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*Full Length Research Paper*

## Assessing the effectiveness of water quality education programs in controlling soil phosphorus levels in the Beaver River Watershed, Utah

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Received 13 June, 2013; Accepted 12 March, 2014

Federal Environmental Protection Agency (USEPA) 319 Program funds were obtained to educate landowners on how to make improvements on their farms that would help keep manure and P-laden sediments out of the Beaver River Watershed in Utah. The primary objective of this study was to employ an integrative evaluative tool (long-term monitoring of soil P test levels) to evaluate the effectiveness of the educational efforts. The study hypothesis was that educational efforts would result in a significant change in soil P test level, thereby indicating a significant impact of the educational campaign. Over the study period between 1998 and 2009, 12% of growers sampled in the study region adjusted their P management programs so that proper nutrient sufficiency could be attained and maintained in their soils. Despite the inroads gained in effecting positive changes in grower practice over the study period, many growers (especially those whose fields were in close proximity to their dairy operations) were more affected by the high direct cost of spreading manure waste over a larger area, and ended up applying more P than the crop required. This over-application was evidenced by a little over 14% of study sites (7 of 49) showing increases in Olsen P levels of greater than 50 mg/kg over the study period. The strong influence of economic considerations on P management must be addressed in future educational programs.

**Key words:** Best management practices, water quality, phosphorus, manure, soil testing, fertilizer management, riparian buffers, agricultural extension.

### INTRODUCTION

The Beaver River watershed is estimated to cover some 306,000 acres in Beaver County, Utah. Bordered by the Tushar mountains to the east and the Mineral mountains to the west, the estimated population is 3,700 people and is experiencing about a 0.22% increase in population growth projected through the year 2020. Approximately, 170 farms (of an average of 495 acres in size) are

contained within the watershed which is comprised mostly of cow/calf and alfalfa operations with a few interspersed dairies (Utah State University, 2008).

In Utah's arid climate, water is a critically valuable resource. Competition for high quality water between farms, growing municipal and landscape uses, and local recreation is high. The Beaver River is the primary water

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resource in Beaver County and is prized as a local fishery, recreation area, and a valuable source of water for farm and municipal uses. Water flow and quality monitoring of the Beaver River in the early 1990's showed a variety of problems ranging from high rates of sediment load and high concentration of associated phosphorus (Beaver River Task Force, 2001). The Utah Department of Environmental Quality determined that high phosphorus levels in the Beaver river and Minersville reservoir were having a negative effect on fish development in the river and reservoir (Beaver River Task Force, 2001). In 1994, the Beaver River Task Force began addressing problems in the watershed using federal Environmental Protection Agency (USEPA) 319 Program funds to educate landowners on how to make improvements on their farms that would help keep manure and P-laden sediments out of the Beaver River. Utah State University Cooperative Extension's (USUCE) role on the task force was that of training and educational information development and dissemination. Educational programs that promote learner participation and feature practical demonstrations using local methods and data have proven to be very successful in encouraging farmers to implement projects on their own farms (Downing et al., 2007). Additionally, studies world-wide designed to determine the reasons for or against the adoption of agricultural best management by farmers, are also helpful in designing effective grower educational programs (Fernandez-Corenjo et al., 2005; Pannell et al., 2006; Saltiel et al., 1994). Therefore, an annual Beaver River Watershed Tour was established by USU CE, which for the last 15 years has showcased water quality improvement projects being conducted cooperatively by various growers and institutions in the watershed. After reviewing numerous alternatives that are commonly promoted to manage manure P (Lory, 1999) the education program was designed to include the following water quality protection projects and manure management systems: stream bank restoration, piping streams and ditches, improved fencing (stability and location), improving irrigation efficiency and uniformity, range reseeding, and improved livestock watering facilities (both physical and proper siting). Many producer meetings (annual crop schools, field days, workshops, etc.) were held over that same 15-year period to teach agricultural best management practices (BMPs). In addition to showcasing the projects noted above, focus during grower education events was given to rotational grazing with off-site watering (that is., fencing off the river and developing alternative ways to water animals off river while practicing rotational grazing to minimize over-grazing and soil disruption), and the importance of soil testing before applying manure or commercial fertilizer.

## Objectives

The primary objective of this study was to employ an

integrative evaluative tool (long-term monitoring of soil P test levels) to evaluate the effectiveness of the many educational events and techniques employed in the Beaver River Watershed area.

The study hypothesis was that educational efforts and implementation of soil and grazing management BMPs would result in a significant change in soil P test level, thereby indicating a significant impact of the educational campaign of USU CE. To accomplish this objective, the following specific tasks were undertaken:

1. Obtaining initial soil tests to measure phosphorus levels in hay fields and pastures along the Beaver River at the beginning of the educational campaign.
2. Repeating soil tests on the same fields at the end of a decade of water quality improvement education and project application.
3. Comparing the two sets of soil test values to assess any positive changes in soil P level, and interviewing farmers to find out why they felt the phosphorus levels either increased or decreased on their individual fields.

## METHODOLOGY

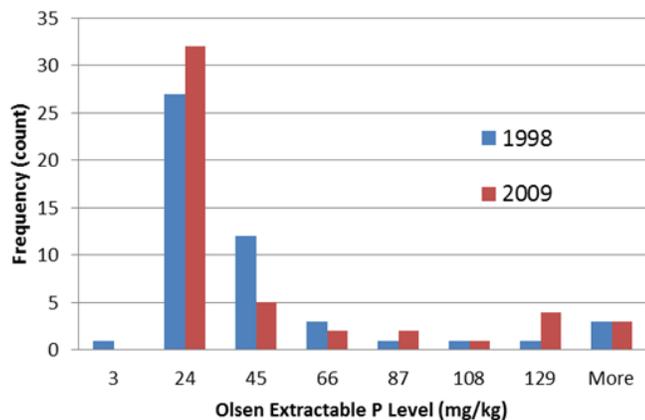
Many of the hay fields and pastures sampled were fairly small in size but several large hay fields and pastures were also tested. The hay fields and pastures ranged in size from 1 acre to over 200 acres. The average size was 32 acres. In 1998 soil samples were taken in the irrigated meadows along the Beaver River between Beaver City and the Minersville Reservoir. In 2009, the same hay fields and pastures were sampled again to see if phosphorus levels had changed since 1998. A total of 49 hay fields and pastures were sampled.

Each field was randomly sampled to a depth of 12 inches (30 cm) in at least six separate locations and the soil from each location was composited. The composite soil samples from each field were sent to the Utah State University Analytical Laboratories (USUAL) for Olsen (Ammonium Bicarbonate) Extractable P analysis.

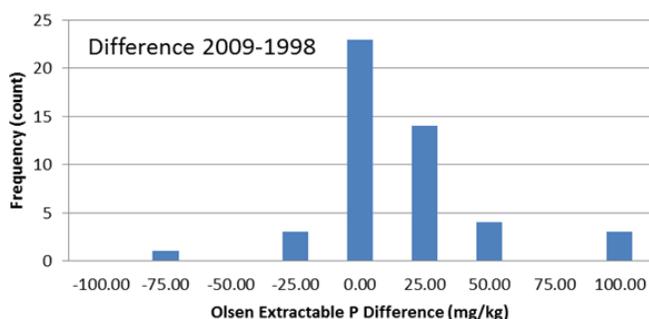
Data from the 1998 and 2009 data sets were compared, and a histogram of soil P test levels was contrasted for the two data sets. An ANOVA test on the two distributions was undertaken to test the difference in the means of the two sample sets. Categorical evaluation was also undertaken to classify each soil test result using the interpretive levels used by USUAL. This was done to evaluate the "migration" of soil test results between the categories of "deficient" (<15 mg/kg Olsen P), "sufficient" (15 to 30 mg/kg Olsen P), and "high" (> 30 mg/kg Olsen P) with respect to crop need over the time period of the sampling.

## RESULTS AND DISCUSSION

A histogram showing the distribution of Olsen Extractable P for the two sampling dates is given in Figure 1. The relative distribution indicates a shift in the data over the sampling period where fewer fields fall in the two groups above "sufficient" (the groups between approximately 30 to 70 mg/kg). However, it appears that some of these fields may have migrated to both lower and higher levels of analysis. There is a significant rise in the number of



**Figure 1.** Histogram of Olsen P test levels in each year of the study.



**Figure 2.** Histogram of the difference in Olsen-Extractable P test between 2009 and 1998.

observations in the “sufficient” category (15 to 30 mg/kg) indicating a net improvement over the sampling period in soil P management. It is desirable that all fields would fall in this category indicating grower attention to maintaining soil P levels conducive to optimal crop growth without over- or under-fertilizing.

Unfortunately, there seems to have also been a net increase in the number of fields having very high soil test levels (> 50 mg/kg). Figure 2 is a histogram of the frequency of the difference between 2009 and 1998 Olsen-Extractable P levels (negative values indicate a decrease, positive values indicate an increase over the time period). Seven fields showed an increase of more than 50 mg/kg (Figure 2) from 1998 to 2009. Based on follow up grower interviews in 2009, it appears that those fields with large increases in Olsen-Extractable P were situated in close proximity to dairies and the growers found it financially prohibitive to transport their manure waste to fields further away. This is consistent with the finding of Saltiel et al. (1994) where economic factors were shown to be the most important factors affecting the adoption of sustainable agricultural practices. Manure applications in such economically-dominated situations in

**Table 1.** Statistical comparison of log-transformed sample means.

| Variable            | 1998   | 2009  |
|---------------------|--------|-------|
| Mean                | 1.332  | 1.360 |
| Variance            | 0.159  | 0.185 |
| Observation         | 49     | 49    |
| Pearson correlation | 0.727  |       |
| Hypothesized mean   |        |       |
| Difference          | 0.000  |       |
| df                  | 48     |       |
| T stat              | -0.634 |       |
| P(T≤t) one- tail    | 0.265  |       |
| T critical one-tail | 1.677  |       |
| P(T≤t) two- tail    | 0.529  |       |
| T critical two-tail | 2.011  |       |

our study, were at levels higher than crop P demand, resulting in the buildup of Olsen-Extractable P over the study period.

Because the data is clearly log-normally distributed (Figure 1), to compare the means of the two data sets, the data was log transformed and processed using an ANOVA-based t-test. Table 1 contains the results of the statistical comparison which clearly show that the two means are not significantly different. This indicates that there were essentially just as many sites that increased in Olsen-Extractable P, as decreased, resulting in no shift in the mean over the study period. Interestingly, the mean is between 21 and 23 mg/kg which is in the middle of the sufficiency range, indicating that growers on the whole are targeting that level of extractable P over the study area even if individual growers chose to make P management decisions using criteria other than plant need.

