the self-reliant energy source Biodiesel will have carbon di-oxide free atmosphere because carbon di-oxide is cycled between plants and environment and thereby atmosphere is free from carbon di-oxide multiplication. Therefore, regions under the cloud of this type of self-reliance in energy source by Biodiesel are directly contributing to the task of reducing global warming effects of the world also.

Action Plan Need for Self-Reliance

Action plan required for implementing the scheme of self-reliance in energy sources would be listed as techno, commercial and social activities.

Techno Activities

The technical aspects of producing this energy source in small as well as large scale were carried out by technocrats around the world. Almost all the requirements for the successful production of this energy source from non-edible vegetable oils were completed by the researchers. A suitable production methodology could be evolved for using any vegetable oil based on its local availability without much difficulty by a set of scientists and engineers appointed for this purpose.

Commercial Activities

This commercial activity depends on the local availability of non-edible vegetable oils. Appreciating market could be developed for non-edible vegetable oils in any locality ensuring selling and buying of the commodity in whole sale and in retail. Similarly, the commercial outlets for the finished product Biodiesel could also be developed alongside with raw non-edible vegetable oils. The commercial activity may include the buy-back guarantee between farmers and industrialists for the finished product Biodiesel.

Social Activities

This activity includes the prime awareness campaign by local groups among themselves. The periodic interaction at regular intervals among locals, administrators and industrialists is also coming under the social activities so as to distribute the benefit of this scheme evenly to all the contributors. This final social activity among the contributors in a smooth and healthy way could only lead the scheme towards success that is empowers farmers with energy source that is oil.

Case Study - Bio-Transesterification Diesel (BTD) and BioHydrogenation Diesel (BHD)

The Kyoto protocol [1] held in Kyoto, Japan in December 1997, iterates 6% reduction of greenhouse gases with respect to 1990 within the period 2008-2012 for Japan. In addition, transportation sector is to reduce CO_2 emission up to emission level in 1995 in order to achieve the purpose written in the Kyoto protocol.

First generation Biodiesel called Bio-Transesterification Diesel (BTD) is composed of long-chain fatty acids with an alcohol attached. It is produced by transesterification process in which vegetable oil react with methyl alcohol or ethyl alcohol in the presence of potassium hydroxide (KOH) or sodium hydroxide (NaOH) catalyst. The products of the reaction are biodiesel and glycerin, approximately in the ratio 3:1. Biodiesel significantly reduce emissions of Hydrocarbon (HC), Carbon Monoxide (CO), and particulate matter (PM) when used in automotive diesel engines because of its oxygen content and higher cetane number than fossil diesel [2]. U.S. Environmental Protection Agency (EPA) also found HC, CO and PM benefits from the use of biodiesel in engines [3]. Energy diversification and CO_2 reduction requirements emphasis the use of Biodiesel in automotive engines as well as in stationary engines meant for electricity production.

Second generation Biodiesel called Bio-Hydro fined Diesel (BHD) is a straight- chain hydrocarbon derived from the alkyl chains of the vegetable oil. It is produced by Hydrogenation of vegetable oil at reaction temperature of 260°C+. Study of reactivity and the pattern of product yields conducted of palm oil hydrogenation using pilot plants delivered hydrocarbon oil equivalent to the conventional fossil diesel under mild hydrogenation condition [4]. Moreover, as a result of various evaluations for the hydrogenated palm oil (oxidation stability, low temperature flow property, life cycle assessment (LCA); it was found that the hydrogenated palm oil (Bio-Hydrofined Diesel) has performances almost equivalent to fossil diesel fuel.

Evaluation of exhaust gases of vehicles running on conventional fossil diesel mixed with 20% Bio-Hydro fined Diesel (BHD) showed lower THC, CO, and PM than with fossil diesel alone. Biodiesel (BTD) and its blend help reduce

enormous emissions of total hydrocarbon, carbon monoxide and smoke. However, both BHD and BTD cause slightly increasing emission of Nitrogen Oxide. LCA evaluation between fossil diesel and palm oil produced BHD and BTD showed that, although WTT-CO_2 of BHD and BTD is higher than that of fossil diesel, WTW-CO_2 is lower due to the application of the biomass zero count rule and WTT energy efficiency was highest for fossil diesel, followed by BHD and then BTD. Hydrogenation of vegetable oil appears to be a better option than Transesterification in producing diesel substitute because of BHD's high oxidation stability, low viscosity, high cetane number (101) and disappearance of double bond in structure.

Sustainable development can be made by the use of Biodiesel in the bus depots by reducing the cost of operation and also reducing the exhaust emissions by saving environment and our earth. Total of about 54.29% of cost can be reduced by the use of Biodiesel in the bus depots of India [5].

Conclusion

Sustainable automotive and stationary engine fuels are fuels that satisfy the conditions of "3E", namely, they are "economical", "environmentally-friendly", and promote "energy security". The focus has shifted to issues of supply stability (diversification of resources) and environmental compatibility (CO_2 reduction), against higher import costs of crude oil prices due to Birr devaluation and the global warming problem. The renewable fuels, such as Biodiesel, probably would be the most viable option by utilizing domestic surpluses and non-edible vegetable oils while enhancing energy security. Many experts also see the introduction of biomass fuels as a promising solution to fossil diesel costs. Biodiesel contains no sulfur or aromatics and its use in diesel engines results in substantial reduction of Hydrocarbons, Carbon monoxide and Particulate matter. In addition to being renewable alternate fuel for diesel engines, Biodiesel have positive performance attributes such as increased cetane number, high fuel lubricant and high oxygen content, which make it a preferred blending stock also with future ultra clean fossil diesel.The byproduct glycerin from transesterification is used in cosmetics and soaps thereby providing the necessary value addition to the Biodiesel.

