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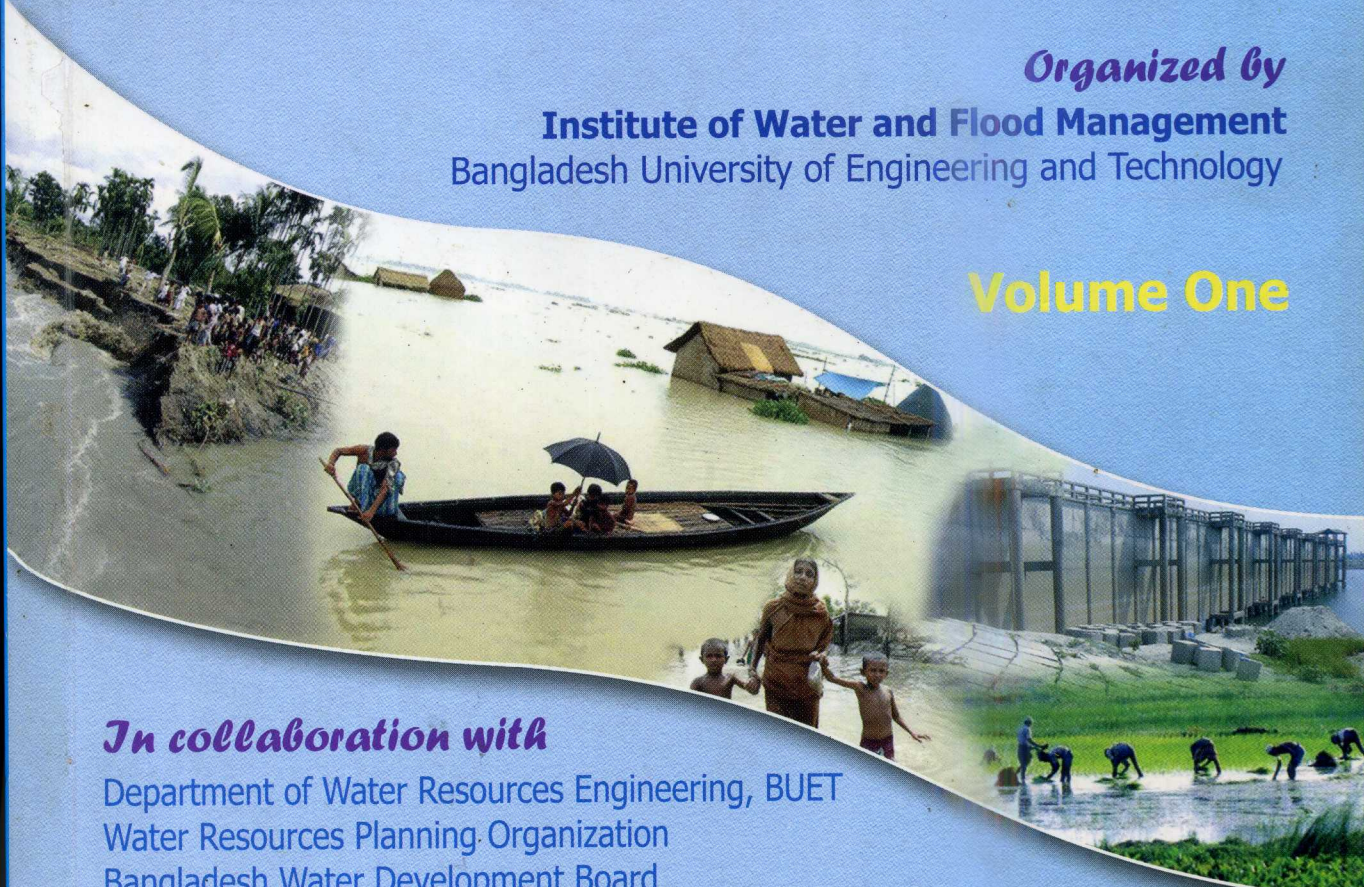
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AWARENESS AND ATTITUDE OF SOLID WASTE DISPOSAL AND WATER POLLUTION IN UPPER MAHAWELI CATCHMENT IN SRI LANKA

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Abstract

Solid waste generation and river water pollution are growing environmental problems in Sri Lanka. The crisis of solid waste disposal and its impact on water pollution cannot be understood and controlled only by technical or engineering strategies. The environmental sociological perspectives are helpful to understand the actual subjective factors and forces of solid waste generation and water pollution. It is very important to comprehend the environmental awareness, attitude, perception and concern of people in the process of sustainable solid waste management and integrated water resource management. This paper basically attempts to analyze the awareness and attitude of people in terms of solid waste disposal and water pollution in upper Mahaweli, Sri Lanka. The sub-catchment of Pinga Oya, a tributary of Mahaweli was used as the main field of this study.