The number and percentage of the total fields falling in a given interpretive category of Olsen-Extractable P are given in Table 2 which provides another indication of the impact of the educational campaign on soil P management. The data show a consistent migration of soil P level toward the “sufficient” category from both high and deficient levels. If one bases an evaluation of the impact of the educational campaign on the statistical difference in the mean value of Olsen-Extractable P over the study period, or on a histogramatic distribution of soil P level over time, the real effect of the educational effort may be missed. The data in Table 2 show that a substantial number of growers (over 12%) have taken plant need into account in the management of soil P. Many growers that had high initial test levels reduced P input and moved into the “sufficient” category over the study period. Also, growers with low initial soil P test levels, improved P management to their advantage by increasing P inputs and bringing their soils up to sufficient levels. The latter was a surprising finding in the data.

**Table 2.** Number of sites with indicated Olsen P test levels in each year of the study.

| Year   | Low (<15 ppm) | Adequate (15 to 30 ppm) | High (>15 ppm) |
|--------|---------------|-------------------------|----------------|
| 1998   | 19(38.8%)     | 12(24.5%)               | 18(36.7%)      |
| 2009   | 16(32.7%)     | 18(36.7%)               | 15(30.6%)      |
| Change | -3(-6.1%)     | +3(+12.2%)              | -3(-6.1%)      |

More emphasis in the educational campaign was given to effecting a reduction in high soil P test levels due to environmental issues associated with off-site transport of excess P. The overall improvement of soil P management toward meeting and maintaining sufficiency levels for optimal crop performance was initially overlooked when analyzing the results, but certainly helps show the impact of educating growers about the levels of the nutrients needed.

## Conclusion

Over 12% of growers sampled in the study region adjusted their P management programs so that proper nutrient sufficiency could be attained and maintained in their soils. This response to the educational program undertaken to train growers on crop P need and the consequences of P mismanagement, is a strong indicator of the campaign's effectiveness.

Despite the inroads gained in effecting positive changes in grower practice over the study period, many growers (especially those whose fields were in close proximity to their dairy operations) were more affected by the high direct cost of spreading manure waste over a larger area, and ended up applying more P than the crop required. This over-application was evidenced by a little over 14% of study sites (7 of 49) showing increases in Olsen-Extractable P levels of greater than 50 mg/kg over the study period. The strong influence of economic considerations on P management must be addressed in future educational programs.

Future educational programs should be developed to help growers appropriately value and personalize the potential environmental costs of P mismanagement (such as local surface water quality degradation, fishery health, etc.), provide options for handling the volume of manure waste that can serve as economically viable alternatives to disposal rates of application on crop land, and on other field P management options such as new crop rotations with higher P use potential, etc. These additional educational efforts may help growers driven by economic-based decisions, to more fully consider the need to balance P applications with crop need.

## Conflict of Interest

The author(s) have not declared any conflict of interests.

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*Full Length Research Paper*

# Impact of youth rural-urban migration on household economy and crop production: A case study of Sokoto metropolitan areas, Sokoto State, North-Western Nigeria

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Over the past decades, rural-urban migration research has focused on the hypothesis that the migration of household population, especially youths, has significant influence on the economy and crop production of households. This study aimed at examining the impact of youth rural-urban migration on household economy and crop production in Sokoto metropolitan area of Sokoto State, Nigeria. A multistage sampling technique was used to draw the sample of the study. Descriptive and inferential statistical tools were used to analyze the data obtained. The results indicated that all the migrant household heads were males, married and most of them fell within the ages of 45 to 54 years, while the majority of the migrants were within the ages of 18 to 27 years, single, males and literate. The common place migrated to by the migrants was Kaduna State due to lack of social amenities in their original place of residence. Majority of the migrants practiced temporary migration by coming back home at the onset of the rainy season to assist their parents on the farm, resulting to minimal losses in agricultural production for the household and at the same time remitting to their parents a certain amount of money which was used to cater for the welfare of the family. A non significant relationship was realized between the age of the migrants and some reasons behind their migration to the urban centres. It is recommended that social amenities should be provided by the government, nongovernmental organizations and the rural people with the aid of community driven development to the rural areas.

**Key words:** Impact, youth, rural-urban, migration, household income, crop production, Sokoto.

## INTRODUCTION

In the past decades, youth labour migration and household agricultural economic research has focused on the hypothesis that the migration of the household population, especially youth, has significant influence on

the economy and crop production of the households. The family labour which the rural farmers depends solely upon was reduced drastically due to migration of the youth to the rural centres. This phenomenon

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consequently resulted to high cost of production, low productivity, and reduction in annual income and a fall in standard of living of the rural populace (Akangbe et al., 2006). In a related study by Zimmerer (2004) reported that increased migration and transnational, as well as growth of forest product based handicraft industries, have led to rural households and communities abandoning agricultural lands, resulting to the growth of the imported agricultural packages. Farm labour provided by active and energetic youth is considered as an essential component of agricultural productivity in rural areas, because agriculture in isolated areas of an open country with low population density solely depends on family labour. Rural farmers, due to peasantry nature of the farm business and low income status, mostly depend on family labour, which is mostly provided by the youth. Despite the importance of youth migration to the urban centres due to, most especially, lack of social infrastructure in the rural settings, and lack of rural job opportunities during the dry season of the year, and its repercussions resulted to low yield and high cost of farm labour. Farm labour seasonal migration is often tremendous in magnitude and is widespread throughout the nation of Nigeria. Its net result has been described as having negative impact on the local development and production due to the reduction in human resources (Ray, 2001).

Migration, whether at the international or local level may be a deliberate decision or attempt by the migrant to reap social or economic benefit associated with changing locations. There are different types of migration. Internal migration is termed as the movement of people to a new home within a state, country or continent while external migration is the movement to a new home in a different state, country or continent (Adepoju, 2003; Adamu, 2009; Agbonlahor and Enilolobo, 2013). According to Chandna and Bala (1994) migration is the movement that involves a permanent or semi-permanent change in residence from one settlement to another. Rural - urban migration or labour migration on the other hand is defined as the movement of able bodied individuals from rural villages of origin to cities to earn a labour wage (Hunnes, 2012). Migrants are people who have left their homes to a new location, either temporarily or permanently in order to reap private social or economic gains (Adepoju, 2003). Youth rural urban migration was defined as the movement of youth from one geographical region to another, which may be on temporary or permanent basis (Adewale, 2005). Youth tend to move away from one place to another due to need to escape violence, political instability, congestion, drought in various dimensions and suspected or real persecution (Fadayomi, 1998). The level of poverty, lack of job opportunities and gross inadequacy of social infrastructures was found to be one of the reasons behind youth rural-urban migration (Aworemi et al., 2011). Also the seasonality of the primary job or the agricultural activities which the rural populace engaged in, results in seasonal unemployment and in addition,

small scale business opportunities in rural areas are being wiped out (black smith, pot making, processing of agricultural produce, fishing industry etc) by the supply of technological products from the urban centers thus, causing structural unemployment for parts of the year (Akinyele, 2005).

The movement of youth from rural to urban areas is a common occurrence in Nigeria where most of the rural areas are ignored by the government despite the fact that majority (60 to 70%) of the country population resides there. Studies by Ehirim et al. (2000), Adesiji et al. (1998) and Akinyele (2005) on rural-urban migration revealed negative effects of the migration on both the rural areas and the urban settings in Nigeria. According to Adesiji et al. (1998) when the energetic and productive members of the rural populace migrated to the cities, the original place of residence experience low food production, and high cost of labour, while the new location on the other hand may be faced with over population, resulting in unemployment, high rates of crime, prostitution, outbreak of diseases etc.

Due to inadequate or lack of scientific studies on impact of youth rural-urban migration on household economy and crop production in the study area, there is therefore a need to conduct research on the field in order to create a proper understanding of its effects on the households of the study area.

The specific objectives of the study are to describe the socio-economic characteristics of the migrants' household members and the migrants themselves; determine the nature of youth rural-urban migration and its relationship to the household heads farm yield; determine the reasons leading to youth rural-urban migration; find out the businesses engaged in by the migrants and their perceived income; determine the food coping strategies adopted by the household heads

## METHODOLOGY

The study on the impact of youth rural-urban migration on household crop production and economy was conducted in some metropolitan areas of Sokoto city. The areas are Kware, Wamakko and Dange/Shuni. Kware is approximately 12 km east of Sokoto city, Wamakko is 10 km west of Sokoto city and Dange/Shuni is approximately 10 km north of the city. Wamakko Local Government Area (LGAs) was purposively selected for the study. The LGA was carved out of Sokoto Local Government Area in 1991. The LGA has four (4) districts which are Dundaye; Wamakko; Gumbi and Gumburuwa. The study area is located on the longitude 3 and 9° East and latitude 10 and 14° North. It is bordered to the North by Tangaza Local Government, South by Bodinga Local Government and Yabo Local Government Areas, West by Silame Local Government and to the East by Sokoto and Kware Local Government Areas. The area has a population of 176,619 (NPC, 2006). The major occupation of the people is farming, fishing and trading. The major tribes of the area are Hausa/Fulani and many other Nigerian minor and major tribes are also found.

The climate of the study area is characterized by a long dry season (October/November-April/May) with a short rainy season (May-September/October), (Singh and Babaji, 1989). Rainfall starts