References

The 3rd Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, *"Kyoto Protocol to the United Nations Framework Convention on Climate Change",* (1997).

Schumacher. L. G. W. G. Hires, and S. C. Borgelt, *"Fueling a diesel engine with methyl-ester soybean oil . Liquid Fuels From Renewable Resources"*-Proceedings of an Alternative Energy Conference, Nashville, Tennessee State, U.S.A (1992).

United States Environment Protection Agency (EPA), *"A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions Draft Technical Report".* EPA 420-P-02-001, (2002).

Akira Koyama, Hideshi Iki, Yasutoshi Iguchi, Kazushi Tsurutani, Hitoshi Hayashi, Seitaro Misawa, *"Vegetable Oil Hydrogenating Process for Automotive Fuel",* Proceedings of the SAE International Fuels and Lubricants Meeting, Kyoto, Japan, 1871-76, July 2007.

S. Bhandarkar, R. Nijagunappa, *"Use of Bio-Diesel as an alternative fuel for sustainable development of transport in Gulburga bus depots"* IMECH-International Conference Proceedings - Innovations in Fuel Economy and Sustainable Road Transport, Pune, India, 149-160, 2011.

Abbreviation

BTD	-	Bio-Transesterification Diesel
BHD	-	Bio-Hydro fined Diesel
NaOH	-	Sodium Hydroxide
KOH	-	Potassium Hydroxide
HC	-	Hydrocarbon
CO	-	Carbon Monoxide
PM	-	Particulate Matter
EPA	-	U.S. Environmental Protection Agency
LCA	-	Life Cycle Assessment
WTT	-	Well to Tank
WTW	-	Well to Wheel

Urban Rental Housing Conditions and Affordability Problems of Civil Servants in Aleta Wondo Town, Ethiopia

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This study was conducted to investigate "Urban Rental Housing conditions and Affordability problems of civil servants in Aleta Wondo Town. To this end, a mixed approach research was employed. Both quantitative and qualitative data were collected mainly through questionnaire survey to 158 randomly selected sample civil servants. KII, FGD and personal observation were also used to collect additional information. The survey result indicated that 70.9% of the respondents are living in rental houses and only 27.8% are found to be homeowners. Among the renters, the majority (83.9%) rented their housing unit from private residents. The study also revealed that the factors that most affect civil servants' access to homeownership are lack of disposable income (89.2%), the difficulty of obtaining land (86.5%), high and increasing cost of building materials (73%) and lack of housing finance/loan (54.1%).

Introduction

Housing is one of the basic necessities for human survival; despite this, it has remained as a critical problem of most cities in the world (Mahider, 2013). Around the world, over one billion urban residents live in inadequate housing where living conditions are poor services are insufficient (Habte, 2010). According to the report by Mckinsey Global Institute (MGI) quoted in Florida (2014), some 330 million urban households worldwide currently live in substandard housing or are financially stressed because of housing cost. In the developing world, some 200 million households are located in slums; and in developed countries, like USA, EU and Japan, more than 60 million households are financially stressed.

A growing population number in urban centers coupled with an increasing tendency of people to live alone has resulted in continuous rising demand for homes, but the supply of new housing cannot keep pace with the growing demand (Habte, 2010). As such, cities around the world, in developing and developed economies alike, are struggling to meet the housing need of their inhabitants (Garemo, et al, 2014). The supply of urban housing in developing countries is severely constrained and unevenly accessible for different consumer groups, often with increasing cost (Habte, 2010). Olima (2013), noted that the major symptoms of urban housing problem in developing countries include an absolute shortage of housing units, emergence and proliferation of slums and squatter settlement, rising house rent and growing inability of citizens to buy or build their own houses. Some writers argue that the provision of housing in urban areas should be tailored to address the needs of different consumer groups. In this respect, Ndubueze (2009) noted that people in different socio-economic groups have different housing consumption characteristics and problems. Besides this, there is a spatial variation of poverty levels between states and regions in a country. Therefore, examining housing affordability across a different socio-economic groups and states in a country not only offer valuable insight towards local housing realities of different groups, but also indicates the way to deal with their respective housing problems where they exist.

As such, civil servants as a segment of the population, have their own housing problems which require to be addressed in a special way.

Accommodation problem of civil servants in many countries has become a crucial demand to be tackled with. For many years, civil servants have been victims of life because of un-affordability to rent, buy or build their own houses in the market rates (Nnunduwa, 2009). With regard to home ownership, the majority of civil servants has a low purchasing or building power (Muturi, 2013) due to low income, lack of access to credit from financial institutes and access to land (Fasika, 2011; Nnunduwa, 2009). As a result, the majority of civil servants in many countries is forced to live in private rental houses (Thapa, 2005) whose rents are rising rapidly with no or limited mechanisms laid down to control it.

Statement of the Problem

The rapid rate of urbanization in combination with the poorly developed economic base has posed a number of problems, including housing deficiency and un-affordability, in cities of the developing world. Ethiopia, being one of the less developed countries, is facing serious housing problems in most of its towns and cities. The housing sector in Ethiopia can be described as being of poor quality, having massive shortage, and being congested, unsecured and unplanned. Ethiopia's current urban housing deficit is estimated between 900,000 and 1 million units in urban areas (UN-HABITAT, 2011). In addition, about 60% of urban areas of the country are slums devoid of social and economic services, with overcrowded and dilapidated substandard houses lacking basic housing facilities and services, (UN-HABITAT, 2014).

Many studies have been conducted on issues related to housing problems; however, most are directed to Addis Ababa or some major regional capitals. Most of these studies failed to address measuring affordability level in general in Ethiopian cities and the rental housing situation pertaining to civil servants in particular.