This paper is part of the study of effects of socio-economic and political factor in solid waste generation and water pollution in river Mahaweli. Semi-structured questionnaires (200 household & 150 shop-owners) and (35) in-depth interviews with key informants were used to collect quantitative and qualitative data from upper Mahaweli watershed areas. The samples were selected on stratified basis and purposively and data were analysed quantitatively and qualitatively. The secondary information was mostly collected from the sociological literature.

The awareness and attitude of people in the upper Mahaweli catchment was found to be very influential for solid waste disposal and water pollution. Households (86%) are more aware of the environmental issues related to solid waste disposal and water pollution than shop-owners (62%). Awareness of women (74%) is higher than men (52%) and women are conscious on local environmental issues based on environmental health crisis whereas men are interested in national or provincial level issues based on political-economic background. When it comes to environmental attitude of people, the results of this study is found to be deviating from some of the universal trends. Households, female, elders, Sinhalese (ethnic group) and people with lower education level hold stronger environmental attitude and concern. Elders and people with lower education level who maintain closer relationship with local eco-system economically and culturally and frequently subject to environmental health issues are very much conscious about crises related to solid waste and water pollution. As a results, a grassroots environment social movement is emerging among these environmentally concern people against the improper solid waste disposal and water pollution in river Mahaweli.

1 INTRODUCTION

This paper basically attempts to examine the awareness and attitude of people in terms of solid waste disposal and water pollution based on the study of effects of socio-economic and political factors in solid waste generation and water pollution in Upper Mahaweli catchment (UMC). Although the natural sciences have been dealing very much with the crisis of solid waste and water pollution, the relevant sociological perspectives are helpful to understand the actual subjective factors and forces of solid waste disposal and its connection with water pollution. Therefore, sociological or environmental sociological approach can realize subjective causes and effects of the solid waste

Among the rivers, Mahaweli is the largest river basin found in Sri Lanka estimated as in draining 16 percent of Sri Lanka's land surface (10327 km). The Mahaweli irrigation system makes a considerable contribution to national food production and it still serves as the leading hydro-electricity generator to the nation. *Pinga Oya* is one of the important tributaries of the Sri Lanka's longest river *Mahaweli*. The stream originates in the mild rolling terrain of *Pujapitiya* division of *Kandy* district in the Central Province and flows through a course of 6 km before it meets *Mahaweli* River just upstream of the *Polgolla* diversion barrage of the *Mahaweli* multipurpose irrigation scheme. The upper part of the *Pinga Oya* catchment belongs to the *Pujapitiya* division which is a mildly populated rural and sub-urban area with a largely agricultural land use, whereas the downstream part belongs to the densely (Muslims) populated *Akurana* division. The stream runs through *Akurana* town which has the second highest population density in Sri Lanka (Census & Statistic Department, 2007).

The quantity of solid waste has also increased over the period of years in Sri Lanka with changes in consumption patterns. Analysis of data has revealed that the per-capita day waste generation on the average was 0.85 kg in Colombo Municipal Council, 0.75 kg in other Municipal Councils, 0.60 kg in Urban Councils and 0.40 kg in Village councils (ARRPET, 2006). The primary source of the solid waste is households, markets and commercial establishments while the secondary sources are industries and hospitals. Daily waste collection by Local Authorities is estimated at 2683 tons. However, the total solid waste generated in Sri Lanka is assumed to be around 6400 tons per day. The major proportion of the solid waste stream in Sri Lanka is dominated by organic waste fractions generated from households, markets, and slaughterhouses (UNEP, 2006).

