**GENDER BASED ADAPTATION TO CLIMATE CHANGE IMPACTS ON WATER RESOURCES: AN ANALYSIS OF THE WORKING PERSONNEL BEHAVIOR**

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**ABSTRACT**

Being one of the most significant environmental challenges, climate change has clear scientific, economic, social, cultural and political implications. Water being vital to life and needed in most human activities, any correlation between climate change and water resources is of primary concern and significance. Small islands developing states like Mauritius have a high risk of vulnerable water resources being severely affected by climate change and adaptation programs may not yield effective results without a proper assessment of the level of commitment of the population. Its impacts do not affect men and women in the same way, thus the need for gender sensitive adaptation programs. However, the gender dimension has not really been addressed up to now in climate change policies. This paper aims to analyse the behaviour of the Mauritian citizen, particularly the working personnel, with regards to their willingness to participate in applying water-related climate change adaptation measures. A survey-based approach was considered to collect primary data for a sample of 419 respondents. The results show that gender is in fact related to the willingness of the target population to apply water-related adaptation measures. The corresponding findings can provide insights for better policy implementation towards targeted measures island-wide.

Key Words: Climate change impacts, Water resources, Gender, Adaptation, Small islands developing states

**INTRODUCTION**

Of the world's environmental challenges, the two most significant may well be stratospheric ozone depletion and climate change. A simple definition of climate change would be observed changes with regard to air and ocean temperature, melting of glacier and average sea level rise. The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) recognizes climate as being the key factor shaping the characteristics and distributions of natural systems such as hydrology, water resources, terrestrial, marine and freshwater biological systems, as well as agriculture and forestry. Impacts of climate change are being seen not only on physical and biological systems on all continents and most oceans, but also on human systems, while the scientific, economic, social, cultural and political implications of climate change are also acknowledged. There is unequivocal scientific evidence of climate change effects on the frequency and intensity of climate hazards, leading to the degradation of the ecosystem, reduction of the availability of drinking-water and food, and changes to livelihoods that will in turn increase the vulnerability of communities to various natural hazards.

**Impacts of climate change on water in SIDS**

The correlation between climate change and freshwater resources is of primary concern to human society, water being vital to all forms of life and required in almost all human activities. Abundant records and climate projections exist, proving the potential of vulnerable freshwater resources to be strongly affected by climate change.
change, with wide-ranging consequences for human beings and the ecosystem. In the fourth assessment report of the IPCC in 2007, the causes of negative impacts on freshwater systems and their management are emphasised as being largely due to the observed and probable rise in temperature, sea level and rainfall variability. Changes in precipitation patterns and intensity would affect water availability, sea-level rise would cause salinization of coastal aquifers, and consequent floods and droughts would affect water quality, with amplified water pollution.

Mauritius is one of the 51 Small Island Developing States (SIDS), among the least responsible of all nations for climate change while being more prone to suffer from its adverse effects, due to its characteristics namely concentration of population, activities and infrastructure along the coastal zone, intense tropical cyclones, droughts, as well dependence on vulnerable water resources for freshwater supply, among others. Climate change impacts are a major barrier to sustainable development in SIDS where water resources sector is recognized as being vulnerable to climate change impacts since those islands tend to rely on any one or all of three main natural sources of water which are surface water, rainwater and groundwater. Sea-level rise in SIDS is expected to threaten freshwater resources through saltwater intrusion within freshwater aquifers, and both the frequency and severity of droughts may amplify in the future. A local study conducted by Proag highlights that almost sixty per cent of the annual potable water supply in Mauritius comes from boreholes and coastal boreholes might be affected by saltwater intrusion.

The need for adaptation

Adaptation involving changes in normal processes, practices and structures to lessen the consequences of climate change impacts is a heavily discussed option as a solution to climate change impacts. Even if emissions would be curbed right away, the climate change scenarios described in the IPCC would still have an impact on humans, and consequently, they need to adapt to countenance challenges due to some already inevitable climate change. Much emphasis is laid on the fact that adaptations depend on customs, institutions and policies, and on the necessity to enhance the ability to respond successfully to climate change, that is the adaptive capacity, with responses to include adjustments in behaviour. Focusing on the water sector, the use of Integrated Water Resources Management (IWRM) as a tool in seeking adaptation measures is encouraged since current water management practices may not be robust enough to sustain the impacts of climate change. Defined by the systematic process for the sustainable development, allocation, and monitoring of water resources, the idea and principles of IWRM were expressed in Chapter 18 of Agenda 21, A consensus document from the United Nations Conference on Environment and Development (UNCED), held in Rio in 1992.

