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The Impact of CSR on Rural Women Custodians of Seed, Food and Climate Change Resilience in Nigeria's Niger Delta Region

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WP/23/025

The Impact of CSR on Rural Women Custodians of Seed, Food and Climate Change Resilience in Nigeria's Niger Delta Region

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The Impact of CSR on Rural Women Custodians of Seed, Food and Climate Change Resilience in Nigeria's Niger Delta Region

Joseph I. Uduji & Elda N. Okolo-Obasi

Abstract

Purpose – The purpose of this paper is to critically examine the multinational oil companies' (MOCs) corporate social responsibility (CSR) initiatives in Nigeria. Its special focus is to investigate the impact of the global memorandum of understanding (GMoU) on development of enterprising rural women as custodians of seed, food and traditional knowledge for climate change resilience in the Niger Delta region of Nigeria.

Design/methodology/approach – This paper adopts a survey research technique, aimed at gathering information from a representative sample of the population, as it is essentially cross-sectional, describing and interpreting the current situation. A total of 768 rural women respondents were sampled across the rural areas of the Niger Delta region in Nigeria.

Findings - The results from the use of a combined propensity score matching and logit model indicated that the meagre interventions of MOCs' CSR targeted at the empowerment of rural women in custodians of seed, food and traditional knowledge for climate change resilience recorded significant success in improving the role of women in agricultural production, especially in women involvement across value chains.

Practical implications - This suggests that any increase in the MOCs' CSR targeted at increasing rural women's access to seed preservation facilities, food processing facilities, extension system that impact strong body of knowledge and expertise that can be used in climate change mitigation, disaster reduction and adaptation strategies, will enhance women's responsibilities in households and communities, stewards of natural and household resources, and will position them well to contribute to livelihood strategies adapted to changing environmental realities.

Social implications – This implies that MOCs' GMoUs' policies and practices should enhance women's participation; value and recognise women's knowledge; and enable women, as well as men farmers to participate in decision-making process in agriculture, food

production, land and governance; as women need to be acknowledged and supported, as the primary producers of food in the region, able to both cultivate healthy food and climate change resilience through small scale agro-ecological farming system.

Originality/value – This research contributes to gender debate in agriculture from a CSR perspective in developing countries and rational for demands for social projects by host communities. It concludes that business has an obligation to help in solving problems of public concern.

Keywords Environmental justice, custodians of seed, climate change resilience, gender equality, corporate social responsibility, multinational oil companies, sub-Saharan Africa.

1. Introduction

As it were, Africa is on the brink of losing a great deal of valuable knowledge about harvests (crops),nourishment, medicines, biodiversity, climate change, ecosystems and more, just when it is most required (African Women Development Fund, 2013). For long, women in most African traditions have been central in choosing, storing, and improving the diversity of their seeds. In producing food for their families in varying conditions, women ended up developing a sophisticated propensity in understanding their ecosystem and the climate, making very precise calculations as to what they are to plant in the following seasons (FAO, 2011; Uduji and Okolo-Obasi, 2022a). The density of this knowledge system, the close relationship that rural women seem to have with land as well as seed, and their grasp of the range of needs of the family cum the community cannot be taken too lightly (IFAD, 2012). It has progressed over generations. This awareness lies at the heart of women's unending role in building resilience and in their standing in the community (FAO/IFAD/ILO, 2010). In Africa, women have been recognised for handling certain defined roles in farming traditions such as choosing, storing, breeding, improving, diversifying, increasing and exchanging seed, taking advantage of the knowledge they inherited from the generations before them (Africa Competitive Report, 2017). Traditionally, in certain communities in African, the seed variety which women cultivate fosters the community physically, culturally as well as spiritually; and it is taken to be sacred, an intergenerational custom and an obligation (African Economic Outlook, 2017). In Nigeria, women have the tendency to be the core custodians of wild foods and are well-informed about where this food occurs. Wild foods are vital in the diet of most rural communities due to their usually being highly nutritious. They are depended upon in times of crop shortage too, when they are often referred to as hunger foods. As it were, they

also grow in wild areas which may include pathways, sacred sites and even river banks (African Development Report, 2015). Such areas are usually called marginal lands, which belies their significance to the ecosystem, the food system, and to women as custodians. Wild areas are more and more endangered by development projects and land grabs. As climate unpredictability increases, the wild relatives of domesticated crops are a serious source of robust new qualities that have shown resilience in sometimes unreceptive conditions (Ajala, 2017; Uduji and Okolo-Obasi, 2022b).