Therefore, this research is expected to fill this gap and add to the body of the existing knowledge. The principal objective of the study was to assess the housing conditions and affordability problems of civil servants in Aleta Wondo town. Under the general objective, the investigators tried to examine the patterns of housing tenure of civil servants; identify the factors that influenced

them access to home ownership; and investigate the problems faced by civil servants living in rented houses, as specific objectives.

Literature Review

Despite the fact that affordable housing has become the focus of streams of recent literatures, it seems that there is no specific definition for it as affordability considerations differ for different groups of people (Hellinan et al, 2006). The definition of affordability varies according to a household's individual circumstance (Centre for Affordable Housing, 2015). As such, its definition varies from country to country (The Economic Times, 2015).

Affordable housing is housing that is appropriately priced for low to moderate income households so that they can also able to meet other basic living costs such as food, clothing, transport, medical care and education. As a rule of thumb, affordable housing is that costs less than 30% of gross HH income (Centre for Affordable Housing, 2015). According to Aribigbola (2011) "affordable housing" refers to the capacity of HHS to meet housing costs while maintaining the ability to meet other basic costs of living. CORT (2015), states that a house is affordable if the total housing costs are affordable for the occupants, taking the commonly accepted guideline of a cost that doesn't exceed 30% of HH'S gross income.

Maclennan & Williams (1990) cited in Hellinan et al (2006) associate affordable housing with the price or rent of securing any given standard of housing (or different standards) that doesn't impose, in the eye of any third party (usually government), an unreasonable burden on HH income. Hulchanski (1995)   expressed that affordable housing is concerned with housing costs (including rents, Mortgages, property taxes, maintenance & basic Utilities) that incur less than 30% of household income or budgets. The Housing Cost Approach (housing expenditure-to-income approach) is the most common measure and embraces the house price-to-income ratio and the rent-to-income ratio. Even if they have some limitations, they also have some unique advantages such as simplicity, comprehensibility, availability of required data and amenability of spatial and trend comparative housing studies. The rent-to-income ratio was adopted in this investigation due to availability of the required data Maclennan and Williams, 1990).

The Right to Adequate Housing

The International human rights law recognizes the right to adequate housing as part of the right to an adequate standard of living (OHCHR, 2015b). The legal status of the right to adequate housing is mainly based on the 1948 Universal Declaration of Human Rights (UDHR) and the 1966 International Covenant in Economic, Social and Cultural Rights (ICESCR) (OHCHR, 2015a). In addition, in Ethiopia (FDRE,1995) three articles, Articles 90(1) mention housing as one of the guiding policy principles. Thus, under Article 41(3) and (4), the publicly funded social services to which all Ethiopian nationals have the right to equal access and which the government is obliged to provide can be interpreted to include housing services. Under Article 41(5), the term assistance can be interpreted to include housing provisions if the category of people mentioned are in need of them.

Overview Housing Situations in Ethiopia

According to the population and housing census (CSA, 2007) in Ethiopia there are 15, 103, 134 housing units most of which, 80.8% are found in the rural areas and 19.2% are found in towns of the country. In urban areas, owners occupied housing units account for about 39.3% and about 40.4 % of the urban housing units are rented from private households (CSA, 2008a). The urban housing units are generally of poor quality, having massive shortages (over 900,000), congested, unsecured and unplanned. It is estimated that only 30% of Ethiopia's total housing stock is in fair condition, whereas the largest proportion, 70%, is in need of total replacement (Center for Affordable Housing Finance Africa, 2014; UN-HABITAT, 2011). This is mainly attributed to low per capita income, low investment in housing, rapid growth of population, massive urbanization, rising cost of building materials, low income of urban dwellers to afford descent and standard housing, low investment or scarcity of financial resources to increase housing development and low supply of serviced residential plot (Habte, 2010).

Housing problems of Civil Servants

   Governments provide public services to their citizens via civil servants. One major factor that critically affects the effective delivery of services and the implementations of development projects is identified to be frequent " turn over" of dissatisfied employees and the difficulties of filling vacancies left by them (Ohashi, 2013). Among others, one way to facilitate the attraction and retention of civil servants especially in regional and remote locations is the provision of adequate housing (Department of Housing, 2015). Despite this fact, accommodation problem of civil servants has been neglected in many countries.

   Nnunduwa (2009), in his study of "Design of Low - cost Houses for Civil Servants in Tanzania" indicated that beyond 2002, the government of Tanzania provided only 6000 residential houses to accommodate more than 800,000 civil servants which put the ratio of houses to the number of civil servants at less than 0.01. Muturi (2013), on his part described that only 3,000 out of 131, 745 civil servants in Kenya own houses under mortgage and tenant purchase which represents only a 2.2% ownership. Onyike (2007), cited in Foluke et al (2015) carefully studied the situation of housing affordability in Owerri, Nigeria, and explained that the majority of civil servants in the state cannot afford adequate housing without substantial assistance from the government.

   Fasika(2011), in her study of access to homeownership of middle - and low - income earners in Bahir Dar city revealed that only 34% of the employees, have their own housing unit and 56.7% lives in rental houses. 45% of homeowners have become homeowners by constructing their own houses. Financial source for 40.5% of homeowners was loan from individuals.

   All the literatures reviewed so far revealed that purchasing of a completed house at the current   market price is beyond the reach of civil servants and the only option left for them, i, e. building a house, is also becoming more and more unaffordable for which they attributed lack of access to obtain residential land and credit from financial institutes (Fasika, 2011; Foluke et al, 2015, Muturi, 2013 and Nnunduwa, 2009). They also showed that most of the civil servants living in rental houses are not satisfied with their rental housing units, and these were attributed to poor housing units, densely populated

neighborhoods, high rental prices, long distance to work place, among others (Fasika, 2011; Foluke et al, 2015; Muturi, 2013 and Nnunduwa, 2009).