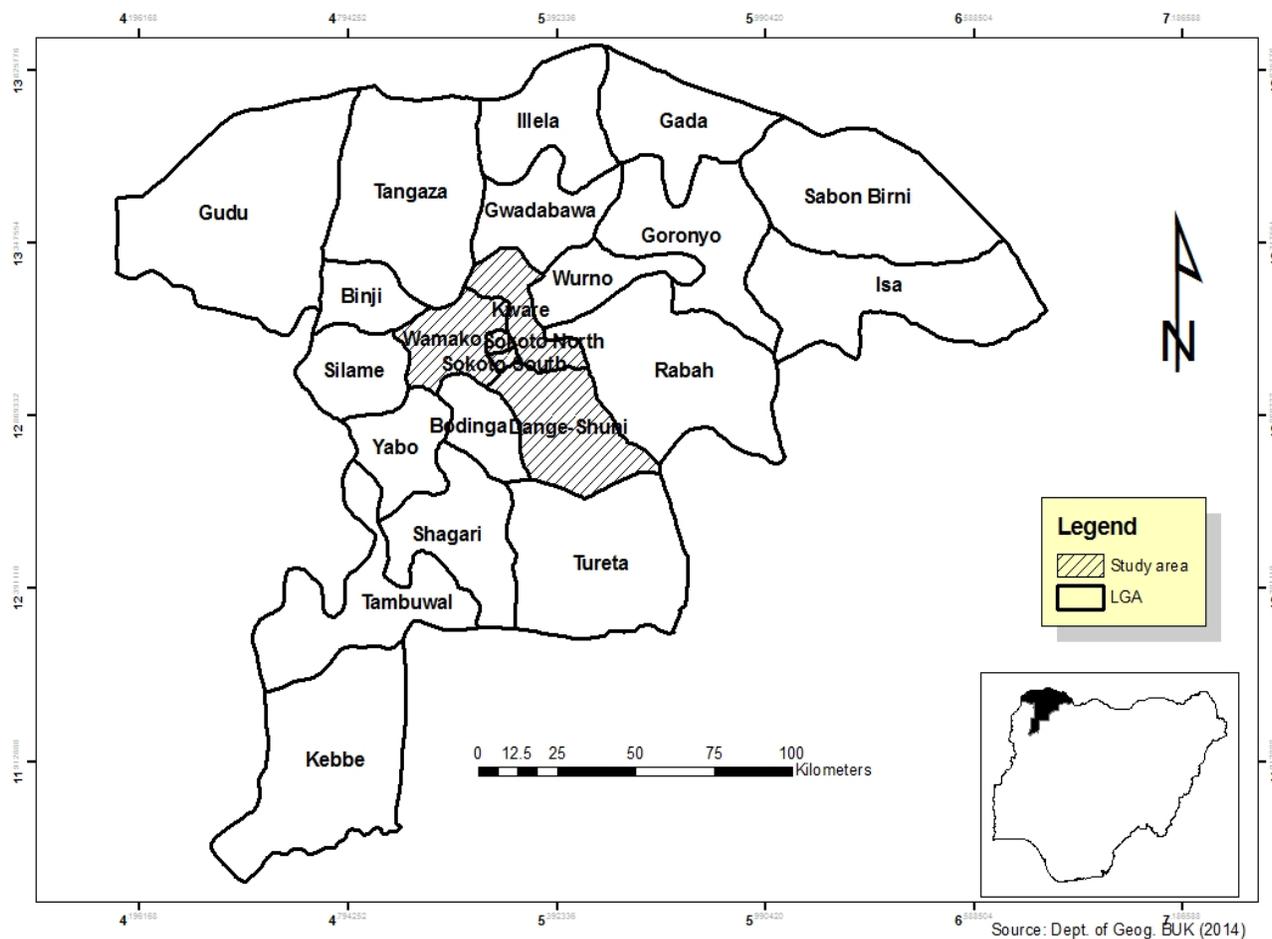


Figure 1. Map of Sokoto State showing the study area.

in late May and ends in late September or early October with annual rainfall ranging from 400 to 700 mm (Singh, 1995). The minimum and maximum temperatures are 19 and 34°C respectively with mean annual temperature of 21.5°C with relative humidity of 52 to 56%. The study area experiences harmattan wind (N-E Trade wind) which is a dry cold dusty wind blowing between the months of November to February. The soil of study area is predominantly sandy to sandy-loamy with low fertility level particularly poor in primary nutrients like nitrogen, phosphorus and potassium. The vegetation of the area falls within the Sudan Savannah agro-ecological zone characterized by sandy soil, loamy soil and some patches of Fadama land. An assortment of various species of grasses and legumes, patches of bushes and sparsely distributed indigenous tree species majority of which are thorny tree species are also found. Such trees include *Acacia spp* and *Adansonia digitata* (Figure 1).

Multistage sampling technique was employed to arrive at the sample size of the study. The first stage was the purposive selection of Wamakko Local Government Area out of the three Local Government Areas that constitute Sokoto metropolis because of the high numbers of youth known to have migrated to the urban centres. The third sampling technique involved the random selection of two districts out of the four districts in the Local Government Area, and the fourth technique involved the purposive selection of two villages from each of the selected districts due to the concentration of migrants in the communities. Lastly, the

sample size of the study constitutes 98 comprising 58 households and 40 migrants.

The primary data of the study was solicited from the respondents through the use of two sets of structured questionnaires; one set was administered to the households and the other to the migrants while the secondary data was restricted to published documents such as textbooks, journals, seminar papers, internet sources and past student projects. The data obtained were subjected to both descriptive statistics (percentages and frequency distribution) and inferential statistics (Chi-square) tests. A test of null hypothesis on the significant relationship between the some selected socio-economic characteristics (age, occupation, marital status) of the migrants and the reasons for their migration was tested using Chi-square analysis.

The study considered two sets of variables; dependent variable which was socio-economic factors influencing migration and independent variables which include the reasons for migration, type of business engaged in by the migrants in cities and the estimated income of the migrants. Age of the migrants was measured in years; marital status of the migrants was measured as single, married, divorced and widow. Educational attainment of the migrants was measured based on Qur'anic education, primary school education, secondary school education, tertiary education, adult education and never attended school. Household size of the head of household and migrants was measured based on the number of people in the house; and the youth rural-urban migration

**Table 1.** Distribution of household heads and their wards socio-economic characteristics (n=98).

| Variable                                      | Household heads (58) |            | Migrants (58)     |            |
|---|----------------------|------------|-------------------|------------|
|   | Frequency            | Percentage | Frequency         | Percentage |
| <b>Age (years)</b>                            |                      |            |                   |            |
| 18 - 22                                       | 0                    | 00.0       | 29                | 72.5       |
| 23 - 27                                       | 0                    | 00.0       | 9                 | 22.5       |
| 28 - 34                                       | 0                    | 00.0       | 2                 | 05.0       |
| 35 - 44                                       | 15                   | 25.9       | 0                 | 00.0       |
| 45 - 54                                       | 30                   | 51.7       | 0                 | 00.0       |
| 55 - 64                                       | 12                   | 20.7       | 0                 | 00.0       |
| >64   | 1                    | 01.7       | 0                 | 00.0       |
| <b>Age of wards at first migration (year)</b> |                      |            |                   |            |
| 10-14   |                      |            | 6                 | 10.3       |
| 15-19   |                      |            | 41                | 70.7       |
| > 19  |                      |            | 11                | 19.0       |
| <b>Marital status</b>                         |                      |            |                   |            |
| Married                                       | 58                   | 100.0      | 29                | 72.9       |
| Single  | 0                    | 00.0       | 11                | 27.5       |
| <b>Educational attainment</b>                 |                      |            |                   |            |
| Qur'anic education                            | 34                   | 58.6       | 8                 | 20.0       |
| Primary education                             | 8                    | 13.8       | 28                | 60.0       |
| Secondary education                           | 6                    | 10.3       | 8                 | 20.0       |
| Adult education                               | 10                   | 17.3       | 0                 | 00.0       |
| <b>Household size (people)</b>                |                      |            |                   |            |
| 9 - 13  | 31.0                 | 53.4       | 22.0              | 55.0       |
| 14 -18  | 22.0                 | 37.9       | 14.0              | 35.0       |
| >18   | 05.0                 | 08.6       | 04.0              | 10.0       |
| <b>Occupation of household heads</b>          | <b>Frequency</b>     |            | <b>Percentage</b> |            |
| Farming                                       | 49.0                 |            | 84.5              |            |
| Trading                                       | 02.0                 |            | 03.4              |            |
| Farming and trading                           | 07.0                 |            | 12.1              |            |
| <b>Mode of land acquisition</b>               |                      |            |                   |            |
| Inheritance                                   | 40.0                 |            | 69.0              |            |
| Inherited and purchased                       | 18.0                 |            | 31.0              |            |
| <b>Farm size (ha)</b>                         |                      |            |                   |            |
| 0.1 – 0.9                                     | 40.0                 |            | 69.0              |            |
| >1  | 18.0                 |            | 31.0              |            |

Source: field survey, 2012.

was measured based on reasons for migration such as lack of basic social amenities, search for job, household food security, looking for better education and the perceived income of the migrants was measured in Naira.

## RESULTS AND DISCUSSION

Most (51.7%) of the household heads fell within the age range of 45-54 years, 25.9% falls within the age bracket of 35-44 years, and 20.75% of the household heads fall

within the age ranges of 55-64 years while only (1.7%) of the household heads were 64 years or older (Table 1).

The findings of the study imply that most of the household heads were within the age bracket of 45-54 years, indicating old ages and as such not active in terms of agricultural productivity. This could be due to the fact that the energetic youth belonging to the household have migrated to the cities which may lead to trend of agricultural productivity trend in the study area (Akangbe, 2006).

Majority (72.5%) of the migrants fell within the age ranges of 18 - 23 years, 22.5% were within the age brackets of 24 - 29 years while only (5%) of the wards (migrants) were within the ages of 30 -35 years (Table1).

The findings shows that majority of the migrants were within their youthful stage of development, a stage when a youth could take decision in conjunction with their parents to travel outside the domains of their parents. The implication of this finding is that the young migrants have the strength and risks bearing ability associated with such population movement. This finding is line with Gimba and Kumshe (2000) that majority of the migrants from the villages to cities are young and energetic to cope with the hurdles of activities faced in cities.

The majority (70.7%) of the migrants surveyed had migrated at the age range of 15-19 years, 19.0% of the migrants migrated at the ages of 19 years and above, 10.3% migrated at the ages of 10-14 years (Table 1). Although the majority of migrants were only within the ages 15-19 years, and in child development stage, it appears they were able to identify the benefits accrued to migrants and were therefore influenced to migrate to the cities.

All (100%) of the household heads were married men while the majority (72.5%) of the migrants were single; 27.5% were married (Table 1). The finding that the majority of the migrants were single suggests it is easier for them to travel than married men, proceeds obtained from labour in the city are then sent to their parents at home. This contradicts the findings of Agbonlahor and Enilolobo (2013) in the South-western Nigeria where majority of the migrants were married, which indicates that they are likely to pay a frequent visit to their families at regular intervals to minimize social impact of separation from place of origin or residency.

The finding that all household heads were males could be due to the fact that in this part of the country, based on their custom, tradition and culture only the males are involved in rigorous agricultural activities (farming). This finding is in agreement with Ango et al. (2011) who reported that majority of the male of the rural populace in the northern part of the country engages in farming whereas the female folks partake only in rearing of children, domestic, other household chores and processing of agricultural produce.

None of the household heads and the migrants was illiterate as they have attained one form of education or the other. Most (58.6%) of the household heads had attained Qur'anic education, 17.3% of the household heads attained adult education, 13.8% of the household heads attained primary education, while only (10.3%) of the household heads attained secondary education, 60% of the migrants had attained primary education while 20% of them attained Qur'anic education and secondary school education respectively (Table 1). It is a normal trend or practice among the people of northern part of Nigeria, to first enroll children into Qur'anic education

before being engaged in to any type of education (Chaudna and Bala, 1994).

Both the household heads and the migrants were from moderate to large family size. As shown in the findings in Table 1, most (53.4%) of the migrants household heads had a family size of 9 to 13 people, 37.9% had a family size of 14 to 18 people while only 8.6% of the household heads had a family size of 18 peoples and above. While in the case of the migrants 55% of them were from a family size of 9 to 13 people, 35% were from family size of 14 to 18 people while only (10%) of the migrants were from a family size of 18 people and above. This finding is in agreement with Kamaldeen (2003) and Ejeoma (2000) that majority of the households in the rural settings exceed 15 people due to the nature of the way they live together, and dependence on family as a source of farm labour, and that household size of a rural people is always much greater than their counterparts living in the city.