In the meantime, the economy of Nigeria hangs heavily on the oil and gas sector, which makes available up to 95% of export revenues, 80 to 85% of government incomes, and about 32% of gross domestic products (GDP). Nigeria is the largest producer of oil in Africa and among the top ten all over the world. Its recoverable reserves were valued at 36.2 billion barrels in January 2007. Unfortunately, in spite of the country's oil relative wealth, GDP per capita is 2,400 USD, and impoverishment is widespread – about a half of the nation's populace live on less than $1.25 per day (Francis *et al,* 2011). The Southern part of the country, known as the Niger Delta region, is where the oil and gas reserves are concentrated. The region, with all its natural wealth, is marked by lack and underdevelopment (NDDC, 2001). The people of this gifted region have been farmers and fishermen traditionally, but decades of activities around oil and gas (spillage and flaring), as well as swiftly rising population posed threat to these traditional sources of livelihood; consequently, the region's rate of joblessness is higher than the national average (NDDC, 2004). Without doubt, the negative effect of the oil extraction activities is felt in various areas in the region, including in relation to, human settlement and migration patterns and energy, transport and traditional industry, agriculture and food security, biodiversity and ecosystem, water resources as well as human health (UNDP, 2006).According to Ekhator (2020), women bear the brunt of environmental injustice in Nigeria and the consequences of oil extraction operations of MOC have also impacted on the health of the women in the region. In this region, there are challenges and constraints that women face that affects their inability to improve nutrition, healthcare and food security (Olusegun and Oyelade, 2021; Okongwu, 2021). The impact of MOCs' extraction in the region has considerably weakened women's access to pollution – free farmlands and fishing water. Notwithstanding, that women in Nigeria face state-sanctioned discriminatory practices, and economic and social barriers, they have stood up against the negative activities of MOCs by protesting those activities and eventually pushing the MOCs to concede to some of the women demand in the Niger Delta (Ugochukwu, 2020; Ekhator, 2019). According to Barikor-Wiwa (1997), the Federation of Ogoni Women's

Association (FOWA), an umbrella organization for all women's groups in Ogoni, Niger Delta of Nigeria, made a resolution that MOCs must not be allowed to continue oil extraction in their land. These women play the key role in organizing the massive protest against the MOCs in the region, and in every struggle for environmental justice in Niger Delta (Ekhator, 2019, 2020; Barikor-Wiwa,1997).

Notwithstanding, multinational oil companies (MOCs) participate in a plethora of corporate social responsibility (CSR) activities in the Niger Delta and other part of the country (SPDC, 2013). Every year, MOCs invest in social projects and programmes in communities predominantly in the Niger Delta. The earlier investments were in agricultural development programmes in the nineteen sixties and have grown over the years to include small businesses and education, healthcare, roads and civil infrastructure as well as water projects, which the local communities gain from (Chevron, 2014). As the years passed by, MOCs have enhanced on how they get involved with local communities to carryout these projects. In 2006, MOCs brought into functioning a novel way of operating with communities called the global memorandum of understanding (GMoU). The GMoU stands fora vital shift in operational method, laying emphasis on clearer and responsible processes, consistent communication with the grassroots, sustainability and conflict avoidance (SPDC, 2018).In this agreement with GMoUs, the communities choose the development they want, while MOCs make available reliable financing for five years, making sure that the communities do not face monetary challenges as they embark on the execution of their community development plans (Chevron, 2017).

Nevertheless, the advent of GMoU has largely been seen as a strategy the MOCs are using to repel public criticisms of their misbehaviour and a means for evading government control via regulations (Asgil, 2012). Indeed, as a concept, GMoU model has been heavily complained against, and there is now strong debate over its effectiveness and practical implications (Frynas, 2009). While promoters view GMoU as a vehicle for possibly reviving an old dynamic in MOCs-community relations, detractors see it as a ground for new tasks to be demanded of old establishments (Marchant, 2014; Slack, 2012). This variance in observations invariably sets the context for the GMoU model discuss, setting as rivals those in for the preservation of an already entrenched MOCs-community relationship against those who maintain that MOCs-community relationships must be made to acclimatise with the changing community values in the Niger Delta region (Lompo and Trani, 2013; Renouard and Lado,