Water of river *Mahaweli* is polluted mainly by soil erosion, chemical and agricultural pollutants, industrial pollution and solid waste disposal (The Ministry of Forestry and Environment, 2000). The solid waste disposal is one of the leading causes of water pollution in *Mahaweli* (Werellagama, 2000). Most of the solid waste is dumped or processed as open dumping site on the river basins. In *Pinga Oya*, the average DO decreased from 5mg/l to 4mg/l and NO₃ - N increased from 0.5 mg/l to 1.75 mg/l in 2003. Further, fecal coliform levels as high as 7500 pfu / 100 ml was measured. There is a strong relationship between fecal pollution and human settlements indicating frequent biological contamination from human excreta and solid waste discharged from houses and shops (Herath, 2003).

The concept of awareness and attitude are very important in understanding the environmental issue as well as environmental action of people in every walk of human life. Environmental awareness of people was leading factor that was taken into consideration in comprehending the solid waste generation pattern and water pollution. Although it is practically difficult to measure or judge exactly the level of environmental awareness and attitude of people, data was collected on the

factors related to the awareness and attitude of sample population on current environmental issues in national and local level.

Environmental awareness is defined as a combination of motivation, knowledge and skills. When the environmental awareness of an individual is combined with external stimulating physical and practical conditions, the result can be a desire and will to make environmentally friendly choices (Pongrácz, 1999). Environmental awareness starts to develop when people notice that unfavorable, threatening changes in the surroundings emerge, and the effect of this cannot be corrected easily. The attitude of people chiefly affects the generation, separation, storage, transporting and final disposal or sustainable management of solid waste. Zeiss & Atwater (1991) expresses that physical impacts of solid waste (health risks, odor, noise, vibration, litter, flies, dogs and crows) and non-physical impacts (property value decrease, community image loss and social discrimination) influence the attitude of peoples' solid waste disposal. Petts (1994) suggested that citizens' attitudes are influenced not only by impacts, but also by a lack of credibility in solid waste managers, decision makers, decision processes and control mechanism for waste facility siting and operation.

2. METHODOLOGY

The questionnaire method is found to be very useful in understanding the field situation and collecting basic quantitative and qualitative information. For this purpose, 350 questionnaires were administered on households and shop-owners located in UMC, in the four Divisional Secretariats (DS), divisional administrative unit, Akurana, Pujapitiya, Harispattuwa and Pathadumbara. The majority of questionnaires were administered in Akurana DS considering the objective, seriousness of problem and multicultural background. The number of questionnaires to be administered in each Grama Niladari Divisions (GN), village level administrative unit, depend on the size of the population. The sample of questionnaire study was selected from the GN divisions of these four DS divisions which are physically closer to river Mahaweli and its tributary canals using simple random method. However, since this study mainly focuses on solid waste generation and water pollution, the GN Divisions of Akurana DS were given priority in selecting the sample.

The in-depth interview method was the major data collection method used to gather information related to qualitative aspects of awareness and attitude with regard to solid waste generation and water pollution of UMC. The qualitative data and information collected from in-depth interviews used to build up strong findings and arguments of this study with help of quantitative data generated from questionnaire survey. Thirty five (35) in-depth interviews were used on the basis of purposive sample method. The purposive sampling was useful in selecting the most ideal and relevant stakeholders and key informants representing all the state institutions, civil society organizations and different socio-economic categories. The secondary data and information were collected from the relevant sociological studies, journals, project reports, documents and statistics of Local Government Authorities, Mahaweli Authority, and Divisional Secretariats and Grama Niladharies.

To study the environmental attitude of households and shop-owners with regard to solid waste disposal and water pollution in UMC, nine common questions were brought forward to the respondents through the questionnaire survey. The environmental attitude of respondents was tested through the scores earned by them based on the positive and negative attitude statements (questions) as given in the questions. The Independent Sample Test (t test of means comparison) method was used to test the attitude of households and shop-owners by using SPSS.