There exist several adaptation policy processes and projects, including the National Adaptation Programmes of Action (NAPAs) implemented under a UNFCCC process by UN agencies for Least Developed Countries (LDCs) within which are twelve SIDS, as well available funding sources for adaptation of SIDS such as the Global Environment Facility (GEF) trust fund, the Special Climate Change Fund (SCCF), the Least Developed Countries Fund (LDCF), which supports the preparation and implementation of NAPAs, and The adaptation fund under the kyoto protocol. As at March 2010, the UNFCCC has received NAPAs documents for several SIDS being LDCs and having water resources as a priority. Those NAPAs documents contain measures which have been used as a basis for this study with regard to proposals of water-related adaptation measures in mauritius.

Till end 2009, there has not been any coherent strategy in place to handle adaptation to climate change impacts in mauritius, due to inadequate technical, intellectual and financial capacity in the field of climate change adaptation. However, a current United Nation Development Programme (UNDP) project has been set up locally under the Africa Adaptation Program (AAP), with a view to set up policies and identify adaptation measures in priority sectors.
including water resources for further implementation\(^1^7\). As a result, a Climate Change division now exists within the ministry of environment and sustainable development, with a water resources working group to look into appropriate water related policies and measures\(^1^7\). The Maurice Ile Durable (MID) concept, a national project geared towards sustainable development and funded by the UNDP, also urges to increase the preparedness of Mauritius to adapt to climate change as far as possible\(^1^7\).

### Engendering adaptation to climate change: from global to local

Gender mainstreaming is the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels\(^1^4\). Despite the formal commitment of the United Nations to mainstream gender within all policies and programmes, gender characteristic currently are feebly addressed in climate change debates, the causes being the lack of data and research on the issue of gender and climate change\(^1^9\). As a consequence, the continued absence of gender issues in climate change debates is striking in the negotiations and development of proper adaptable measures\(^2^0\).

The issue of disproportionate impacts of climate change on women has been raised by some researchers recently\(^6\). The consequence of traditional patterns of gender roles being that women and men have multiple responsibilities in the home, at the workplace and in the community, it is recommended to take into account the gender variable considering that fact that the mitigative and adaptive capacity of men and women differ as regards to climate change\(^6\). A gender sensitive approach could guarantee real benefits both in terms of efficiency in the climate change process and progress towards equity terms\(^2^0\). Policies would be more effective if they are tailored to respond to the interests and needs of both women and men, and to further the goal of gender equality and should be based on a more holistic understanding of human perception, values, and behavioural choices, including considering the specifics for different groups like women and men in society\(^2^0\). Adaptation policies and measures should be gender sensitive and available tools to integrate gender perspectives into development planning should be used into adaptation policies, programmes and measures\(^2^0\). Since, climate change impacts women's lives differently than men's\(^1^9\), further recommendations are the stimulation of gender awareness among planners and project developers, as well as the inclusion of gender expertise into projects and the representation of all members of an adapting community in climate change planning and governance processes.

In the field of gender, water and climate change, the gendered characteristics towards water use and management are fairly well-documented and it is accepted that their needs and priorities differ in terms of water use\(^2^1\). Differences and inequalities between women and men influence both individual and collective responses to the subject of water resources management, thus the importance of understanding gender roles, relations, and inequalities in order to help explain choices and different options of people\(^2^0\). Even if women need sustainable water facilities and are the worst victims of poor sanitary and water situations, both men and women should be involved as they are equally important actors in this field\(^2^2\). The government has an important role in facilitating the sustainable development of water resources since insufficient participation of both women and men has stalled programmes and projects aimed at addressing sustainability in water resources management\(^1^4\). Both women and men should be recognised as central to the provision, management and preservation of water, with the contribution of both genders, in order to mutually improve project performance and the chances of sustainability\(^1^4\).