2012; Idemudia, 2014; Ite, 2007; Eweje, 2006; Ekhator, 2014). Even at that, women in many of the farming communities of the Niger Delta are upholders of complex information (knowledge) and abilities about seed as well as biodiversity and climate; which require continuous learning, observational capacity and a holistic grasp, in order to read and construe the dynamic interplay between the ecosystem, the assemblage and the gradually unpredictable climate change. This takes commitment, traineeship with elders, and drill (practice). Though, several papers in the literature discuss CSR for women's welfare in Nigeria; however, what is clear from this study is that CSR in Niger Delta for gender equality remains a rich and fascinating area of enquiry, which is becoming more important in CSR theory and practice. And since it is profoundly under-researched, it represents a tremendous opportunity for improving our knowledge and understanding about CSR in overcoming barriers to sustainable development in Africa. In line with the aforementioned, this paper is an addition to gender discourse in the viable agriculture development and comprehensive growth literature from the CSR perception, by looking at the pragmatic facts in four areas that have engrossed much interest in the literature. The paper is interested in ascertaining the level of CSR investment that the MOCs have made as it concerns custodians of seed, food and traditional awareness(knowledge) for climate change elasticity as well as finding out the level of gain from such investment that accumulate for the business minded rural women and its impact on their trading activities. These four areas of focus correspondingly stand for four main questions noted below:

i. To what extend does each gender partake in the GMoU involvement of the MOCs in the host communities?
ii. How intense is the MOCs' CSR investment in endowing women in agricultural development in the Niger Delta region of Nigeria?
iii. Does the involvement of MOCs' GMoU actually trigger positive changes on development of resourceful rural women custodians of seed, food and traditional knowledge for climate change resilience in the Niger Delta region of Nigeria?
iv. Do MOCs' GMoU involvements have influence on gender in sustainable agriculture development in Nigeria's Niger Delta region?

1.1 Study hypothesis

Traditionally, girls, from an early age, learn with their mother and grandmothers in the Niger Delta region of Nigeria. They become environmentally literate, acquiring knowledge through

practice in the fields, gardens and forests (PIND, 2011). Understanding the signs in the ecosystems have need of careful observation and responsiveness to detail-changes in the behaviour of insects, plants, animals or birds, patterns of rain or draughts, levels of moisture and so on (PIND, 2015). Despite their significant input towards providing food and the management of food security as well as climate change resilience (PIND, 2018), in this region, women normally have little or no say in how budgets of households are managed, with the implication of less money being spent on food, education, or health, than if they were in control of the purse strings (PIND, 2019). In same region (Niger Delta), women are likely to have constrained access to education, employment, and finance, and are more in the position to be victims of hunger and disease. Thus, we postulate as follows:

i. CSR of MOCs making use of GMoU has not been successful with the development of enterprising rural women custodians of seed, food and traditional knowledge for climate change resilience in the Niger Delta region.
ii. CSR of MOCs utilising GMoU has no notable impact on gender in sustainable agriculture development in Nigeria's Niger Delta region.

In line with the aforementioned, the main interest of this research is to ascertain the level of CSR investments of MOCs in the conditions of women custodians of seed, food and traditional knowledge for climate change resilience, and how such MOCs intervention affects the means of support of such women in host communities. The paper adds to disparity debate in sustainable agriculture development and inclusive growth literature from the CSR standpoint. The standing of this research work set off from modern-day sustainable agriculture development literature, which has aimed at, inter alia; gender and conservation agriculture (Farnworth *et al,* 2016); gender in climate change (Jerneck, 2018); analysis of smallholder farmers (Kefyalew, *et al,* 2016); an integrated market for seeds (Keyser, *et al,* 2015); gender response to climate change (Lambrou and Piana, 2006); adoption of modern rice technologies (Mariano *et al,* 2012); gender equality in agriculture (Adamon and Adeleke, 2016); roots for the future (Aguilar *et al,* 2015); evaluation of local climate adoption plans (Baker *et al,* 2012); gender, development and globalisation (Berneria, 2016) and use of imported maize seeds (Tura *et al,* 2010).

The subsequent parts of the paper are presented thus: section 2 (a brief examination of the literature and theoretical underpinning); section 3 (description of the method and materials);

section 4 (presentation of the results and corresponding discussion) and section 5 (conclusion with implications and future research directions).