3. RESULTS AND DISCUSSION

3.1 Awareness

The environmental awareness of people is very useful in creating environmental consciousness among people and mobilize them for collective environmental actions in order to prevent or control some environmental problems and promote environmental health. It is totally impossible to make collective environmental actions or environmental movement without a proper environmental awareness or knowledge. The environmental awareness leads to consciousness and finally towards the collective actions functioning as a circle. For example, awareness on seriousness of dengue fever, number of death and infected persons due to dengue brought about a great consciousness individually and promoted required collective actions among people in Akurana to control further transmission of dengue irrespective of their social and economic differences.

3.1.1 Awareness on national level environmental issues related solid waste

The knowledge or awareness is socially constructed and the social realities lay the foundation for scientific knowledge base (Burger, 1966). It is also necessary to identify the awareness of respondents regarding environmental issues in the national related to solid waste disposal. It was found that households' (86%) awareness is higher than shop-owners (62%) regarding national level solid waste related issues. Although there is almost equal gender distribution in household sample, male (56%) and female (44%), the factor of gender in the sample of shop-owners is not equally distributed, male (85%) and female (15%). There is also considerable difference between awareness of male (78%) and female (95%) in terms of national level solid waste disposal. On the other hand, even in the male dominant commercial sector female (74%) awareness is fairly higher than male (66%). It is clearly indicated that women's awareness is considerably higher than men since women's favorable education background and they have constant touch with the printed and electronic media than men. Also, shop-owners are always busy with their business activities and reluctant to allocate any time for some national level environmental issues compared to household sector. The outbreak of epidemics (22%), the improper disposal of solid waste (20%), land pollution (18%) and loss of aesthetic value (16%) are major national level environmental issue identified by respondents. The main source of awareness of both households (26%) and shop-owners (38%) is "by experience" which refers to direct personal observation of sites of issues by respondents. The electronic media (television & radio) is reported to be the second important source of awareness. Third access to awareness of national level issues is the officers and state institutes.

3.1.2 Awareness of local environmental issues related to solid waste

The awareness of national level issues can be different from local context of ecological conditions. Also, since respondents have been having direct association with their local physical environment, the awareness of local environment issue can bring more realistic picture environmental knowledge of people. According to the study, households (81%) are well-aware of the environmental issues at their area than that of shop-owners (56%). It is important to understand the content, nature of daily routine and relationship with the local environment of households and shop-owners. The majority household respondents are well-educated (qualified above advanced level) and committed towards common social activities are very much concerned about their local ecosystem and changes in it than shop-owners. Also, women who mainly represent household sector have close relationship with nature and subjectively feel the changes occurring in the ecosystem than shop-owners. As

Boda, (1991) expresses women in Third World have close link with nature and make their livelihood based on their local environment. The main issues identified by people are river water pollution (34%), disposing solid waste besides the roads (28%), the contempt scenes with bad smell of organic waste (20%) and disturbance by animals (18) such as wild boar, monkeys and dogs. The sources of awareness were self experience (62%), government officer (22%) and workshops or meetings (17%) and religious centers (8) in this regard.

3.1.3 Awareness of environmental issues related to Pinga Oya

The Pinga Oya is ecologically, economically and culturally significant to people living in the Pinga Oya catchment. However, at present, the river-rin and riparian eco-system of Pinga Oya is in danger. There are many socio-environmental problems in Pinga Oya or its ecoy-system. It is obviously proved by the studies of Werellagama (2000), Herath (2003) and Hettiarachchi (2003) that solid waste disposal has seriously influenced on water quality and eco-system of Pinga Oya. These studies have discovered some critical river-rin and riparian ecological crisis of Pinga Oya which are considered to be threat to the entire Mahaweli Project.

There is no much difference between households' awareness (86%) and shop-owners' awareness (78%) regarding the environmental issues of Pinga Oya because respondents of both these sectors are either well experienced or made aware by external bodies in this regard. The factors such as enthusiasm, active participation and better educational background have promoted higher level of awareness with regard to every level of ecological issues of Pinga Oya. The identified issues are water pollution (28%), disposal of solid waste into canal (15%), discharging black water (14%), illegal construction (12%), silting (10%), bad smell (10%) and floods (06). The 44% of the shop-owners come to know about the issue by their experience and it is only around 11% with the households. Since vast majority of the shops or their business are located on the bank of Pinga oya by the side of the road, shop-owners are able to witness the water pollution and physical damage caused to the eco-system of Pinga Oya. Nevertheless, 58% of the households get the awareness from their respective Divisional Secretariats because households have very close connection with the DS office in order to fulfill their administrative, welfare and legal services. The 11% households and 20% of shop-owners obtain the awareness from local authority (Pradesiya Shaba).