Methods and Materials

Aleta Wondo town is located at about 333km south west of Addis Ababa and about 64km south west of the regional capital, Hawassa along the road that leads to Negele Borena. In the global grid system, it lies approximately between $6^0 35' 37''$ – $6^0 37' 00''$ North latitudes and $38^0 24' 10''$ – $38^0 26' 00''$ East longitudes.

Figure 1 Location map of Aleta Wondo town (Source: Arc-GIS) According to the 2007 Population and Housing census report of CSA, the total population number of Aleta Wondo town is 22,093, of which the number of male populations is 11,646(52.7%) and those of female population is 10,447(47.3%). There is a total of 4,975 households in the town and 4,748 housing units indicating a deficit of 227 housing units.

Research Design

In this study, the researchers employed a mixed research design to collect, analyze and interpret the data. Mixed research design was selected for this investigation because it enables to capture the best of both quantitative and qualitative approaches (Creswell, 2003). In doing so, both quantitative and qualitative survey designs were employed. The concurrent research method was employed where both forms of data were collected at the same time during the study and integrated in the interpretation of results. In order to achieve the objectives of the study, both primary and secondary sources of data were used. The primary data had been collected from sampled civil servants and the concerned officials of the municipality. The secondary data were collected from various published and unpublished sources such as books, Journals, theses, official documents and reports of the municipality.

In Aleta Wondo town, there are a total of 793 civil servants in 18 institutions (Wondo Town Civil Service Office, 2015). Four institutions were purposively selected as they nearly comprise half of the total civil servants in the town. They were Aleta Wondo First Cycle Secondary and Preparatory school, Health center, Aleta Wondo Town Municipality and Trade and Industry Office. These institutes constituted the sample frame from which sample units were selected proportional to their number of employees. In selecting the sample units from each institute, simple random sampling was employed. To determine the sample size, the following formula had been adopted from Kothari (2004). Therefore, a total of 158 sample employees were selected. The sample size from each institution was selected proportional to their size as follows. Questionnaires, KII, FGD and direct observation are instruments for primary data collection. Official reports, books, journals are also as secondary sources of information. The data collected were analyzed quantitatively by using different techniques like percentages, frequencies and the findings were described and presented in a tabular and graph format. Whereas, the data obtained through interviews, FGD and observation were analyzed and described qualitatively. Besides these, SPSS was used to determine whether there is statistically significant correlation between civil servants' socio - economic characteristics and their tenure status. For this purpose, chi-square test was applied. Finally, to assess housing affordability level of civil servants, the rent-to-income ratio was adopted.

Results and Discussion

Age and Sex Distribution of Respondents

As indicated in table 1, out of the sampled respondents, 62.7% are males and only 37.3% are females. This indicates that males have a better exposure to education and employment than females. As gender inequality and bias is deeply rooted and multi- dimensional issue in a society like that of ours', its gloomy side is also reflected in terms of access to residential housing. One female participant in Focus Group Discussion said that:

Age is an important characteristic that has relevance in terms of tenure status i.e. homeownership and tenancy. 62.7% and the remaining 37.3 % are male and female respondent respectively. The age distribution of respondents ranges between 21 and >50. Out of these, the majority, 36.7% of the respondents are in the age group of 26 – 30 years. 25.9% are in the age group of 21 – 25 and 14.6% belong to the age group of 31 – 35. The age of 9.5% respondents falls in the age group 36 – 40 and 7% are >50 years old. The study also indicates that the age groups 41 – 45 and 46 – 50 accounts 3.2% respondents each. As can be seen from the result, majority of the respondents accounting 62.6% are young whose age ranges between 21 to 30 years. These young civil servants earn low income and as they are new entrants as government employees as well as immigrants, they cannot have their own house and their only option is to live in rental houses.

Table 1: Age sex Distribution of Respondents

Sex of Respondents		*Age Composition of Respondents (Years)*							*Total*
		21-25	26-30	31-35	36-40	41-45	46-50	>50	
	Male	16	40	14	11	3	4	11	99
	Female	25	18	9	4	2	1	0	59
	Total	41	58	23	15	5	5	11	158

Source: Field Survey, 2016.

Marital Status, Household size and Educational Attainment of Respondents

With regard to marital status, respondents were provided with four choices to select from. These are single, married, divorced and widowed. Accordingly, the majority of the respondents, 85 (53.8%), are married while 70 (44.3%) are single. Again, 2 (1.3%) are divorced and only 1 (0.6%) is a widower.

Table 2.

Marital Status, Household Size and Educational Status of Respondents

	Frequency	*Percent*
Marital Status		
Single	70	44.3
Married	85	53.8
Divorced	2	1.3
Widowed	1	0.6
Total	158	100.0
Household size		
1 – 3	98	62.0
4 – 6	48	30.4
7 – 9	9	5.7
10 – 12	1	0.6
>12	2	1.3
Total	158	100.0
Educational Status		
9 – 12	5	3.2
10+1 – 10+3	32	20.3
BA/ BSc/ BEd/ MD	117	74.1
MA/ MSc	4	2.5
Total	158	100.0

Source: Field Survey, 2016.

Out of the sampled respondents, the majority 98 (62%) have 1-3 members in their families while 48 (30.4%) reported that they have 4-6 members in their household. Household size of 9 (5.7%) respondents is 7-9 whereas only 1 (0.6%) respondent's family size falls in the range of 10-12. Finally, 2 (1.3%) respondents said that their household size is >12.

Education is a key determinant of individual opportunities, attitudes, and economic and social status (CSA, 2014). Its effect on housing related issues is unquestionable. The survey result provided in Table 4.1 indicate that the majority 117 (74.1%) of the respondents are first degree holders while 32 (20.3%) of them responded that their educational level ranges from 10+1 – 10+3. The number of second-degree holders is only 4 (2.5%). Finally, 5 (3.2%) of respondent's educational level ranges between grade 9 to 12. The survey result indicated that the majority of respondents were well educated.