Based on the findings it was also observed that families with a greater number of people living in their households tended to have their children migrating to the cities purposely to ensure that the rest of the family members left at home were able to sustain themselves with the little that the farm produced. This finding is in accordance with Waliu (2003) that rural household with large family size produced food that is insufficient for their living, thus, sending their children to migrate to urban areas so as to reduce the amount of food consumed by the family.

### **Socio-economic characteristics of household heads**

Majorities (84.5%) of the household heads were farmers, 12.1% were engaged in farming and trading while only (3.4%) of the household heads occupation was solely traders (Table 1). This implies that the rural populace who mostly are farmers engaged mostly in agricultural activities and their end-produce are either meant for family consumption and little for sale to provide those items not produced in the farm. The rural areas are known to have limited or non availability of social amenities which if present as in the urban areas, can serve as an opportunity for varying job opportunities. The finding of the study concurs with United Nations (2001) and Aworemi et al. (2011) that majority of the villagers engaged in farming since they lack social and basic amenities that will provide them with better opportunity to engage in other occupation similar to those that are available in the urban areas.

Majority (69%) of the household heads inherited their pieces of land, 31% inherited and bought the land used for agricultural activities while none of the household heads were found barrowing and leasing the land used for agricultural activities (Table 1). The finding reveals that majority of the household heads inherited the piece

**Table 2.** Distribution of migrants based on reasons for migration (n = 40).

| Reasons for migration               | Frequency/percentage |             |      |             |
|-------------------------------------|----------------------|-------------|------|-------------|
|                                     | Yes                  | %           | No   | %           |
| Search for better employment        | 32.0                 | 80.0        | 08.0 | 20.0        |
| Change environment                  | 15.0                 | 37.5        | 25.0 | 62.5        |
| Further education                   | 21.0                 | 52.5        | 19.0 | 47.5        |
| To learn trade                      | 16.0                 | 40.0        | 24.0 | 60.0        |
| Look for money through labour       | 13.0                 | 32.5        | 17.0 | 67.5        |
| Join family members in the city     | 02.0                 | 05.0        | 38.0 | 95.0        |
| Better housing in the city          | 04.0                 | 10.0        | 36.0 | 90.0        |
| To improve welfare                  | 18.0                 | 45.0        | 22.0 | 55.0        |
| Better transport in the urban areas | 13.0                 | 32.5        | 27.0 | 67.5        |
| Social status of one's parent       | 00.0                 | 00.0        | 40.0 | 100         |
| Escape from punishment              | 00.0                 | 00.0        | 40.0 | 100         |
| Free in terms of movement           | 00.0                 | 00.0        | 40.0 | 100         |
| Crop failure and famine             | 05.0                 | 12.5        | 35.0 | 87.5        |
| Lack of social facilities           | 37.0                 | 92.5        | 03.0 | 07.5        |
|                                     |                      | <b>176*</b> |      | <b>374*</b> |

Source: Field survey, 2012; \*Multiple response.

of land from their parents; because it is known to be part of the tradition and culture of the people of the study area that land belonging to deceased parent is shared to his heirs.

The findings showed that 69% of the household heads had a farm size ranging from 0.1-0.9 ha and 31% of them had a farm size of 1 ha and above (Table 2). This implies that majority of the respondents had small plots of land for their agricultural activities. The finding concurs with Adamu (1997) the plot of land which the rural populace possess are mostly small in nature because it has to be shared among the heir of deceased owner.

#### Factors responsible for rural – urban migration

Majority (92.5%) of the migrants migrated to the cities because they lack social amenities and infrastructures in their places of residence 80.0% migrated for better employment, 52.5% migrated to further education, 45% of the migrants migrated to improve present welfare, 40.0% migrated to learn trade, 37.5% migrated to change environment, 32.5% migrated to look for money through labour as well as better transport in the urban areas respectively (Table 2). The findings also reveals that 12.5% of the migrants travel to the cities because of crop failure and famine, 10% travelled to cities for better housing, while only (5%) migrated to join family members in the city. The findings showed that majority of the migrants leave their villages to the cities because they lack social amenities which are found in the cities which if present in the rural areas will provide them with many job opportunities that would deter them from travelling to the cities. This finding corroborates the works of Adepoju

(2003), Martin and Taylor (2003), Adamu (2009), Aworemi et al. (2011) and Hunnes (2012).

#### Places (Cities) migrated to and nature of migration practiced

The findings reveal that 27.5% of the migrants migrated to Kaduna State, 22.5% travel to Kano State, 12.5% travel to Lagos State, 10.5% migrated to Zamfara State, 7.5% travel to Sokoto city, Abuja and Niger States respectively while 5.0% of the migrants travel to Kebbi State (Table 3). Kaduna State having the higher percentages migrants from this study may be due to presence social infrastructure, high rate of job opportunities, better educational facilities as well as its serene environment. According to most of the migrants, they migrated to Kaduna State due to its closeness to Sokoto State in terms of distance and were found to be better than their original place of residence in terms of social infrastructures and amenities.

#### Nature of migration, jobs engaged in, and amount (naira) earned by the migrants

As indicated in the findings of Table 3, the majority (87.9%) of the household heads agreed that their wards return home after a while and 12.1% were of the view that their wards stay where they migrated to for life. The findings imply that majority of the household wards who migrated returned home on the onset of the rainy season, did so to assist their parents in farming activities and thus, these group of migrants' practices temporary

**Table 3.** Migrants distribution based on places migrated to, nature of migration, jobs engaged in, and amount earned/month (n = 40).

| <b>Places migrated to</b>          | <b>Frequency</b> | <b>Percentage</b> |
|------------------------------------|------------------|-------------------|
| Niger State                        | 3                | 07.5              |
| Kano State                         | 9                | 22.5              |
| Sokoto city                        | 3                | 07.5              |
| Kaduna State                       | 11               | 27.5              |
| Zamfara State                      | 4                | 10.5              |
| Lagos State                        | 5                | 12.5              |
| Abuja                              | 3                | 07.5              |
| Kebbi State                        | 2                | 05.0              |
| <b>Nature of migration</b>         |                  |                   |
| Temporary migration                | 7                | 12.1              |
| Permanent migration                | 51               | 87.9              |
| <b>Nature of Labour engaged in</b> |                  |                   |
| Labour works                       | 4                | 10.0              |
| Okada/Kabu-kabu riding             | 7                | 17.5              |
| Trading                            | 21               | 36.2              |
| Taxi driving                       | 3                | 07.5              |
| Studies                            | 5                | 12.5              |
| <b>Amount earned monthly(#)</b>    |                  |                   |
| Less than or equal to #10,000      | 1                | 2.5               |
| #10,100 - 20,000                   | 5                | 12.5              |
| #20,100 - 30,000                   | 4                | 10.0              |
| #30,100 - 40,000                   | 8                | 20.0              |
| #40,100 - 50,000                   | 5                | 12.5              |
| > #50,000                          | 10               | 30.0              |
| Nothing remitted home              | 5                | 12.5              |

Source: Field survey, 2012.

migration. This type of migration practiced by the respondents goes contrary with the type practiced by the southern Nigerians who mostly returned home only during the festive periods of the year. This finding concurs with Adewale (2005) and Olorunshogo (2007) that migrants from the village to the cities either stay in the cities to practice permanent migration or often go home frequently to pay visit to their people thus practicing temporary migration.

As shown in Table 3, that 36.2% of the migrants engaged in petty trading, 17.5% were Okada (Motorcycle) riders, 12.5% went for studies, and 10.0% were labourers while only 7.5% of the migrants were taxi drivers. The findings indicate that majority of the migrants engaged in one form of business or the other that provides them income. No migrants were involved in white collar job that generates appreciable amount of money due to lack of good educational background and capital to invest in the cities. Based on the findings, majority of the migrants were of the opinion that despite not engaged in white collar, migration to the cities is

better than remaining idle at home. This finding is in contradiction with Okpara (1983) that the rural people in the cities only end up in petty businesses and unskilled vocation jobs in the urban areas that attracts no much income.

The findings depicts that 30% of the migrants earned more than #50,000 (Naira) monthly, 20% earned between #30,100 and #40,000 monthly, 12.5% earned between #10,100 and #20,000 and between #40,100 and #50,000 respectively while only 2.5% of the migrants earned below or up to #10,000 per month. Part of the income generated / gained was used for self-keeping while the remaining is remitted home to family (Table 3).

### **Impact of youth rural – urban migration on household food crop production**

As shown in the findings 36.2% of the household heads stated that two of their wards had migrated, 34.5% stated that only one of their wards migrated, and 27.6% of the

**Table 4.** Distribution of household heads based on number of migrated wards and their yield/year (n=58).

| Variable                       | Frequency | Percentage |
|--------------------------------|-----------|------------|
| <b>Migrated wards</b>          |           |            |
| One child                      | 2         | 34.5       |
| Two children                   | 21        | 36.2       |
| Three children                 | 16        | 27.6       |
| Four children                  | 1         | 01.7       |
| <b>Harvest per year (bags)</b> |           |            |
| 4 - 8                          | 32        | 55.2       |
| 9 - 13                         | 18        | 31.0       |
| >13                            | 8         | 13.8       |

Source: Field survey, 2012.

household heads stated that three of their wards migrated and only (1.7%) of the household heads stated that four of their wards ever migrated (Table 4). The finding of the study implies that the higher percentage of the household heads had only two of their children that have ever migrated; or it could be due to the fact that there is enough agricultural harvest by the family. This result is in contradiction with Kamaldeen (2003) who reported that from every household there always found some wards migrating and their number ranges from 4 and above this is because the agricultural produce harvested was small and it could not be enough to feed the family for the whole year. Migration of the wards according to him is the next alternative to purchase of seed and other farm inputs that could be used next year and is therefore considered as an act of supplementing the family income or food stock.

The result in Table 4 reveals that most (55.2%) of the household heads had 4 to 8 bags of assorted grains/year, 31% 9 to 13 bags of assorted grains/year and 13.8% of the household heads had realized a yield of 13 bags and above of assorted grains/year. The findings imply that most of the household heads produced between 4 to 8 bags of assorted grains/year, an indication of the peasantry nature of the agricultural activities where farmers cultivate mostly for household consumption and selling some of the farm produce to provide essential commodities not produce in the farm. This type of agricultural activities made farmer to operate on a small piece of land due to lack of capital and government incentives.

#### **Food coping strategies adopted by the heads of the household in the community**

As indicated in Table 5, majorities (93.1%) of the household heads received assistance from their migrating wards in form of monies sent while the

remainder did not. This finding implies that majority of the migrants engages in one form of business venture or the other from which some incomes were generated. It's out of these incomes that some were sent home for up keep of the family. The findings in Table 5 also revealed that 46.6% of the migrants remitted between #10,000 and #20,000 to the family at home, 17.2% of the migrants remitted less than #10,000 and #20,000 – #30,000 respectively to their family at home while only 8.6% of the migrants did not remit any amount of money to their family. The finding shows that majority of the migrants remitted certain amount of money to their family at home.