3.2 Attitude

According to Murad & Siwar (2007), factors such as gender, ethnicity, residential area and education level influence the attitude of household generation and management of solid waste among urban dwellers in Malaysia. The social and demographic factors such as age, gender, ethnicity, education, income level and neighborhood influence on the environmental attitude of people (Mc Millan, Hoban, Clifford & Brant (1998). This study presents the attitude of different socio-economic and demographic groups comparatively in order to analyse the relationship between attitude and solid waste generation and its impact on water pollution.

Table 1 clearly explains the different level of environmental attitude of households and shop-owners. The mean environmental attitude of household (34.6400) is higher than shop-owners (31.5333). It is very significant to understand the as to why households holds more environmental attitude than shop-owners. The social and demographic factors and environmental awareness of household respondents are favorable for holding better environmental attitude than shop-owners. As discussed above, the education level and environmental awareness of households are higher than shop-owners. Even the factor of gender plays crucial role in determining environmental

attitude of households and shop-owners. It is the female, who mainly represent the household sector and female record with better education, environmental awareness and attitude status compared to shop-owners.

Table 1: Comparison of environmental attitude of households and shop-owners

| <i>Response</i> | <i>Households</i> | <i>Shop-owners</i> |
|-----------------|-------------------|--------------------|
| Mean | 34.6400 | 31.6133 |
| Median | 35.0000 | 32.0000 |
| Mode | 34.0000 | 32.0000 |
| Std Deviation | 3.4671 | 2.8444 |
| N | 200 | 150 |

These business rational actions of traders promoted them towards profit maximization rather than environmental concern. These traders hardly follow environmentally friendly business policy and absorb all the valuable natural resources. As a result of rational market economic policy, shop-owners hold less environmental attitude. On the other hand, majority of respondents in the household sector except in towns of study areas have very close connection with environment and eco-system of UMC.

3.2.1 Education and attitude

Education is one of the key factors in determining the environmental attitude of people depending on their economic and cultural background. Generally, education is supposed to be having positive relationship with the environmental attitude among middle or upper middle class people in developed countries or economically least developed societies. Several studies found that higher level of education have a positive effect on environmental attitude McMillan, Hoban, Clifford & Brant (1998). However, education may not positively effect on environmental attitude or environmentalism in developing countries. It is the less educated or economically poor people (peasants) in India and Sri Lanka are engaged in many collective environmental actions against the unsustainable development project compared to well-educated and rich people (Mahees, 2007). Even in study of effects of socio-economic and political factors in solid waste generation and water pollution in UMC, the education levels are not important determinants of environmental attitude.

The education of this community is not significant in the process of constructing environmental attitude or ideologies compared to their culture and social interaction. Educated youth specially girls find it difficult to perform the practical action in the real world based on their knowledge due to cultural restrictions and pressure of changing political economy. Thus, it is the political economy and patriarchal culture influencing environmental attitude more than the education. For example, even less educated women who enjoy more cultural freedom and have interaction with others hold better environmental attitude and engage in many environmental conservation actions than educated women in Akurana community. The less important of role of education in environmental attitude can be further observed from shop-owners too.

Table 2 presents environmental attitude of shop-owners on the basis of their education level. Even in this table, the environmental attitude of shop-owners was measured based on two level of education as below and above Advanced Level (A/L).

Table 2: Comparison of environmental attitude with education level of shop-owners

| Education | N | Mean | Std. Dev: | Std. error | t value | Sig. (p=.05) |
|-----------|----|---------|-----------|------------|---------|--------------|
| Below A/L | 64 | 32.4844 | 2.0470 | .2558 | | |
| Above A/L | 82 | 31.0732 | 2.6702 | .2948 | 4.582 | .034 |