2. Literature and theoretical underpinnings

2.1 Women custodians of seed diversity

Seed variety lies essentially in the hands of women in a greater part of traditions in Africa – from the choosing of seed to storage, to deciding which types to plant and the quantity, based on the various types of rain they envisage will likely come (African Women Development Fund, 2013). Before the time of harvest, women detect which crop should be designated for seed and which for consumption. For many generations, women have expertly chosen crops with a wide range of qualities to meet various needs, from produce to disease resistance, from sense of taste to post-harvest usage, from time consumed in cooking to way of storage (Adamon and Adeleke, 2016). Studies show time after time that women have a more all-encompassing seed selection criterion than men (FAO, 2011; FAO/IFAD/ILO, 2010). Although men in several traditions cultivate particular crops which are corresponding to those nurtured by women, thus, further improving the variety of the food system. Deciding on which varieties of crops to plant when the rains come needs a deep and delicate capacity to read the wider environment (ecosystem) and the way the climate behaves. Women seed custodians have to ascertain which of the seed they have produced will do best in conditions they foresee; and in the situation of climate instability, this developed ecological awareness held by women becomes much more useful (Keyser *et al,* 2015). The country side(rural) African family depends largely on the women to make correct decisions about the weather patterns they forecast and the ranges of crops they select to plant, to guarantee the family of food (Tura *et al,* 2010). Knowledge of the selection of seed also has need of a deep awareness of how to store their diverse varieties of seeds securely from one season to the next, and sometimes for even as long as decades. Women have advanced a range of techniques, reliant on the variety from seed smoking over fire to seed protection, to mixing of seeds with herbs and ashes to keeping them safe from fungus and pest. Cereals are likely to be dried in the sun and then stored in granaries; pest deterring weeds such as marigold are also made use of with ash. These practices have been developed and polished through careful practice and reflection over generations (Kefyalew *et al*, 2016). In Philippines, for instance, women's awareness and skills got them status and respect in the family and community, who depend on them as

custodians in charge of seed variety for food, nourishment, cultural undertakings and local economies (Mariano *et al,* 2012).

2.2 Women's knowledge for climate change resilience

Climate change has serious corollaries in four magnitudes of food security: food availability, food obtainability (accessibility), food usage and food systems steadiness (Farnworth *et al,* 2016). Farmers who are women currently account for 45 – 80 percent of all food production in emerging countries subject to the region (FAO/IFAD/ILO, 2010). About two third of the female labour force in evolving nations, and more than 90 percent are involved in agricultural work (FAO, 2011). In time of climate change, traditional food bases become more irregular and scarce; women face loss of earnings as well as harvests – often their only source of food and returns (Lambrou and Piana, 2006). Related upsurges in food prices make food more unreachable to poor people, particularly to women and girls whose well-being has been found to be weakening more than that of men in terms of food shortage (IFAD, 2012). However, it is imperative to remember, that women are not only susceptible to climate change but also real actors or agents of change in relation to both mitigation and taking on (Jerneck, 2018). Women often are seriously knowledgeable and have skills that can be used in climate change mitigation, lessening of disaster and adaptation schemes (African Women Development Fund, 2013). Additionally, women's duties in households and communities, as stewards of natural and household resources, places them well to add to livelihood schemes adapted to changing environmental veracities. This is traditionally an extremely skilled and esteemed role because the endurance of the household and communities hinge on them; yet, women are regularly left out from making decisions concerning access to and utilization of land and resources critical to their means of support (African Competitive Report, 2017). Therefore, it is necessary that the rights of enterprising rural women are safeguarded in relation to food security, even-handed access to resources, and equitable contribution in decision-making processes. In the Niger Delta, the menace of climate change, revealed in the upsurge of extreme weather conditions such as droughts, tempests and tidal wave, has been acknowledged as an issue of main concern in the region (Uduji *et al,* 2019). Its maintainable growth challenge with wide-ranging impact not only on the environment but also on physical and social development of the local communities in the region (Uduji and Okolo-Obasi, 2022a). The problem associated with climate change including draught, indeterminate rainfall and deforestation, make it tougher for women to source for food, water and energy for cooking cum heating in the region (Uduji *et al,* 2020). Due to climate hazards in the Niger

Delta, women's livelihood is affected by the destruction of crops and livestock, which are the major means of female livelihood in the region (Uduji *et al*, 2021).