Occupation and Work Experience of Respondents

Out of the total 158 respondents, 70 (44.3%) are teachers, 22 (13.9%) are accountants and 15 (9.5%) are nurses. The number of engineers is 8 (5.1%) while secretaries and guards accounted 5 (3.2%) each. Again, 4(2.5%) respondents each replied their occupation as janitors and officers; while the number of Doctors and Health Officers is 3 (1.9%) and 2(1.3%) respectively. Others like Laboratory Technician, Computer Administration and Councilor each accounted 1(0.6%). The remaining 17(10.8%) respondents simply replied "civil servant" as their occupation.

Majority of the respondents' (31.6%) have work experience is between 1 and 5 years. This is followed by 29.1% respondents whose work experience is between 6 and 10 years. Again, 8.2% respondents had work experience that ranges between 11 and 15 years. Those respondents with work experience >15 years and <1 year accounted 19.6% and 11.4% respectively. The survey result revealed that the majority (72.1%) of respondents' work experience was below ten years. This implies that it is difficult for them to accumulate enough money during this short duration that may enable them to solve their housing problems.

Monthly Income and Saving Level

Household income is the principal factor affecting housing quality and tenure status. It also plays an important role as a primary determinant of whether a household is in need of affordable housing. The total monthly income (net income plus additional income of a spouse or other) of most of

the respondents accounting 115 (72.8%) ranges between 1501-3500 birr. With regard to respondents saving capacity, it is found that 37 (23.4%) of them save nothing because lack of disposable income due to the imbalance between income and expenditure. On the other hand, 38 (24.1%) respondents' monthly saving is between 100-300 birr whereas 24 (15.2%) and 21 (13.3%) save 301-500 and <100 birr per month respectively. In addition, 16 (10.1%) of respondents monthly saving falls in the range of 701-900 birr and 10 (6.3%) respondents saving is 901-1100 birr. Finally, 501-700 and >1100-birr monthly saving accounted 6 (3.8%) respondents each.

Table 3. Total Monthly Income of Respondents				
	Monthly Income	Frequency	Percent	Cumulative Percent
	=<500	2	1.3	1.3
	501-1000	7	4.4	5.7
	1001-1500	3	1.9	7.6
	1501-2000	34	21.5	29.1
	2001-2500	33	20.9	50.0
	2501-3000	17	10.8	60.8
	3001-3500	31	19.6	80.4
	3501-4000	9	5.7	86.1
	4001-4500	6	3.8	89.9
	4501-5000	6	3.8	93.7
	>5000	10	6.3	100.0
	Total	158	100.0	

Source: Field Survey, 2016.

Housing Conditions of Respondents

Housing is considered to be one of the basic necessities for human survival. In contrast to this, many cities and towns in Ethiopia are facing acute problem of providing adequate housing to their residents. The notion of adequate housing incorporates both the quantity and quality of houses available to inhabitants of a given geographical area. With this regard, Muleta (2014) noted that in addition to the availability of housing itself, the housing condition including its quality and facilities is an important component that also affects the welfare of households. Therefore, it is essential here to examine the housing conditions of civil servants living in the study area.

Physical Structure

This section assesses the physical structure of the housing units in which sampled respondents currently reside. This includes wall of the housing units, ceiling type and floor of the housing units (Table 4).

Table - 4 Physical Structure of the Housing Units

Physical Structure of the Housing Units	Home Owners		Tenants		Living with Family		Total	
	Fre.	%	Fre.	%	Fre.	%	Fr.	%
Wall Type								
Wood and Mud	34	21.7	83	52.9	2	1.3	119	75.8
Hollow Blocks and Cement	3	1.9			0	0.0	8	5.1
Stone and Cement	7		5	3.2	0	0.0	29	18.5
Bricks and Cement	0	4.5	22	14.0	0	0.0	1	0.6
Total	44		1		2	1.3	157*	100.0
		0.0	111	0.6				
		28.0		70.7				

Ceiling Type							
No Ceiling	7		22	14.0	0	0.0	29	18.5
Abudjadid (Fabrics)	21	4.5	57	36.3	1	0.6	79	50.3
Plastics	2	13.4			0	0.0	11	7.0
Chip Wood	14	1.3	9	5.7	1	0.6	38	24.2
Total	44		23	14.6	2	1.3	157*	100.0
		8.9	111	70.7				
		28.0						
Floor type								
Earth Floor	12		22	14.0	1	0.6	35	22.3
Wooden Tiles	1	7.6		1.9	0	0.0	4	2.5
Cement Floor	31		3	53.5	1	0.6	116	73.9
Bamboo Floor	0	0.6	84	1.3	0	0.0	2	1.3
Total	44	19.7		70.7	2	1.3	157*	100.0
			2					
		0.0	111					
		28.0						

Source: Field Survey, 2016.

Missing Value

Out of the total 157 respondents, the majority 119 (75.8%) claimed that their houses are constructed from wood and mud. Next, the walls of 29 (18.5%) respondents' housing units are constructed from stone and cement. "Hollow blocks and cement" and "bricks and cement" accounted 8(5.1%) and 1 (0.6%), respectively. The ceiling type of the housing units of 79 (50.3%) respondents are made of fabrics, 38 (24.2%) from chip wood, and 11 (7%) from plastics. Moreover, 29 (18.5%) of them replied that they are living in houses that have no ceiling at all. The floor type of 116 (73.9%) respondents are cement tiles. 35 (22.3%) replied earth floor, 4(2.5%) wooden tiles and 2(1.3%) bamboo floor.It can be deduced from the result that the majority of the houses in which sampled civil servants live are made of less durable materials like wood and mud. Besides this, some of them have plastic ceiling or no ceiling at all; and floor types of some are bamboo or earth floor. This indicates that they are in poor conditions and below the standard.