Although, in general, the higher education level have positive effect on environmental, it is found negative relationship in this table. According to table 2, shop-owners below the education of A/L (with the mean of 32.4844) grasp the higher degree of environmental value than the shop-owners with the education of above the A/L (with the mean of 31.08732). This difference is significant (0.034) at the significant level of 0.05. It is clearly proved that shop-owners with lower level of education hold higher degree of environmental attitude. The business middle class respondents earn their highest educational qualification and run their well-established business at national level or internationally. These educated and rich businessmen are very much concern about their business rather than environmental attitude. According to the results of in-depth interviews, it is the well-educated and rich shop-owners mainly violate the environmental rules in construction of buildings than the poor and less educated shop-owners. Moreover, these fairly educated small level businessmen are having symbiotic relationship with the life supporting ecological system. However, it does not refer that all the shop-owners are environmentally sensitive and having favorable environmental attitude than that of household respondents.

3.2.2 Ethnicity and environmental attitudes

Ethnicity and race are two important concept determining environmentalism. The ethnic background of a person largely effects on his or her neighborhood arrangement, consumption patterns, eating habits, group enjoyment and socio-cultural functions (wedding, funeral & puberty ceremonies). For example, the food habit and entertaining family functions of Muslims are rather different from Sinhalese. In a broader context, the ethnicity of a person influences his or her environmental attitude in different manner depending on other socio-demographic factors. According to Morrissery and Manning (2000), there is a close relationship between race or ethnicity with environmental attitude. Many studies of black and white differences in environmental concern and related constructs have often found race to be a significant predictor of attitude towards environmental issues (Tylor, 1989). For example, a survey in a metropolitan Virginia area found African American to be less environmentally concerned than Anglo Americans (Caron & Sheppard, 1995). However, in another sociological study of Caron (1989), he states that black and white do not significantly differ on their level of environmental concern.

Table 3: Comparison of environmental attitude of Muslim and Sinhala shop-owners

| Ethnicity | N | Mean | Std. Dev: | Std. error | t value | Sig. (p=.05) |
|-----------|----|---------|-----------|------------|---------|--------------|
| Sinhala | 60 | 32.7000 | 2.1885 | 0.2825 | | |
| Muslims | 86 | 31.3721 | 1.9101 | 0.2059 | 4.329 | .039 |

According to table 3, environmental attitude of Sinhalese (main ethnic group) is higher than Muslim. The mean value of Sinhala shop-owners (32.7000) is higher than Muslim shop-owners (31.3721) and this attitudinal difference is significant (.039) at 0.05 levels. Most of the business

premises of Muslim shop-owners are located in Akurana town areas and they have less or limited relationship with the natural environment. The high price for business premises and extremely competitive business environment made these Muslim shop-owners more business oriented through rational profit maximization process. They often attempt to take the maximum utility of business lands because of limited land resources and nature of mountain topography. Although Islam promotes environmentally friendly livelihood pattern, some shop-owners who symbolically practice popular religion hardly concern about environmentalism. On the other hand, majority of Sinhala shop-owners are found out of the Akurana town are having close connection with physical environment compared to Muslim shop-owners.

3.2.3 Gender and environmental attitude

In analyzing environmental attitude or environmentalism, the concept of gender plays crucial role as a leading socio-cultural factor of this study of solid waste generation and its impact on water pollution. According to Zelezny, Chua & Aldrich (2000), women report stronger environmental attitude and behaviors than men in the studies of gender differences in environmentalism across many ages and 14 countries. A variety of theories have been used to explain gender difference in environmental attitude. One widely used approach is based on gender roles and socialization. The socialization theory points that behavior is predicted by the process of socialization, whereby individuals are shaped by gender expectation within the context of cultural norms. Females across culture are socialized to be more expressive, to have stronger "ethic of care", and to be more independent, compassionate, nurturing, cooperative, and helpful in care-giving roles. On the other hand, males are socialized to be more independent and competitive. The stronger relationship between women and environmental attitude, which has been proved by many studies, is found even in the study of effects of socio-economic and political factors affecting solid waste generation pollution in and water pollution. It is clearly presented in the table 4.