2.3 Women's informal entrepreneurs

According Ramadani *et al* (2019), most of the existing entrepreneurship literature focuses on formal enterprise but more recently more attention has been placed on informal entrepreneurship. Entrepreneurship usually implies law abiding activity, but informal entrepreneurship can involve unauthorized or illegal entrepreneurship activity that can include tax evasion and self-employment (Rashiti *et al*, 2017; Nikolopoulos & Dana, 2017; Dana, 2007). The informal economy provides individuals with business opportunities regardless of immigration status or educational qualifications and this is especially important to entrepreneurs (Ramadani *et al*, 2019; Mason *et al*, 2019; Dana, 2007). In the context of this paper, informal sector farmers are defined as those that are not legally registered at the national level of federal government of Nigeria GESS programme, although could be connected to a registered association (Dana, 2011; Ramadani *et al*, 2019).However, according to African Economic Outlook (2017), Nigeria has the highest number of women entrepreneurs in the world; as there are over 41 million small and medium enterprises (SMEs) in the country and women constitute 40% of this number. Nevertheless, according to African Competiveness Report (2017), this high level of women's participation in entrepreneurship in Nigeria has been found out to be necessity-driven. While it is estimated that globally, nine out of ten start-ups shrivel up and cease to exist within three years thereby requiring accelerator programmes to avert such prompt closures, many women entrepreneurs in Nigeria are not fully operating at their peak, which could be attributed to discriminatory practices, low productivity, limited entrepreneurship and leadership skills; other challenges include inadequate training, inadequate management experience, lack of information, inadequate infrastructural development, lack of strategies to develop financial literacy, limited access to external loans for business sustainability, and poor family support; as a result, women entrepreneurs in Nigeria experience business failures, early exit, stagnant growth and low return on investment (African Development Report, 2015). The advancement of enterprises is generally observed as a substantial measure of success and a key driver to the creation of affluence, occupation and economic development in every nation (African Economic Outlook, 2017). Women entrepreneurs provide a considerable input to national economic growth by their involvement in entrepreneurship particularly in both small businesses and

high growth business which enhance the financial situation of most nations (African Development Report, 2015).

2.4 Theoretical underpinnings

Subsequent to the preceding predicaments, in a society like Nigeria, where lack of financial opportunity has fostered an entrepreneurial mind-set, and where distrust of Western feminism is culturally entrenched, neoliberal feminism may be women's best option (Akinbobola, 2019). Actually, Khonje (2020) suggests that neoliberalism feminism is more likely to be embrace in

Africa, and in Nigeria in particular, better than some other kinds of feminism that are circulating there. Also, Akinbobola (2019) argues in that the high level of poverty and unemployment in Nigeria, and the general lack of opportunities for access to financial empowerment, have fostered and individualized entrepreneurial mind-set that is some way more in line with this kind of feminism, problematic though that may be. However, neoliberal feminism is criticized for its disregard for structural inequalities and thus for failing women most susceptible (Dabrowski, 2021).Nevertheless, this study took on a quantitative methodology but views the result from the liberal feminist theory standpoint and African outlook of CSR. The liberal feminist theory as worked upon by Fischer *et al* (1993), asserted that the liberal feminist tradition can be taken back to feminism's initial days of first wave and argues for the requirement of social reform so as to give women the same status and openings as men. The central basis of the liberal theory undertakes that men and women are equal and that levelheadedness, not sex is the foundation for individual rights. It accentuates the existence of discriminatory obstacles and systematic unfairness facing women, such as limited access to resources, to training and even to business experience, which must be abolished. Liberal feminism is outgrown of political understandings of impartiality, entitlement, and rights of individuals. The liberal feminist outlook has been the foundation for many changes in the legal system that have resulted in greater equality. According to Unger and Crawford (1992), liberal feminist theory in the context of women's entrepreneurship postulates that if women in equal measures access the openings available to men such as learning, work experience, and other resources, they would perform correspondingly.

According to Rexhepi and Ramadani (2017), a call focus of corporate sustainability is stakeholder relations, of which corporate social responsibility can be one facet. A company

committed to CSR acts as a good corporate citizen, expanding the definition of success beyond profit maximization to also consider the organization's impact, both positive and negative, on the world (Mintzberg, 1983). Globally, CSR activities can span four areas: the workplace, the marketplace, the community, and the environment (Lindgreen and Swean, 2010). Leading companies go beyond compliance, approaching CSR proactively, taking voluntary actions in advance of stakeholder pressure (Mintzberg, 1983). CSR frequently makes good business sense by improving business outcomes such as risk management, corporate and brand reputation and the recruitment and retention of employees (Sepasi *et al*, 2020).