Majority (72.4%) of the household heads were of the opinion that the money remitted home by their wards was not sufficient for home demands, 19% of the household heads agreed that the money remitted was enough while only (8.6%) household heads said that their wards that migrated did not remit money home (Table 5).

As shown in the findings in Table 5, majority (70.7%) of the household heads used the money remitted in purchasing food stuff, 19% paid labourers for services rendered with the money remitted and 8.6% of the household heads bought domestic animals with the money remitted while only (1.7%) household heads engaged in business with the money remitted by their wards that migrated. The result indicated that most of the money remitted home by their migrating wards was used for the purchase of food stuff because the majority of the farmers practiced subsistence farming out of which the yield obtained could not sustain the family.

The findings in Table 5 reveal that the majority (79.3%) of the migrants' absence was not felt by their family while only (10%) of the migrants' family felt the absence of their wards due to the separation with members of their family. The reason behind majority of the families of the migrants not feeling the absence of their wards could be due to temporary migration practiced, and some amount of money remitted home. In addition, the use of information

**Table 5.** Distribution of Heads of Household Based on coping strategies adopted, amount remitted by the wards and the sufficiency of the remitted amount (n=58).

| Variable  | Frequency | Percentage |
|---|-----------|------------|
| <b>Assistance received from wards</b>           |           |            |
| Received assistance from wards                  | 54        | 93.1       |
| No any assistance from wards                    | 4         | 06.9       |
| <b>Amount remitted (#)</b>                      |           |            |
| <#10,000  | 10        | 17.2       |
| #10,000 - 20,000                                | 27        | 46.6       |
| #20,100 - 30,000                                | 10        | 17.2       |
| #30,100 - 40,000                                | 5         | 08.6       |
| >#40,000  | 1         | 01.7       |
| Nothing remitted home                           | 5         | 08.6       |
| <b>Sufficiency of allowance (Remittance)</b>    |           |            |
| Sufficient                                      | 11        | 19         |
| Not sufficient                                  | 42        | 72.4       |
| No remitting of money home                      | 5         | 08.6       |
| <b>Utilization of money sent</b>                |           |            |
| Purchasing of food stuff                        | 41.0      | 70.7       |
| Buying domestic animals                         | 05.0      | 08.6       |
| Paying labourers                                | 11.0      | 19.0       |
| Engage in business                              | 01.0      | 1.7        |
| <b>Feeling of wards absence by the families</b> |           |            |
| Yes   | 12        | 20.7       |
| No  | 46        | 79.3       |

Source: Field survey, 2012.

technology such telephone to interact with the family members also helps in reducing the long silence between the households and their migrated wards.

### Testing of research hypothesis

There is no significant relationship between reasons for migration and food provision coping strategies of the heads of the household.

The Chi-square analysis result in Table 6 revealed a significant relationship between migrants search for better employment in the urban centres and the money remitted home ( $X^2 = 0.36$ , P-values = 0.55). This finding implies that the migrants migrated to the cities due to the presence of job opportunities that yields some money out of which some were remitted home for the upkeep of the family.

The Chi – square analysis also revealed that there is significant relationship between lack of social amenities and infrastructures in the rural areas and migrating of the youth to the cities ( $X^2 = 0.26$ , P-values = 0.61). The finding implies that the migrants migrated from their place of

origin which is characterized with low availabilities of social infrastructure to urban areas where there is more opportunities for venturing into businesses that attracts some income, thereby remitting to the family at home to purchase food stuffs and other needs of the family at home (Table 6).

### CONCLUSIONS AND RECOMMENDATIONS

Youth rural urban migration directly impacts the economy and especially crop production of the rural household in the Sokoto metropolitan area, owing to a number of reasons. Firstly, the youth who form the majority of the and energetic group of rural residents often migrate to urban centres because of push factors like lack of job opportunities, social amenities and infrastructures in rural areas. Secondly, the preference to relocate to urban centres to search for jobs and make remittance back home in rural areas to support family members financially in order to meet the cost of food and other necessities for the welfare and to improve the socio-economic status of the household. As result of the findings it was concluded

that migration of the youth (wards) to the cities is more appreciable to their parents than remaining home idle. Based on these realities, these types of researches are crucial for the development of the Sokoto Metropolitan area and its rural environs.

Based on the above the following recommendations deemed necessary:

1. Provision of social amenities and establishment of cottage industries in the rural areas is necessary to enable the rural residents live a very descent and comfortable live.
2. Government should encourage private sectors to invest in the villages more especially on agricultural activities.
3. Provision of subsidized agricultural inputs such as fertilizers, pest and herbicides, animal drawn plough and irrigation facilities that enable the rural farmers to have appreciable yield is highly recommended.
4. Rural populace should be encourage to establish projects with the aid of community driven development projects in the rural areas.

### Conflict of Interest

The author(s) have not declared any conflict of interests.

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*Full Length Research Paper*

## Factors encouraging ICT usage by agricultural extension scientists in North India

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The role of Information and Communication Technology (ICT) in the research institutions and universities is becoming increasingly prominent because of the potential value of such technologies. ICTs can be used to increase effectiveness and efficiency of extension system. So, in this era of information revolution, the agricultural extension Scientists should be encouraged to use ICTs for extension education. Therefore, the study on “Factors encouraging ICT usage by Agricultural Extension Scientists in North India” was conducted. Factors encouraging ICT usage were categorized under the headings of economic factors, facilitating factors, social and psychological factors and technical factors. Data for the study were collected from the agricultural extension scientists who work in State Agricultural Universities and research institutes under Indian Council of Agricultural Research (ICAR) in North India through the use of a pre-tested on-line questionnaire. Provision of grants to buy ICTs, availability of sufficient number of ICT tools, sufficient ICT familiarity and expertise and in-service training facilitation for using/producing ICTs were observed as serious factors in the effective usage of ICTs. The Duncan’s Multiple Range Test (DMRT) result showed that in usage of ICT there was a significant difference between economic factors with facilitating factors and social and psychological factors. Enabling policies and plans for usage of ICTs for dissemination of agricultural information need to be developed.

**Key words:** Information, communication, technology, usage, agricultural extension scientist.

### INTRODUCTION

Information and Communication Technology (ICT) has pervaded all walks of modern life and society so profoundly that the modern society is colloquially known as information society and has revolutionized the development process itself by influencing its manifold dimensions be it economic, social, political, cultural, environmental, ethical, behavioral, etc. (Kumar et al., 2010). In today's world, professionals with little or no

knowledge of ICT have a much more difficult task before them in comparison to co-workers at the same level but with a reasonable knowledge of ICT (Madadi et al., 2011). ICT has an important role in connecting research, extension and the market toward expanding the professional and entrepreneurship abilities, capacities among the experts and the agricultural communities (Arkhi et al., 2008). To make farm information and

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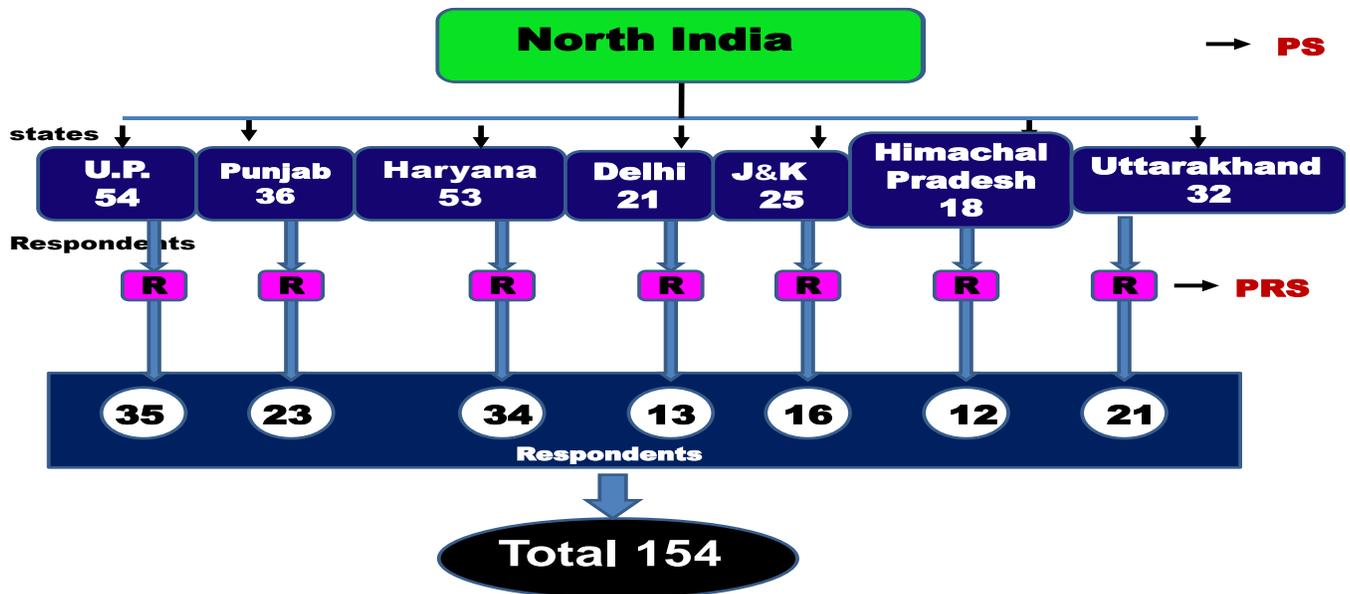


Figure 1. Sampling plan.

technology transfer more effective, greater use will need to be made of modern ICT among researchers, extension personnel, farmers and other stakeholders (Saravanan, 2010).

Asemi (2005) did a case study of Medical sciences University of Isfahan (MUI), Iran. The results of the study showed that all the respondents used the internet frequently because all faculties had an internet connection. Baldwin and Sabourin (2001) found that there was a positive relationship between ICT use and superior performance by Canadian manufacturing sector. A study conducted by Druueckhammer et al. (1986) found a large majority of agricultural education teachers in Louisiana who had computers failed to use them. One reason was a lack of training and another reason was computer anxiety. Martin (1998) has studied computer anxiety levels of Virginia cooperative extension field personnel. He found that computer experiences were associated with self-efficacy. A person with a high self-efficacy level will be less anxious working with computers than a person with a low level. Mashhadi et al. (2007) concluded in his research that a meaningful relationship exists between ages, work experience, computer and the internet related skills, and peoples' perspective towards ICT with the amount of usage of ICT. Yaghoobi and Chizari (2005) found in their research that the usage of ICT was directly related to factors such as age, gender, computer literacy, specialization, knowledge of and access to the internet, their perspective of the internet, and the level of relationship with coworkers. According to Zhang (2005), the efficient usage of the internet was proportional to age, gender, and amount of education. Baliram (2009) concluded that younger scientists having

more expertise and high use of ICT than old and middle age group scientists. Wema (2010) concluded that most livestock researchers were not aware of most of the e-resources available hence they could not access and use them effectively in their research work.