At local level, the National Gender Policy Framework affirms that the Republic of Mauritius has made commitments regarding gender equality and the empowerment of women, with obligations for both State and non state actors to ensure that these commitments are honoured, across all arms of the state and within civil society\(^2^3\). The main objective of the gender unit within the ministry of gender equality, child development and family welfare is to implement and monitor gender mainstreaming...
strategies at policy, programming and output level with ministries, departments and other stakeholders, so as to empower women and promote gender equality and equity. The programmes of that gender unit are guided by the National Gender Policy Framework, so as to respond to changing gender relations and socio economic conditions. In the same line, the National Environment Policy of the Ministry of Environment and Sustainable Development "aims at taking into account social and cultural factors which encourage or discourage environmental protection, including gender-related considerations". In its programme for the years 2010-2015, the Mauritian Government has recently reiterated its commitment to both climate change and gender, by the active participation in the efforts of the international community to address issues relating to climate change and by sustaining "its policies, programmes and projects from a gender perspective while extending technical assistance to all Ministries for the formulation of gender sectoral policies". Consistent with the National Gender Policy Framework, line ministries and sectoral agencies, including the Ministry of Environment and Sustainable Development which comprises the newly created Climate Change Unit, are responsible for developing gender-responsive policies, programmes and budgets within their sectoral and functional scope.

AIMS AND OBJECTIVES

The aim of this paper is to analyse the perception, behaviours and preferences of a category of the Mauritian working personnel from a gender standpoint, with regard to awareness on climate change, understanding of its negative impacts on local water resources as well as willingness to implement water-related adaptation measures. Objectively, the study is based on a holistic understanding of human perception, values, and behavioural choices, and is tailored to respond to the interests and needs of both women and men, so as to enhance the goal of gender equality, while at the same time safeguarding the island's water resources against climate change impacts. The findings of this study may help policy makers to better design more effective, gender-responsive, water-related adaptation actions that would receive the support of the Mauritian working personnel.

MATERIAL AND METHODS

The Survey method was applied in study for data collection and measurement, including asking oral questions to respondents. A structured questionnaire consisting of thirty one quantitative questions and one qualitative question were used to collect data primarily so that they are more or less in the same format and all questions asked to the targeted population of observers, the Mauritian Working personnel, were precisely in the same way. A flow in the transition of topics was maintained to ensure understanding of respondents.

Questions set were grouped into 5 parts as follows:

1. Part 1 attempted to determine the degree of awareness of the respondents towards climate change and its impacts.
2. Part 2 sought to assess the degree of understandability of climate change having negative impacts on water resources in Mauritius.
3. Part 3 consisted of a few adaptation measures to safeguard water resources, tried to evaluate the actual status of the sample population in terms of current application and the level of willingness in implementing the said measures.
4. Part 4 contained a list of proposed adaptation options for safeguarding water resources in Mauritius. The respondent was called upon to evaluate his or her preferred option on a likert scale of 1 to 5 with the highest score to the most preferred measure.
5. Part 5 was an open ended qualitative question inviting the respondent to provide a new idea for water saving adaptation measure that can be applied at home.

Convenience sampling was used to access the targeted population. This technique is cost effective and quicker as selection of the sample units does not necessitate any systematic or
structured process as the probabilistic sampling techniques require and also access to geographically dispersed respondents is difficult and there is no sampling frame\textsuperscript{28}. The three working sectors private, public and parastatal, cover majority of the working areas in Mauritius allowing access to a wide range of people and characteristics like age, gender, education level and residential area having close similarity to the population of Mauritius. The sample population which targeted working people between the ages of 18 to 59 was thus chosen. The limiting age 59 was considered as normally retirement age in Mauritius which recently has been increased to 65 as per the PRB Report\textsuperscript{29}. The sample size calculated to represent the targeted population was 384 given a total working personnel of 524,800 in Mauritius according to the central statistics office\textsuperscript{30}, and considering a confidence level of 95\% and a margin of error of 5\%\textsuperscript{28}. A pilot survey was primarily carried out for detecting any major defects in the questionnaire design, and resulted in twenty five questionnaires revealing a positive response rate of 92\% with no changes needed. The survey was carried out during the period of April to June 2010 and proper monitoring and follow-up assured relatively a high response rate, resulting in collecting 419 questionnaires correctly completed. A few uneducated respondents were attended to. The data collected was then analysed in the Statistical Package for the Social Sciences (SPSS).