Table 4: Comparison of environmental attitude of Male and Female (households)

| Gender | N | Mean | Std. Dev | Std. error | t value | Sig. (p=.05) |
|--------|-----|---------|----------|------------|---------|--------------|
| Male | 113 | 33.0708 | 2.9264 | .2753 | | |
| Female | 87 | 35.5632 | 2.2397 | .2401 | 8.576 | .004 |

According to table 4, in the attitude test of gender and environmental concern with regard to environmental issues and solution in the UMC, female reports higher (35.5632) mean score than male (33.008) in the household sector. This gender based environmental attitude difference is significant (.004) at the significance level of .05. It is revealed that female respondents are having stronger environmental attitude than male respondents in terms of solid waste generation and water pollution in UMC. There are five main reasons for women to hold higher environmental concern than men.

- 1) As it was discussed earlier, the education level as well as environmental awareness of women is higher than men, even the environmental awareness of Muslim women is far more better than Muslim men.
- 2) Women of UMC catchment (mostly Sinhalese women) maintain very close relationship with the environment at their day to-day life.
- 3) It is the women, regardless of their ethnic, class and education differences face the adverse impacts environmental pollution than men.

- 4) Since majority of the Muslim men are engaged in their business out of Akurana area (nationally and internationally), it is the Muslim women participate even in common social activities including
- 5) environmental actions.
- 6) As explained by above socialization theory, women in this study area are made to be ecologically sensitive and responsible to safeguard the environment by the socialization process.

3.2.4 Age and environmental attitudes

The recognition of relationship between age and environmental attitude is useful to understand the environmental consciousness and behaviour of youth and elders separately for the future planning and activities in terms of sustainable solid waste and water resource management. According to Buttel and Taylor (1999) the strongest and most consistent predictor of environmental behavior is age. However, generally, younger people are more likely to hold environmental beliefs than older people. This study also found the significant relationship between age and environmental attitude. The table 5 is about relationship between environmental attitude and age of household respondents.

Table 5: Comparison of environmental attitude and age of households

| Age | N | Mean | Std. Dev | Std. error | t value | Sig. (p=.05) |
|----------|-----|---------|----------|------------|---------|--------------|
| Below 35 | 84 | 34.2024 | 2.3170 | 0.2528 | | |
| Above 35 | 109 | 34.8440 | 3.0947 | 0.2964 | 4.788 | .030 |

The household age distribution is in between 17 to 82 years and the mean is 42. According to Table 5, household respondents above the age of 35 years report holding more environmental concern than householders below 35 years. This age based environmental attitude is also significant (0.030) at the point of 0.05 levels. According to the results of in-depth interviews, older generation, regardless of their gender, ethnic and education background, have been having close interaction with (UMC) Pinga Oya and its eco-system and they are very much concerned about the local environment than younger generation. But, younger generation is only conscious about the artificial beauty and home decoration instead of natural beauty. Moreover, older generation mainly guided by religious principles and practices participate in all sort of social activities than youths. The community participation of old people is further strengthened by their retirement from jobs. Even the participation of Muslim older women in community and environmental actions is very outstanding. The retired female government servants (teachers) play leading role in socio-environmental activities than any other groups in the study area. For example, Akurana Women Welfare Association (AWWA) formed mainly with senior Muslim women plays crucial role in educating and mobilizing Muslim community towards socio-cultural and environmental development of area. Generally, a positive and favorable participation of older generation can be observed not only in environmental activism but also in many other sustainable development activities.

4 CONCLUSIONS

In the process of studying solid waste generation as well as its impact on water pollution and sustainable solid waste management, the social aspects such as awareness and attitude in terms of

solid waste disposal must be given priority. According to this study, in relation to UMC of Sri Lanka, the domestic sector and female are having more awareness on environmental issues with regard to solid waste generation and water pollution since they maintain closer relationship with the ecological system and are very much concern about the environmental lead disasters and environmental health issues. The self experiences or subjective understanding, electronic media and state administrative bodies (DS) were found key modes of sources of their awareness. The attitudes regarding solid waste disposal and water pollution in river Mahaweli were very peculiar to study area and based mainly on culture of Muslims and political economy area. Accordingly, Households, female, elders, Sinhalese and people with lower education level were found to be having stronger environmental attitude. However, it is difficult to generalize the findings related to environmental attitude and ethnicity to whole country. Elders and women with lower education level who enjoyed life supporting and culturally sensitive ecological system are very much conscious about crises related to solid waste and water pollution in UMC.

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