However, the mainstream CSR agenda has largely been driven by Northern actors and therefore reflected the priorities and concerns of Western societies without sufficient room for other concerns (Lindgreen and Swean, 2010). Arguably, the mainstream CSR discourse neglect the local concerns of developing countries, especially African societies. To cure the inherent defects in the mainstream CSR discourse, a Southern perspective to CSR that will help highlight and how CSR can best contribute to sustainable development, such as reduction of widespread inequality that is limiting growth in developing countries (Sepasi *et al*, 2020). Hence, this paper alsolooks at the nature of CSR in an African context using Visser (2006), Amaeshi (2006) and Muthuri (2012). Carroll's CSR pyramid is perhaps the most renowned model of CSR, with its four levels demonstrating the relative significance of economic, legal, ethical and philanthropic obligations in that order. Nevertheless, the exploration of CSR in Africa (Visser, 2006) was made use of in challenging the correctness and appropriateness of Carroll's (1991) CSR pyramid. If Carroll's basic four-part model is recognized and utilized, it is put forward that the relative priorities of CSR in Africa are possibly going to be dissimilar to the classic, American ordering. However, it is also projected that Carroll's CSR pyramid may probably not be the best model for having a grasp of CSR in general, and particularly CSR in Africa. Amaeshi *et al* (2006) have reasoned that the Nigerian understanding of CSR is remarkably dissimilar to the western version, and should be focused towards addressing the distinctiveness of the socio-economic development problems of the country; and should be directed by socio-cultural influences. They might not of necessity replicate the popular Western standard/anticipation of CSR. Charitable initiatives as CSR by companies are predominant in Nigeria (Ekhator, 2014). Thus, in emerging countries, the failure of government in making available amenities for its citizens put emphasis on the roles of multinational in CSR, butcharity is not seen as CSR in Western

countries (Frynas, 2009). Muthuri (2012), counting on the extant literature on CSR in Africa, postulated that the CSR issues dominant in Africa include health and HIV/AIDS, environment, sports, human rights, corruption and governance, accountability, poverty reduction, community development, education and training, economic and enterprise development. As a result, this study embraces quantitative methodology but views the result from the liberal feminist cum African CSR standpoint.

3. Materials and methods

Research into CSR in Niger Delta region of Nigeria is still relatively underdeveloped and tends to be adhoc with a heavy reliance on convenience-based case studies or descriptive accounts (Asongu *et al,* 2019). The focus is often on high profile incidents or branded companies and a few selected communities, with a general lack of comparable benchmarking data (Okolo-Obasi *et al,* 2021). Hence, there is an urgent need for further research on CSR in the Niger Delta region at sectoral levels, as well as on theoretical constructs (Uduji *et al,* 2020).The research strategy taken on for this study is a quasi-experimental one that made use of quantitative methodology, given the shortage of quantitative data on the complexities of CSR impact in the region of Niger Delta (Uduji and Okolo-Obasi, 2022a). The study utilized a survey research technique directed at the procurement of information from a representative sample of women in the rural area. It is basically cross-sectional and defines cum interprets what subsists at present. Figure 1 shows the integral administrative states of the Niger Delta region in Nigeria.

Figure 1: Constituent administrative states of the Niger Delta, Nigeria
Source: NDDC, 2004

3.1 Sample size

We made use of the Fisher (1998) formula to compute the sample size that was put to work in the study. Mathematically, the formula is represented thus:

$$no = \frac{\delta^2 \lambda(1-\lambda)}{\alpha^2}$$

Where,

no= the sample size;

δ = the standard normal deviation for a given level of confidence, (95% confidence =1.96).

α= margin of error at 0.05 for CI at 95%;

λ= proportion to be estimated.

Whenever the value of λ is not identified(known) with certainty, the assumption is thatλ is 0.5. Hence, in this our case, we assumed calculating the sample size thus:

$no = \frac{1.96^2(0.51)(1-0.51)}{0.05^2}$ = $no = \frac{0.960016}{0.0025}$ = 384.0063; approximated to 384.

Considering the size of the region and in order to further minimize the possible sample selection errors, we multiplied the *no* by 2 to attain 768 respondents that we utilized as the total respondents.