## MATERIALS AND METHODS

The National Agricultural Research System (NARS) in India comprises essentially two main streams, viz. the Indian Council of Agricultural Research (ICAR) at the national level and the State Agricultural Universities (SAUs) at the state level. In India, there are 65 state agricultural universities and 99 research institutes under ICAR (47 Institutions, 4 Deemed Universities, 17 National Research Centers, 6 National Bureaus and 25 Directorates). The study included all agricultural extension scientists working in state agricultural universities and research institutes under ICAR (Institutions, Deemed Universities, National Research Centers, National Bureaus and Directorates) in North India. North India comprises of seven states: Uttar Pradesh, Haryana, Uttarakhand, Himachal Pradesh, Jammu, Kashmir, Punjab and New Delhi and the number of agricultural extension scientists in State Agricultural Universities and ICAR institutes in each state respectively are 54, 53, 32, 18, 25, 36 and 21 (Figure 1).

A complete list of agricultural extension scientists who work in State Agricultural Universities and Research Institutes under ICAR (institutions, deemed universities, national research centers, national bureaus and directorates) in North India was prepared. Scientists in this study are those who have positions of Assistant Professor, Associated Professor and Professor in universities and who have positions of Scientist, Senior Scientist and Principal Scientist in institutions. Information about number of agricultural extension scientists in State Agricultural Universities and ICAR institutes in each state was gathered through relevant websites and confirmed from the respective offices of the university/institute through telephonic conversation. Respondents were selected from the population by using Proportionate Random Sampling (PRS)

**Table 1.** Distribution of respondents based on their perception about economic factors encouraging ICT usage (n = 154).

| S/No | Items   | Most important | Important | Less important | Not important | Mean score | Rank |
|------|---|----------------|-----------|----------------|---------------|------------|------|
| 1    | Provision of grants to buy ICTs                           | 96(62.4)       | 51(33.1)  | 7(4.5)         | 0             | 3.58       | I    |
| 2    | Financial inputs for training on ICT production and usage | 97(63.0)       | 49(31.8)  | 8(5.2)         | 0             | 3.57       | II   |
| 3    | Economic support for software purchases                   | 87(56.6)       | 59(38.3)  | 7(4.5)         | 1(0.6)        | 3.51       | III  |
| 4    | Availability of exclusive budget for ICT projects         | 86(55.9)       | 59(38.3)  | 6(3.9)         | 3(1.9)        | 3.48       | IV   |

Figures in parenthesis indicate percentage.

**Table 2.** Classification of respondents based on their perception about economic factors encouraging ICT usage (n = 154).

| Category       | Frequency | Percentage |
|----------------|-----------|------------|
| Low (<11)      | 9         | 5.85       |
| Medium (11-13) | 44        | 28.57      |
| High (>13)     | 101       | 65.58      |

method. For the study, 154 respondents were selected by Proportionate Random Sampling method. Primary data were elicited using a well-structured questionnaire. Factors encouraging ICT usage were categorized under the headings of economic factors, facilitating factors, social and psychological factors and technical factors. Factors were assessed by using a four point continuum viz., Most Important, Important, Less Important and Not Important with the weightage of 4, 3, 2 and 1, respectively. Total score with respect to this variable for a respondent was the sum of the scores obtained by him/her on three factors and the respondents were classified into three groups as low, medium and high based on cumulative square root frequency method. The mean score for a particular item was worked out by dividing the weighted score of the item with the total number of respondents. To compare differences of the factors, data were analyzed by ANOVA, and then Duncan's multiple range test was used to determine the difference between means ( $P < 0.05$ ). Data were analyzed with a statistical software program (SPSS 11.5, 2004).

## RESULTS AND DISCUSSION

### Factors encouraging ICT usage

#### *Economic factors*

An attempt was made to know the economic factors encouraging ICT usage. According to Table 1, among economic factors, provision of grants to buy ICTs, with 3.58 MS, obtained first rank as it was perceived most important by 62.3% of respondents. Financial inputs for training on ICT production and usage was on second rank with 3.57 MS, whereas, economic support for software purchases obtained third rank with 3.51 MS. The fourth rank was occupied by availability of exclusive budget for ICT projects, with 3.48 MS. According to the

results of Karimi et al. (2011), among economic factors given loans or grants to buy ICT equipments was the most important factor encouraging educators to use ICTs. Table 2 revealed that majority of the respondents belonged to high category (65.58%) followed by 28.57% and 5.85% who belonged to medium and low category, respectively based on economic factors encouraging ICT usage.

#### *Facilitating factors*

According to Table 3, among facilitating factors, availability of sufficient number of ICT tools, with 3.43 MS, was on first rank. Investments of the institution/university on infrastructure for ICTs got second rank, with 3.41 MS. Whereas, availability of software on third rank with 3.40 MS. 'Developing the policies and plans for usage of ICTs for dissemination of agricultural information', with 3.34 MS, obtained the fourth rank. Hyesung (2004) showed that facilitating conditions had a significant direct effect on the intention to use information technology. Karimi et al. (2011) among facilities variables, availability of computer and Internet was the most important factor influencing educators to use ICTs, and good light and temperature of computer center was the least important factor. They showed that when computer and Internet connection is provided and handy, individuals feel more comfortable to use them.

Table 4 revealed that majority of the respondents were in high category (52.60%) followed by 38.31% and 9.09% who belonged to medium and low category, respectively.

**Table 3.** Distribution of respondents based on their perception about facilitating factors encouraging ICT usage (n = 154).

| S/N | Items   | Most important | Important | Less important | Not important | Mean | Rank |
|-----|---|----------------|-----------|----------------|---------------|------|------|
| 1   | Availability of sufficient number of ICT tools  | 84(54.5)       | 57(37.0)  | 9(5.8)         | 4(2.6)        | 3.43 | I    |
| 2   | Investments of the institution/ university on infrastructure for ICTs                             | 78(50.6)       | 64(41.5)  | 10(6.5)        | 2(1.3)        | 3.41 | II   |
| 3   | Availability of software  | 74(48.1)       | 68(44.2)  | 11(7.1)        | 1(0.6)        | 3.40 | III  |
| 4   | Developing the policies and plans for usage of ICTs for dissemination of agricultural information | 69(44.8)       | 69(44.8)  | 15(9.7)        | 1(0.6)        | 3.34 | IV   |

Figures in parenthesis indicate percentage.

**Table 4.** Classification of respondents based on their perception about facilitating factors encouraging ICT usage (n = 154).

| Category       | Frequency | Percentage |
|----------------|-----------|------------|
| Low (<11)      | 14        | 9.09       |
| Medium (11-13) | 59        | 38.31      |
| High (>13)     | 81        | 52.60      |

**Table 5.** Distribution of respondents based on their perception about social and psychological factors encouraging ICT usage (n = 154).

| S/N | Items  | Most important | Important | Less important | Not important | Mean | Rank |
|-----|--|----------------|-----------|----------------|---------------|------|------|
| 1   | Sufficient ICT familiarity and expertise   | 93 (60.4)      | 51 (33.2) | 9 (5.8)        | 1 (0.6)       | 3.53 | I    |
| 2   | ICT improves self-efficacy   | 77 (50.0)      | 69 (44.8) | 8 (5.2)        | 0             | 3.45 | II   |
| 3   | Feeling the need to use a technology   | 73 (47.5)      | 67 (43.5) | 13 (8.4)       | 1 (0.6)       | 3.38 | III  |
| 4   | Rewarding the ICT usage efforts of scientists in research, teaching and extension activities | 72 (46.8)      | 63 (40.9) | 13 (8.4)       | 6 (3.9)       | 3.30 | IV   |

Figures in parenthesis indicate percentage.

### **Social and psychological factors**

According to Table 5, among social and psychological factors, sufficient ICT familiarity and expertise, with 3.53 MS, was on first rank. ICTs contribution in improving self-efficacy with 3.45 MS was on second rank. The third rank was occupied by 'Feeling the need to use a technology', with 3.38 MS. 'Rewarding the ICT usage efforts of scientists in research, teaching and extension activities', with 3.30 MS was on fourth rank. The result in Table 5 revealed that though sufficient ICT familiarity and expertise ranked first among the social and psychological factors encouraging ICT usage among the respondents, the other factors such as its contribution towards self-efficacy, feeling the need to use the technology and appropriate rewards for ICT usage also were found almost equally important factors encouraging ICT usage. Hence, policy makers and administrators have to pay special attention to all the above four factors to

encourage ICT usage. According to Hyesung (2004), computer self-efficacy had a significant direct effect on the intention to use information technology.

Table 6 revealed that majority of the respondents were in medium category (51.95%) followed by 38.31% and 9.74% who belonged to high and low category, respectively.

### **Technical factors**

A close look at Table 7 indicates that in-service training facilitation for using/producing ICTs was on first rank and it was perceived by 90 scientists as most important technical factor, only one scientist perceived it as not important. On the second rank, access to a specialized person who can solve technical difficulties faced in institute/ university' was perceived as most important technical factor by 57.8% scientists, followed by

**Table 6.** Classification of respondents based on their perception about social and psychological factors encouraging ICT usage (n = 154).

| Category       | Frequency | Percentage |
|----------------|-----------|------------|
| Low (<12)      | 15        | 9.74       |
| Medium (12-14) | 80        | 51.95      |
| High (>14)     | 59        | 38.31      |

**Table 7.** Distribution of respondents based on their perception about technical factors encouraging ICT usage (n = 154).

| S/N | Items  | Most important | Important | Less important | Not important | Mean | Rank |
|-----|--|----------------|-----------|----------------|---------------|------|------|
| 1   | Sufficient ICT familiarity and expertise   | 90 (58.4)      | 60 (39.0) | 3 (1.9)        | 1 (0.6)       | 3.55 | I    |
| 2   | ICT improves self-efficacy   | 89 (57.8)      | 52 (33.8) | 12 (7.8)       | 1 (0.6)       | 3.49 | II   |
| 3   | Feeling the need to use a technology   | 77 (50.0)      | 69 (44.9) | 7 (4.5)        | 1 (0.6)       | 3.44 | III  |
| 4   | Rewarding the ICT usage efforts of scientists in research, teaching and extension activities | 77 (50.0)      | 65 (42.2) | 9 (5.8)        | 3 (1.9)       | 3.40 | IV   |

Figures in parenthesis indicate percentage.