RESULTS AND DISCUSSION

The profile of the respondents as obtained from the survey is shown in the Fig.1 below:

![Fig. 1: Respondent profile by gender and age](image)

Analysis of the respondents gender profile for the whole sample size revealed an almost equal percentage for each gender with a slightly higher number of females, 50.2\% as compared to males who are of 49.8\%. This means that gender wise, the sample was balanced as compared to the percentage of females in the whole population which was at 50.6\% in 2008\textsuperscript{30}. Analysis of the age declared by respondents, which has been categorized in 3 groups, showed a higher percentage of respondents from those aged between 26 and 40 years, representing 48.4\% of the sample, which was 15.7\% higher than the age group of 41-59 and 29.5\% higher than the age group of 18-25, the least numbered age group. One of the hypothesis considered in this study was geared towards testing how the scenario of gender based adaptation to climate change impacts on water resources applies in Mauritius and was stated in its null form as:

The degree of willingness to implement water adaptation measures are not related to (1) Level of education, (2) Gender, (3) Residential area and (4) Working sector.
For testing the above hypothesis, replies from the corresponding question were taken as dependent variables and personal questions from the survey form provided the gender, education, residential area and working sector of the target group. According to the ANOVA (Table 1) the hypothesis is supported by the study level (F = 2.250, P = 0.082), residential area (F = .020, P = .889) and working sector (F=2.668, P= .071). However, it is rejected by gender (F=4.272, P=0.039). The sustained theory reads as the degree of willingness to implement water adaptation measures are not related to level of education, residential area, working sector but to gender. This is in fact an interesting discovery. A bar chart of the responses can help us visualize the responses and help with the analysis of this relationship. Based on the chart provided in (Fig. 2), it is observed that there is almost equal willingness towards adaptation measures among the gender with a trivial preference for the male population towards adaptation measures.

<table>
<thead>
<tr>
<th>Willingness to water adaptation measures</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<td>STUDY LEVEL</td>
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<tr>
<td>Between Groups</td>
<td>9.696</td>
<td>3</td>
<td>3.232</td>
<td>2.250</td>
<td>.082</td>
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<td>Within Groups</td>
<td>583.302</td>
<td>406</td>
<td>1.437</td>
<td></td>
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<tr>
<td>Total</td>
<td>592.998</td>
<td>409</td>
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<tr>
<td>Between Groups</td>
<td>6.144</td>
<td>1</td>
<td>6.144</td>
<td>4.272</td>
<td>.039</td>
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<tr>
<td>Within Groups</td>
<td>586.853</td>
<td>408</td>
<td>1.438</td>
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<td>Total</td>
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<tr>
<td>Between Groups</td>
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<td>1</td>
<td>.028</td>
<td>.020</td>
<td>.889</td>
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<td>Within Groups</td>
<td>592.324</td>
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<td>1.455</td>
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<td>Total</td>
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<td>WORKING SECTOR</td>
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<tr>
<td>Between Groups</td>
<td>7.66</td>
<td>2</td>
<td>3.83</td>
<td>2.668</td>
<td>.071</td>
</tr>
<tr>
<td>Within Groups</td>
<td>578.576</td>
<td>403</td>
<td>1.436</td>
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<tr>
<td>Total</td>
<td>586.236</td>
<td>405</td>
<td></td>
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</tbody>
</table>

Table 1: ANOVA table for hypothesis

![Fig. 2: Willingness of target population with regards to water adaptation measures](image_url)
The shortage of contemplation regarding gender issues with climate change according to some authors can be considered as the consequence of the apparent necessity felt by decision makers to accentuate their attention, and the limited available resources, on more universal and apparently urgent issues associated to the subject. One of the possible suppositions could be the traditional outline of gender roles mean that women and men have multiple duties in the home, at work and in the community. These many demands leave women with less time for active political participation and in the dynamic contribution in the decision-making processes that impact their lives, surroundings and ambitions. Both concerning mitigation and adaptation policies, scientific and technological measures are preferred to soft policies addressing behaviour and social differences.