Availability of Basic Housing Facilities

This section examines access of sampled civil servants to basic housing facilities such as source of drinking water, toilet, electricity (meter), kitchen and bathing type (see Table 5). Accordingly, the source of drinking water for 93 (58.9%) respondents is shared pipe while 65 (41.1%) respondents use private pipe. Again, 97 respondents representing 61.4% uses shared toilet and electricity (meter) and only 61(38.6%) replied that they have their own private toilet and electricity (meter). With regard to kitchen type, 83 (52.5%) respondents share kitchens with others and 6(3.8%) respondents have no kitchen at all. On the other hand, only 69 (43.7%) of the respondents have their own private kitchen.

In the same way, the bathing type of 72 (45.6%) respondents is shared, 45(28.5%) respondents is private, and 41 (25.9%) of respondents have no bathing room at all. The above discussion of the result reveals that the majority of the sampled civil servants are living in houses where facilities are shared with others. This implies that they have no freedom in using these facilities as they wanted to.

Table - 5. Availability of Basic Housing Facilities

Fcilities	Private		Shared		Not-Available		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Source of Drinking Water	65	41.1	93	58.9	0	0	158	100
(Pipe)	61	38.6	97	61.4	0	0	158	100
Toilet	61	38.6	97	61.4	0	0	158	100
Electricity	69	43.7	83	52.5	6	3.8	158	100
(Meter)	45	28.5	72	45.6	41	25.9	158	100
Kitchen								
Bathing Type								

Source: Field Survey, 2016.

Tenure Status of Respondents

Tenure refers to the arrangements under which the household occupied its living quarters. A housing unit is said to be owner occupied, if the occupant household owns it and it is free from rent. Similarly, a housing unit is considered as rented if the household living in it pays rent to a private individual or to public offices (CSA, 2008a). As indicated in Table 6, 70.9% are living in rental houses while only 27.8% are homeowners. The remaining 1.3% respondents are living with their parents.

Table – 6 : Tenure Status of Respondents

Table 6: Tenure Structure of Respondents							
Sex of Respondents	Tenure Structure of Respondents						Total
	Private-built by own	Private-Purchased	Private-Inherited	Rented-Public	Rented-Private	Living with family	
Male	25	3	4	11	55	1	99
Female	8	1	3	9	37	1	59
Total	33	4	7	20	92	2	158

Source: Field Survey, 2016

Out of the total sampled respondents, 112(70.9%) living in rental houses, 83.9% of them rented from private renters while 16.1% rented from public authorities. From the result, it can be said that the private rental sector, mainly of service quarters, meet the housing needs of the majority of civil servants living in the study area. Despite its huge role in housing supply, the private rental sector is invaded by many problems to which these considerable sections of civil servants have been exposed to.

Monthly Rent

Table – 7 : Monthly Rent

Monthly Rent		Frequency	Percent	Cumulative Percent
	<100	17	15.2	15.2
	100-300	34	30.4	45.5
	301-600	49	43.8	89.3
	601-900	6	5.4	94.6
	901-1200	6	5.4	100.0
	Total	112	100.0	

Source: Field Survey, 2016.

Table 7 presents the amount of rent paid by respondents per month in Ethiopian Birr. The amount of rent paid by 49 (43.8%) respondents is in the range between 301 and 600 birrs followed by 34 (30.4%) respondents whose payment is between 100 and 300. In addition, 6 (5.3%) respondents each pay house rents that fall in the ranges 601-900 and 901-1200. Those who pay monthly rent below 100 birrs accounted 17 (15.2%). However, no respondent pays monthly rent above 1200 birr.

The respondents were also asked if there is change in the amount of rent price. Accordingly, their responses are presented in Table 8.

Table - 8 : Increment in the Amount of Rent Prices

Amount of Change in birr	Frequency	Percent	Cumulative Percentage
≤50	12	16.7	
51-100	28	38.9	
101-150	8	11.1	
151-200	14	19.4	
201-250	0	0	
251-300	4	5.6	
301-350	0	0	
>350	6	8.3	
Total	72*	100.0	

Source: Field Survey, 2016.

3 missing values

The result indicates that 75 (67%) affirmed that in every year or two years owners increase housing rent. The amount of increment ranges between 50 – about 350-birr Problems of Civil Servants Living in Rental Houses. Besides to poor conditions of the housing quarters, sample civil servants' questions were posed in the questionnaire about the major social problems faced by civil servants living in rental houses.

Table - 9
Main Problems Faced by Civil Servants Living in Rental Houses.

Main problems faced by civil servants living in rental houses?	Frequency	Percent*
Lack freedom when getting in and out	96	85.7
Restrictions on the use of water, electricity and toilet.	80	71.4
	60	53.6
Restriction on the number of friends visiting them	56	50.0
Arbitrary increment of rent with urgent/no notice	54	48.2
Lack of freedom for children to play freely	101	90.2
Lack of security of tenure		

Source: Field Survey, 2016.

The total value exceeds 100 % since respondents are allowed to choose multiple answers.

The main problems they stated include lack of tenure security (90.2%), lack of freedom when getting in and out (85.7%), owners' restrictions in the use of facilities such as water, electricity and toilet (71.4%), restrictions in the number of friends visiting them (53.6%), arbitrary increment of rent with a short notice (50%) and lack of freedom for children to play freely (48.2%). In this respect, participants of focus group discussion said the following:

In rental houses you have no freedom at all. You cannot use electricity for other purposes like cooking food. Most landlords do not allow you to use electricity late at night. They also impose restriction in using water. Some even restrict that tenants can use only one bucket of water per day. However, the water supply of the town is not regular and for days or weeks we have to use that single bucket of water or find other alternatives that expose us to additional cost. They also do not tolerate you to come late at night.