**Table 8.** Classification of respondents based on their perception about facilitating factors encouraging ICT usage (n = 154).

| Category       | Frequency | Percentage |
|----------------|-----------|------------|
| Low (<11)      | 5         | 3.25       |
| Medium (11-13) | 53        | 34.41      |
| High (>13)     | 96        | 62.34      |

**Table 9.** Duncan's Multiple Range Test (DMRT) to compare differences of factors encouraging ICT usage.

| Factors encouraging ICT usage    | Mean±SEM                 | Critical difference |
|----------------------------------|--------------------------|---------------------|
| Economic factors                 | 14.14±0.16 <sup>a</sup>  | 0.44                |
| Facilitating factors             | 13.56±0.16 <sup>b</sup>  |                     |
| Social and Psychological factors | 13.66±0.15 <sup>b</sup>  |                     |
| Technical factors                | 13.87±0.15 <sup>ab</sup> |                     |

<sup>a,b</sup> different words with in colons for each of A, B, C and D factors show significant difference at the level of P < 0.05.

important (33.8%), less important (7.8%) and only one scientist perceived it as not important. Investments of the institution/university on the support services of ICTs, was on third rank with 3.44 MS. The fourth rank was occupied by provision of supportive services to facilitate ICT usage with 3.40 MS. These findings clearly indicate the need to organize specialized training programs for AESs for production of ICTs, enhanced budget allotments for ICT, and provision of supportive services as well as technical help to AESs who are interested in production of ICTs.

This result was in conformity with Karimi et al. (2011) who showed that among technical factors encouraging ICT usage, access to a specialized person who can solve technical difficulties when facing, got second rank by vocational agricultural educators in Iran.

Table 8 revealed that majority of the respondents were belonging to high category (62.34%) followed by medium (34.41%) and low (3.25%) categories, respectively. Table 9 shows that economic factors have a significant effect (p < 0.05) on encouraging ICT usage in comparison to faci-

lities factors and social and psychological factors. However, there is no significant difference between economic factors and technical factors. Hence, care has to be taken to ensure availability of ICT tools in institutes/universities along with latest softwares. Apart from developing infrastructure for ICTs, attention has to be given on formulation of policies and plans for usage of ICTs for dissemination of information.

## Conclusion

Provision of grants to buy ICTs, availability of sufficient number of ICT tools, sufficient ICT familiarity and expertise and in-service training facilitation for using/producing ICTs were observed as serious factors in the effective usage of ICTs by Agricultural Extension Scientists which needs attention of planners and policy makers in Agricultural extension.

## Conflict of Interests

The author(s) have not declared any conflict of interests.

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*Full Length Research Paper*

## Impact of agricultural modernization on sustainable livelihood among the tribal and non-tribal farmers

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The sustainable livelihood links with security to basic human needs, food security, sustainable agricultural practices and poverty has an integrating concept. A large number of tribal communities are bereft of stable livelihood and thus they fall in the category of the vulnerable section of Indian society. Considering this fact, the study was conducted in Sabarkantha district of North Gujarat region of Gujarat state, as the economy of the district is basically dependent on agriculture. The farmers of Sabarkantha district are also innovative as well as enthusiastic in modern agriculture. Secondly, the districts rank first with respect to the tribal population. Looking to the common situation of the inhabited villages for the tribal and non-tribal farmer, 11 villages of Bhiloda and Meghraj talukas, having scheduled tribal population of 41 to 50 range of percentage were selected purposively. Total 220 farmers were selected from these villages (20 farmers in each village). For measuring the agricultural modernization and sustainable livelihood of the tribal and non tribal farmer's teacher made tests were developed. The thirteen major criteria of agricultural modernization and twelve sub indicators of sustainable livelihood were determined and total 200 score of agricultural modernization and total 300 score of sustainable livelihood was determined by conference method. The results showed that in case of tribal group, there was positively and significant association between the sustainable livelihood and seven criteria for agricultural modernization viz., extent of use of organic fertilizers, farming pattern, seed selection, available modern sources of energy equipments, extent of use of chemical fertilizers, use of plant protection measures and extent of use of improved dairy practices. While in case of non tribal group, all the 13 criteria of agricultural modernization studied were possessed positive and significant association with sustainable livelihood. It indicated the impact of the agricultural modernization on the extent of sustainable livelihood among the non tribal respondents, while it was very low in tribal farmers.

**Key words:** Bereft, modernization, sustainable livelihood, transition.

### INTRODUCTION

Agricultural modernization means from traditional agriculture to modern agriculture transformation process and means. In this process, the agriculture with modern industry, increasing in modern science and technology

and modern economy management method, make up the agricultural productivity by backward traditional agriculture increasingly contemporary world advanced level of agriculture. Agricultural modernization is a

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psychological state of farmer's mind. Indian society has been undergoing far reaching changes over the last two hundred years and some of all these changes can be subsumed under modernization. India provides a vast and fascinating laboratory for research into modernization. The main factor in the modernization process is represented by the levels of functional achievement attainable as a result of rapid and continuing growth of knowledge and technology in particular. There has been a transition from traditional farming to modern commercial agriculture, due to availability and growth of infrastructural facilities like improved seeds, varieties, fertilizers, pesticides, supplies and services, market facilities, literacy, mass media, research, teaching and extension. In India, agriculture and agro-based industries play an important role in the improvement of the rural economy. At present, about 70% of Indians depend on agriculture for their livelihoods. It is a major constituent of the Indian economy that accounts for not only the main source of income to the rural population, but also has a decisive say in all economic policies of India. Small and marginal farmers constitute a major portion of the rural agriculture sector. The Indian industry is also largely reliant on agriculture for both inputs and end-user applications. However, the limited availability of land, the limited cash returns, and agriculture being confined to one or two seasons in the year, have made the villagers look for other livelihood support systems for their sustenance. A large number of tribal communities are bereft of stable livelihoods and thus they fall in the category of the vulnerable section of Indian society. Therefore, It is essential to provide the latest information regarding the agricultural modernization to sharpen their knowledge in terms of assets and activities required for a means of living, not only living but have been lead to formalization of the sustainable livelihood approach. Considering this fact, the study was carried out with the objective to evaluate the impact of agricultural modernization on sustainable livelihood of tribal and non-tribal farmers.

## METHODOLOGY

The present study was conducted in Sabarkantha district of North Gujarat region of Gujarat state. The economy of the district is basically dependent on agriculture, as 62.8% workers are engaged in primary sector and the farmers of Sabarkantha district are innovative as well as enthusiastic in modern agriculture. Sabarkantha ranked first with respect to the tribal population in the state. Considering the highest tribal population, multistage random sampling technique was used to select the respondents. According to the Census - 2001 (Anonymous, 2001), proportion of scheduled tribes population to total population in villages are categorized in 9 different percentage ranges at district level, that is, zero percentage range of scheduled tribes population to 76 and above percentage range. It is seen that only 14 villages out of 1,372 were having percentage range of scheduled tribes population of 41 to 50; covered in Khedbrahma, Vijaynagar, Bhiloda, and Meghraj talukas of the district. Among these four talukas, considering the numbers

of villages, Meghraj and Bhiloda talukas were selected purposively. Looking to the common situation of the inhabited villages for the tribal and non-tribal farmers, 11 villages of Bhiloda and Meghrajtalukas, having scheduled tribes population of 41 to 50 range of percentage were selected purposively. Total of 220 farmers were selected from these villages (20 farmers in each village). For measuring the agricultural modernization and sustainable livelihood, teacher made test were developed. The test of agricultural modernization was consisted of the major thirteen criteria. The criteria discussed with the experts and total 200 score of agricultural modernization was determined by conference method. For standardizing the score, the Agricultural Modernization index (AMI) was calculated, for each individual respondent and grouped into three categories viz., low, medium and high AMI. The test of sustainable livelihood was also developed with the help of three main indicators and 12 sub indicators were included after discussion with experts and total 300 score of sustainable livelihood was determined. For standardizing the score, the Sustainable Livelihood Index (SLI) was calculated for each individual respondent.

## RESULTS AND DISCUSSION

In the era of globalization the question of sustainable livelihood has captured all the points of discussion. Various people have defined livelihood differently. Chambers and Conway (1992) define livelihoods as: "A livelihood comprises the abilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities to the next generation; and contribute net benefits to other livelihoods at the local and global levels in the long and in the short term." The concept of sustainable development has acquired the central theme of any tribal development. The concept of sustainable development emerged in the 1980s. It propelled a paradigm shift in development thinking, and continues to dominate the development-discourse at various levels, from the local to global. The best explanation to sustainable development was given by the World Commission for Environment and Development (WCED, 1987), "Our common future", as, "the ability to meet the needs of the present without compromising the ability of the future generation to meet their own needs". The concept of livelihood is rapidly gaining acceptance as a valuable means of understanding the factors that influence people's lives and well-being. "It is comprised of capacities, assets, and activities required for means of living. A livelihood will be sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capacities and assets, both now and in the future, while not undermining the natural resource base" (Carney, 1998). Sustainable livelihood is a way of thinking about the objectives, scope and priorities for development, in order to enhance progress in poverty elimination. Sustainable livelihood aims to help poor people achieve lasting improvements against the indicators of poverty that they

**Table 1.** Correlation coefficient of criteria of agricultural modernization with sustainable livelihood of tribal and non-tribal respondents (n = 220)

| S/No. | Name of criteria for agricultural modernization                              | Correlation coefficient "r" value |                    |
|-------|--|-----------------------------------|--------------------|
|       |  | Tribal farmers                    | Non-tribal farmers |
| 1     | Farming pattern (X1)   | 0.1892*                           | 0.3045**           |
| 2     | Seed selection (X2)  | 0.1907*                           | 0.3660**           |
| 3     | Use of irrigation system (X3)  | 0.1795 NS                         | 0.2024*            |
| 4     | Use of underground pipeline for irrigation (X4)                              | 0.1670 NS                         | 0.2130*            |
| 5     | Use of transportation facility for marketing of agricultural production (X5) | 0.1589 NS                         | 0.5779**           |
| 6     | Available modern machinery and implements (X6)                               | 0.1633 NS                         | 0.2385*            |
| 7     | Available modern sources energy equipments (X7)                              | 0.1924*                           | 0.2289*            |
| 8     | Extent of use of chemical fertilizers (X8)                                   | 0.2012*                           | 0.3263**           |
| 9     | Extent of use of organic fertilizers (X9)                                    | 0.2823**                          | 0.2095*            |
| 10    | Extent of use of storage facility (X10)                                      | 0.1562 NS                         | 0.2125*            |
| 11    | Use of Plant protection measures (X11)                                       | 0.2023*                           | 0.4657**           |
| 12    | Extent of use of harvesting structures (X12)                                 | 0.1724 NS                         | 0.2384*            |
| 13    | Extent of use of Improved dairy practices (X13)                              | 0.2182*                           | 0.3230**           |

\*,\*\* significant at 5 and 1% levels of significance. NS = Non-significant.

define. In spite of all these development initiatives the tribal in our country are still threatened by severe poverty (Mishra, 2007).