The gender-specific divergences considering adaptive and mitigative aptitudes should be completely recognized and well thought-out paying particular attention to the planning and realization of reactions policies. Taking this truth into consideration, the ensuing stride should be the investigation of new ways and means for the integration of the gender variable into national and international negotiations with respect to mitigation and adaptation activities. According to Röhr, gender aspects currently are poorly addressed in climate change debates. The author further states that men and women, due to different responsibilities for care work, social role and income generating work, are differently affected by the effects of climate change, climate protection and adaptation instruments and measures. Röhr goes on saying that gender differences are crucial when it comes to assessing adequate measures, as men trust in technical solutions and women prefer lifestyle changes. To assess the legitimacy of this declaration several analysis were conducted demonstrating the preferences in increasing order of the Mauritian working personnel with regards to several water adaptation measures against gender.

Indeed from the analysis, it was observed that the Mauritian working personnel demonstrate the same aptitude as described by Röhr in his documentation such that males prefer more technical solutions such as increase water availability by safe gathering of rainwater through ground catchment and roof catchment systems. On the other side, the study reveals that females are hortative to more practical approach such as a change in lifestyle to adapt much more quickly as a result of the impacts of human activities on the climate. In most developing areas of the world, including Mauritius, women alongside other members of their households use and manage their natural resources. Climate change and its associated impacts especially with regards to water entail serious adverse consequences on women and their families particularly in terms of their lifestyle. It should be noted that women normally share more responsibilities towards domestic management. Consequently this involves making choices concerning the emissions intensity of the goods for household utilities. However, so far no substantial studies have been carried out to analyse gender issue related to household management and emissions intensity of domestic goods. As such, it is supposed that in highly educated societies, women and men will choose more adaptable and energy efficient options.

According to the IPCC, the requirements for a particular country to ensure a high adaptive capacity comprise of an even and thriving economy, access to technological alternatives, appropriately designed adaptation policies, a structure in place for the appropriate propagation of climate change and adaptation information at all levels in the society as well as an allocation of access to resources derived from equity philosophies. It is on the basis of this clearly declared principle that the FAO proposed a closer examination of gender roles in the climate change debate. It was observed based on our results that this is indeed the case. Unfortunately, a high number of developing countries do not meet the above requirements. This is however the case, in particular, of the Least Developed Countries (LDCs) traditionally distinguished by a low adaptive abilities. The recent conferences of COPs have been characterised by an ever-increasing consideration to the subjects related to developing countries where the problem is highly complex.
Actually mitigation exertions must be coordinated with their developmental requirements, whilst fast adaptation is elemental to circumvent damages from continuing climate change. The challenge for these developing countries is to embark on a low-emissions path that embraces access to low-carbon and proficient energy technologies to endorse an authentic sustainable development, while guarantying a dynamic approach to the challenges derived from climate change. Growing attention is also being paid to the emergence of adaptation issues in the developing world, especially in the least developed countries.

Fig. 3: Willingness of adaptation viz gender
The Marrakech accords in 2001 issued at the seventh conference of the Parties, accentuated the utmost importance for developing countries to receive more support from the international community to sustain their adaptation activities. The Accords established new funds for the following actions: The Special Climate Change Fund (adaptation, knowledge transfer, capability building and climate change alleviation) and the LDCs Fund (assistance for the development of the NAPAs), both under the UNFCCC and managed by the GEF. In Mauritius, a Climate Change division now exists within the local ministry of environment and sustainable development, with a working group focusing on water resources to look into appropriate policies and measures with regards to water.

The literature provides the opinion on the fact that the gender variable must be taken into account viz the mitigative and adaptive capacity of men and women which differ as regards to climate change. As the above demonstrate, this could be the driving grounds why, Röhr believes that it is necessary that all members of an adapting community are represented in climate change planning and governance processes, and recommends that adaptation policies and measures be gender sensitive. Such recommendation may be applied in our local context, given that our hypothesis confirms the influence of gender on the willingness of our respondents to apply adaptive measures.

**CONCLUSION**

Despite formal commitment of the United Nations to mainstream gender within all policies and programmes, currently gender aspects are poorly addressed in climate change debates. This paper concentrated on analysing the Mauritian working personnel's perception, of gender based adaptation to climate change impacts on water resources. The study has emphasized the necessity of having the involvement of all actors of a united adapting society characterized in climate change planning and decision processes. Based on analysis it can be seen that there is potential for all members of the community to work together on issues of climate change.

However this study was based on a target population which represented a specific category (the working personnel between 18 and 59. The work can further be extended to a more representative sample of the Mauritian population, to obtain a broader picture of the discernment of the Mauritian with regard to adaptation measures to safeguard our water resources against impacts of climate change.

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