In rental houses, as we are sharing one kitchen with the homeowners, they do not allow you to use the kitchen at any time you want. To prepare food, you have to wait until they first finish their own work. By the time when they finish their own work, it is too late and we have to hurry to our work place. This again exposes us to additional expenses

Analysis of Tenure structure and Housing Affordability

Table 10 below illustrates the association between tenure structure and socio-demographic characteristics of sampled civil servants in the study area using Pearson's chi-square test of independence. Chi-square test was selected for this analysis since tenure structure and some of the characteristics of respondents are categorical variables. Other quantitative characteristics of respondents were changed in to categorical variables so that they could be used for this analysis. Since tenure types are broadly divided into homeowners and renters, two respondents living with their parents were excluded here and only the information gathered from 156 respondents were considered.

Table - 10
Association between Respondents' Characteristics and Tenure Structure

Respondents' characteristics	*Chi-square*	*P-value*
Sex	2.575	0.109
Age	12.598	0.000*
Marital status	7.145	0.008**
Household size	25.531	0.000*
Educational level attained	2.672	0.263
Work experience	8.089	0.018**
Migration status (Place of Birth)	6.296	0.012**
Years of stay in the town	18.008	0.000*
Net monthly income	11.072	0.004**
Saving amount	8.210	0.016**

Source: Computed from Field Survey, 2016.
Significant At 0.01 And 0.05 Significance Levels Respectively

The result depicts that eight of the ten variables have statistically significant relationship with tenure structure at different P-values of < 0.05. These are age, marital status, household size, work experience, migration

status, years of stay in the town, income and saving. On the contrary, the P-values of sex and educational level of respondents are > 0.05 indicating that they have no statistically significant relationship with tenure structure in the study area.

Affordability Level of Renters

To examine affordability level of rental houses for tenants, the rent-to income ratio was applied. To accomplish this, annual income of respondents was categorized into equal groups and the median of each group was taken as the annual median income of that specific group. Then, the rent-to-income ratio for each group was computed and presented in Table 11as follows.

Table - 11. Rent-to-Income Ratio of Respondents

Income Groups	Annual median Income	Frequency	Percent	Annual median Rent	Rent-to-Income Ratio
6,000	5,040	3	2.7	2,400	47.6 %
6,001-12,000	11,832	4	3.6	5,400	45.6 %
12,001-18,000	14,400	3	2.7	2,400	16.7 %
18,001-24,000	20,652	31	27.7	2,400	11.6 %
24,001-	29,352	32	28.6	2,400	8.2 %
30,000	33,216	13	11.6	5,400	16.3 %
30,001-	39,336	20	17.9	5,400	13.7 %
36,000	42,924	2	1.8	5,400	12.6 %
36,001-42,000	82,128	4	3.6	5,400	6.6 %
42,001-					
48,000					
>60,000					
Total		112	100.0		

Source: Field Survey, 2016.

The survey result shows that the rent-to-income ratio ranges from 6.6% to 47.6% in the study area. The largest value (47.6%) is recorded for 2.7% respondents whose annual income is ≤6,000 birr. Next comes 45.6% which is the value recorded for 3.6% respondents whose annual income is 6,001-12,000

birr. The ratio obtained for the remaining 93.7% range from 16.7% to 6.6%. Using the 30 % bench mark, it can be concluded that rental houses are affordable for the majority of civil servants residing in the study area as most (93.7%) exhibited values less than the specified 30% limit. On the contrary, rental houses are not affordable only for smaller groups accounting 6.3% of respondents with low annual income of less than 12,000 birr.

The use of 30% limit as measure of affordability takes into consideration the quality of the housing units. Most of the housing units' civil servants currently reside are devoid of basic facilities like electricity and water supply. Moreover, nearly 50 % of the rental housing units are consisting of only one room implying they are overcrowded.   Rather than taking 30% (Rent-to-income ratio) as rule of thumb for measuring housing affordability, it would be more realistic to consider it based on the quality of the dwelling units. Therefore, if we reduce it to 10 % over 60 % of the rental housing would become unaffordable.

Income plays an important role as a primary determinant of whether a household is in need of affordable housing, but income also affects the price of housing in the market. Housing is a normal 'good' and, as incomes increase, we expect that more housing will be demanded, which in turn increases the average price of housing. Demographics play a similar role because housing is a necessity, so as the population increases.

Conclusion

Urban housing problem has become a serious concern in many cities of the Third World including Ethiopia. Civil servants in small sized towns like Aleta Wondo devoid of public participation, like condominium building, are facing serious housing problems as observed from the results of the investigation. As most of them are dislocated from their previous localities to reside in the town, the first challenge they encounter is the problem of shelter. Based on the study, the following conclusions are drawn.

1. Most of the housing units used by civil servants are found to be substandard. Some are lacking even to supply basic facilities like electricity, water and

kitchen. In terms of tenure structure, only small proportions have their own houses while the majority of them live in privately owned rental houses.

2. There is no formal housing market system and lack official financial institution supporting housing supply in the town. The only option to build a house is limited to the household. Moreover, housing ownership has become difficult due to factors such as high and increasing costs of building materials, the difficulty of obtaining land, in comparison with low income. That is the ever-increasing cost of construction material as well as the frequent occurrence of shortage of supply soared the housing construction cost beyond the capacity of the majority of the civil servants.

3. Civil servants living in private rental housings are challenged with many problems. Their main problems are social, personal and economic in nature. In terms of housing affordability level, owning a house was found not affordable to civil servants. On the contrary, considering 30 % RIR, as rule of thumb, rental houses were affordable. However, the persisting housing quality and size it would be illogical to use this model. Therefore, if we reduce this model lower than 20%, most dwelling units will become fall below the affordable level.