#### Relationship between selected criteria for agricultural modernization index and the sustainable livelihood of tribal and non-tribal respondents

On the basis of the operational measures developed for the variables, null hypotheses were stated for testing the relationship and their significance on zero order correlations. The zero order correlations were presented in Table 1. It is clear from the results (Table 1) that out of 13 criteria of the AMI among the tribal respondents, the correlation coefficient of one criteria *viz.*, "extent of use of organic fertilizers" (0.2823) was statistically found to be positively and significantly correlated with sustainable livelihood index at 0.01 level of significance, whereas 6 criteria *viz.*, farming pattern (0.1892), seed selection (0.1907), available modern sources of energy equipments (0.1924), extent of use of chemical fertilizers (0.2012), use of plant protection measures (0.2023) and extent of use of improved dairy practices (0.2812) were statistically found to be positively and significantly correlated with sustainable livelihood index of tribal respondents at 0.05 level of significance. As far as the criteria, *viz.*, use of irrigation system, use of underground pipeline for irrigation, use of transportation facility for marketing agricultural production, available modern machinery and implements, extent of use of storage facility and extent of use of harvesting structures concerned, the computed correlation coefficient were found to be positive but non-significant. The above

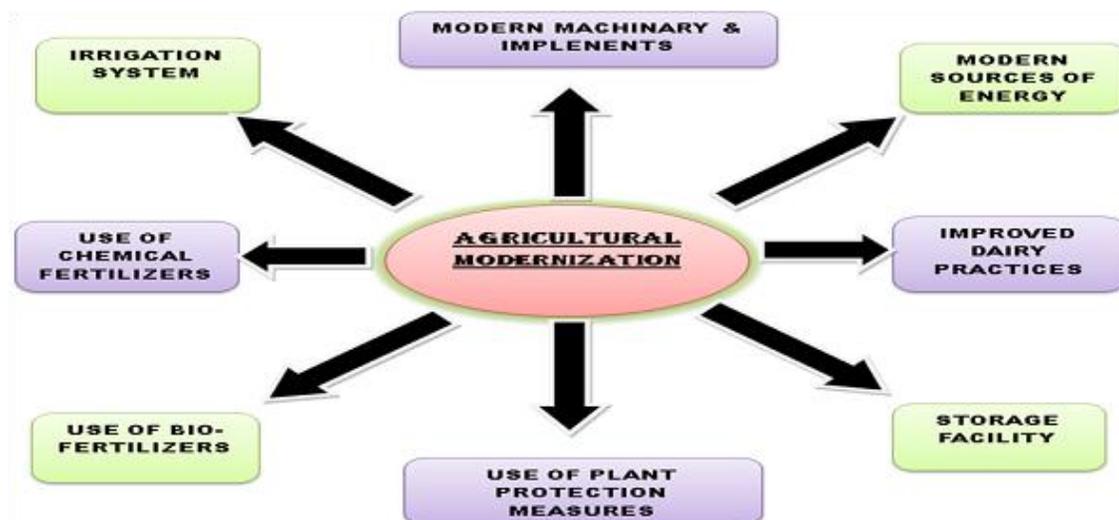
discussion leads to be concluded that criteria of agricultural modernization (Figure 1) *viz.*, extent of use of organic fertilizers, farming pattern, seed selection, available modern sources energy equipments, extent of use of chemical fertilizers, use of plant protection measures, extent of use of improved dairy practices affected significantly and positively the sustainable livelihood of tribal farmers. The probable reason might be that the tribal farmers have somewhat changed their traditional farming to scientific farming and more attention towards the dairy practices and obtain the advantage of communication system as well as marketing and input supply and, services and facilities. The animals are the source of organic manure and also subsidiary income might gave courage to take risk to adopt such a new concept of organic farming, which was directly or indirectly influenced and extent of sustainable livelihood.

While in case of non-tribal respondents, out of 13 criteria of the AMI, the correlation coefficient of six criteria *viz.*, farming pattern (0.3045), seed selection (0.3660), use of transportation facility for marketing agricultural production (0.5779), extent of use of chemical fertilizers (0.3263), use of plant protection measures (0.4657) and extent of use of improved dairy practices were statistically found to be positively and significantly correlated with sustainable livelihood at 0.01 level of significance, while remaining seven criteria *viz.*, use of irrigation system (0.2024), use of underground pipeline for irrigation (0.2130), available modern machinery and implements (0.2385), available modern sources of energy equipments (0.2289), extent of use of organic fertilizers (0.2095), extent of use of storage facility (0.2125) and extent of use of harvesting structures (0.2384) were statistically found to be positively and significantly

**Table 2.** Association between the agricultural modernization of the tribal and non-tribal respondents and their sustainable livelihood.

| Consequent variable        | Correlation coefficient „r“ value |                    |
|----------------------------|-----------------------------------|--------------------|
|                            | Tribal farmers                    | Non-tribal farmers |
| Agricultural modernization | 0.1527NS                          | 0.3613**           |

\*\* Significant at 1% levels of significance. NS= Non-significant.



**Figure 1.** Agricultural Modernization index (AMI).

correlated with sustainable livelihood at 0.05 level of significance (Table 1). The above discussion leads to be concluded that all selected criteria for agricultural modernization were significantly and positively correlated with sustainable livelihood of non-tribal respondents. It is interesting that all criteria for agricultural modernization were applied by the non-tribal respondents and changed their traditional ways of livelihood. It was indicated that, the impact of the agricultural modernization on the extent of sustainable livelihood among the non-tribal respondents. The probable reasons might be that the non-tribal respondents have changed their ways of living owing to distinguishes changes of assets *viz.*, natural, social, human, physical and financial.

### Evaluate the impact of agricultural modernization on sustainable livelihood

It is clear from Table 2 that the agricultural modernization (0.1527) was positively but non-significantly correlated with sustainable livelihood of tribal respondents, while the agricultural modernization (0.3613) was positively and significantly correlated with sustainable livelihood of non-tribal respondents at 0.01 level of significance. Therefore, it can be concluded that the agricultural modernization

was more affected for the sustainable livelihood of non-tribal respondents in comparison of tribal respondents. The probable reason might be that sustainable livelihood index is the function of many indicators. All the identified indicators of sustainable livelihood have adopted the agricultural modernization. However, it was observed very low in tribal respondent. Siva and Eswarappa (2005) also reported that during the last 50 years the planning process in India has failed to reduce the disparity between the tribal and non tribal populations. Today, the first and foremost problem before tribal communities in India is how to earn and sustain livelihoods. There are varieties of livelihoods practices by the tribal communities in different part of India and elsewhere, such as by the hunter-gatherers, pastoralist, shifting cultivators, who live in different environments. A number of changes have been taking place with regard to the land use, access, control and utilization of their resource and these changes in term have largely affected the sustainable livelihoods of the people without any sustainable replacement.

### Conclusion

It can be concluded that the impact of agriculture

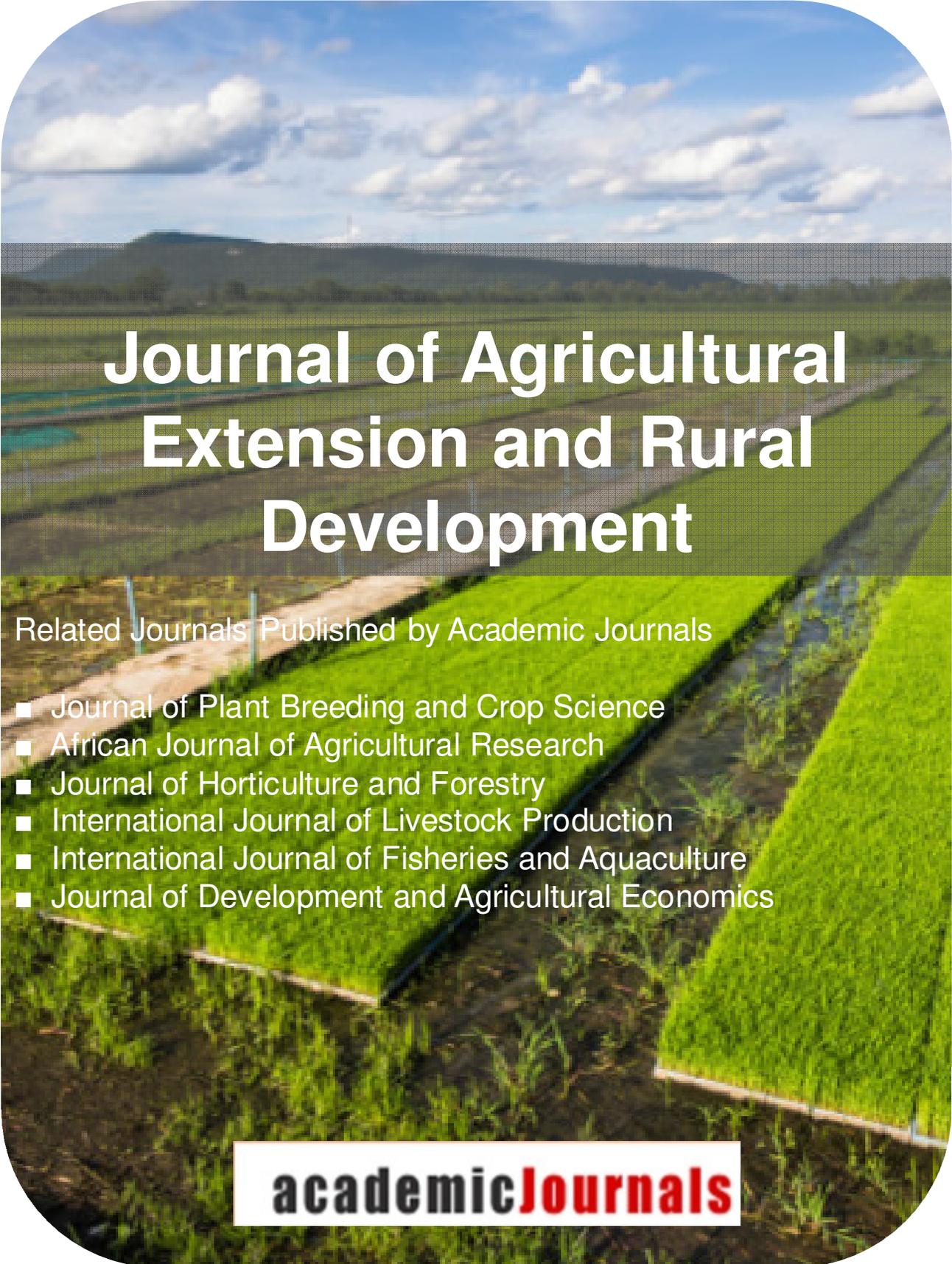
modernization was more affected for the sustainable livelihood of non-tribal respondents in comparison to tribal respondents. It indicated that the non-tribal respondents have changed their ways of living owing to distinguishes changes of assets viz., natural, social, human, physical and financial. However it was observed very low in tribal respondents.

### **Conflict of Interests**

The author(s) have not declared any conflict of interests.

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