Generally, it can be concluded that accommodation problems of civil servants are not given the necessary attention. As the local community is the direct beneficiary of public services provided by civil servants, neglecting their problems including their housing conditions, potentially will negatively affect both the quality and quantity of services provided to the community. Therefore, the result of the survey revealed that housing problems of civil servants should be given due attention both by the government, the town's municipality and the local community.

References

Aribigbola, A. (2011). *Housing Affordability as a Factor in the Creation of Sustainable Environment in Developing World: The example of Akure, Nigeria.* Department of Georaphy and planning sciences, Adekunte Ajasin University, Nigeria.

Center for Affordable Housing (2015). *What is Affordable Housing? Government of South –* WesternAustralia; Australia.

Center for Affordable Housing Finance Africa (2014). Ethiopia. Africa Housing finance yearbook 2014.

CORT (2015). *Community Housing: Concepts and Definitions. CORT Community Housing,* Auckland, New Zealand.

Creswell, J.W. (2003). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches.* 2nd ed. SAGE Publications, USA.

CSA (2007). *The 2007 Population and Housing Census of Ethiopia: Summary Report at a Country Level.* Central Statistical Agency, Addis Ababa, Ethiopia.

CSA (2008). The 2007 Population and Housing Census of Ethiopia: Statistical Report at a Country Level. Central Statistical Agency, Addis Ababa, Ethiopia.

Department of Housing (2015). *Government Employee Housing. Government of Western Australia.* Derived from www. housing.wa.gov.au > Housing Authority > Housing options ...

Fasika Belay (2011). *Factors Influencing Access to Private Homeownership in Bahir Dar city, Amhara Region: The Case of Middle - and Low - Income Workers.* MA Thesis, Addis Ababa University; Addis Ababa, Ethiopia.

FDRE(1995). *The Federal Democratic Republic of Ethiopia Constitution.* Addis Ababa.

Florida, R. (2014). *Solving the Global Housing Crisis.* City lab com. Derived from www. city lab.com|...|38|89|

Foluke, F. O. Ismail, O. Rukaiyat, O.A, and Yakubu, J. (2015). *Housing Affordability by Federal Civil Servants in Minna, Nigeria: Emerging Issues.* Journal of Management and Sustainability, vol. 5, No.1Canadian Center of science and Education.

Garemo, N.,Mischke, J., Ram, S., Sankhe, S. and Woetzel, J. (2014). *Tackling the World's Affordable Housing Challenges.* Mckinsey and Company C1996 – 2015.

Habte AlemuGudeta (2010). *An Assessment of Urban Housing Supply and Affordability in Jimma Town with Special Reference to Condominium Housing.* MA Thesis, College of Development studies. Addis Ababa University, Ethiopia.

Hallinan, B., Robinson, M. and Scobie, G.M. (2006). *The Concept of Affordability.* Working paper 06/03. The Treasury, Wellington, New Zealand.

Kothari,C.R.(2004). *Research Methodology: Methods and Techniques.* 2ndRevised edition. New Age International Publishers, India.

Hulchaniski, J(1995). *The Concept of Housing Affordability: Six Contemporary Uses of Expenditure-to-income-Ratio.* Housing studies. 10(4), 471-491.

MahiderHalefom Mahari (2013). Welfare Impact of the Condominium Housing Program in Mekelle. MSc. Thesis, Department of Economics, College of Business and Economics, Mekelle University, Mekelle, Ethiopia.

MuletaWordofa (2014). *Assessment of Housing Provision Challenges on Urban Residents: The Case of Bekoji Town, Arsi Zone, Oromia Regional State, Ethiopia.* MA Thesis, Haramaya University, Haramaya, Ethiopia.

Muturi, M.M(2013). *Employer - Assisted Housing Addressing Accessibility and Affordability for Civil Servants in Kenya.* A research project, Department of Real Estate and Construction Management, University of Nairobi; Nairobi, Kenya.

Ndubueze, O.J(2009). *Urban Housing Affordability and Housing policy Dilemmas in Nigeria.* PhD Dissertation, Centre for Urban and Regional Studies, School of Public policy, The university of Brimming ham.

Nnunduwa, E.J(2009). *Design of Low - Cost Houses for Civil Servants in Tanzania.* Tanzania Buildings Agency, Consultancy Division, Dar es Salaam, Tanzania.

Ohashi, K. (2013). *Can Ethiopia pay Civil Servants Better and Not pay for it?* Country Director of the world Bank (WB) in Ethiopia and Sudan. Addis fortune.

OHCHR (2015a). *International Standards: Adequate Housing. Office of Higher Commissioner for Human Rights.* Derived from www.ohchr.org...

OHCHR (2015b). *The Rights to Adequate Housing. Office of the united Nations High Commissioner for Human Rights;* Fact sheet No. 21, Rev.1,Geneva, Switzerland

Olima, H.A. (2013)*Determinants of House Construction Cost in Kenya.* International Journal of Business and commerce, vol.4, No.1, Asian Society of Business and Commerce.

Thapa, K. (2005). *Rental Housing: Myths and Reality. The Roles of Public, Semi - public and Private Sectors in the Provision of Rental Housing in Thimphu, Bhutan.* MA Thesis, Master's programme in Urban Management and Development the Economic Times (2015). Definition of Affordable Housing. Bennett Coleman and Co.

UN-HABITAT (2011). *Condominium Housing in Ethiopia:* The Integrated Housing Development Program. Nairobi, Kenya.

UN- HABITAT (2014). *National Report on Housing and Sustainable Urban Development.* Ministry of Urban Development, Housing and construction, FDRE.