3.2 Sampling procedure

A multi-staged sampling technique was utilized in choosing the respondents for the study. We were directed by the fact that our sample is to be drawn mainly from the host communities with substantial presence of the multi-national oil companies. We also made it necessary to select respondent from communities where cluster development boards (CDBs) have been formed and functional as well as communities where such has not been formed. Based on that, two local government areas (LGA) were sampled from each of the 9 states of the region in line with the plan. The purpose that guided the assortment was on the basis that the MOCs sustained noteworthy presence in the LGAs. Also from the chosen LGAs, we picked two host communities based on the existence of MOC in the communities. In doing this, we also put into consideration communities that belong to a CDB (this we termed the

CDB communities) and the ones that do not belong to a CDB (this we termed the non-CDB communities). The CDB communities were used as our "treatment" group, while the non-CDB communities were used as our "control" group. The community gate keepers assisted us in the final stage to arbitrarily choose 384 respondents from the treatment group as well as another 384 from the control group. This is to attain the final 768 respondents that were utilized in the study. We, for that reason, spread the sample size in line with the population of women in each of the states as shown below:

Table 1. Sample size distribution table

States	Total Population	Female Population	% of total population	State Sample	Treatment	Control
Rivers	7,303,924	3,725,001	17	130	65	65
Bayelsa	2,277,961	1,161,760	5	38	19	19
Abia	3,727,347	1,900,947	9	70	35	35
Imo	5,408,756	2,758,466	13	100	50	50
Cross River	3,866,269	1,971,797	9	70	35	35
Akwaibom	5,482,177	2,795,910	13	100	50	50
Delta	5,663,362	2,888,314	13	100	50	50
Edo	4,235,595	2,160,153	10	76	38	38
Ondo	4,671,695	2,382,564	11	84	42	42
	42,637,086	**21,744,914**		**768**	**384**	**384**

Source: NDDC, 2001 /Authors' computation

3.3 Data collection

We gathered data for the work with the use of participatory appraisal technique which is executed with a written semi-structured interview (SSI) questionnaire. In putting this technique to use, we considered the vivacity of the outlooks of the people being studied in achieving the objectives of the study. The main tool used for the survey is the SSI used in gathering data from the sampled 768 respondents. It was handed out directly to the respondents with the aid of local research assistants. We engaged research assistants because of the challenges such as language barrier that the respondents may face in making sense out of the instrument utilized. The incapability of the researchers to speak the varied local languages and dialects of the numerous ethnic groups in the sampled rural communities made it necessary to use the local research assistants. They assisted us as well in traversing terrain of the region which is rough and uncertain.

3.4 Analytical framework

Bringing together the use of propensity score matching (PSM) and logit regression model, we estimated the effect of CSR of MOCs using GMoU on improving rural women's enterprises in the capacity of custodians of seed, food and traditional knowledge for climate change resilience in the Niger Delta region. We made use of the same to estimate the overall effect on gender in sustainable agriculture development in the Niger Delta region of Nigeria. Our choice of this technique was informed by the need to regulate the problems of endogeneity and selectivity. To embrace the propensity score matching technique, we first put into consideration the respondents from the communities that have become a part of or formed a cluster development board as "treatment" to be able to evaluate an average treatment effect of CSR. After that, an ideal assessment group "the control" was chosen from a larger survey and then matched to the treatment. This match was based on set of observed features. Propensity score matching requires estimating the effect of an intervention on treatment on the basis of observed covariates for both the treatment and the control groups; the observed features are the selection features used in picking the individual respondents. These features are not affected by the treatment (Uduji and Okolo-obasi 2022b). Due to this reason, in this study, the choice to be treated (CSR intervention), although not arbitrary, is dependent upon the variables observed. Therefore, to estimate the effect of CSR of MOCs using GMoU on women's enterprise development and sustainability, the treatment group was acknowledged. We denoted this treatment group as R_i =1 for $woma_1$ and R_i = 0 otherwise (control group). We, afterwards, matched the treatment to the control group on the grounds of the propensity score: (possibility of acquiring CSR of MOCs using GMoU given observed characteristics).

To this, we have: $P(X_1) = Prob(R_2 = 1/X_2)$ $(0<P(X_2) < 1)$ (1)

In equation (1), X_1represents the vector of pre CSR control variables, if R_1's are independent over all 1 and the results are free from CSR given X_1 then results are also free from CSR given $P(X_1)$ just as they would do if CSR are received arbitrarily. For us to draw clear-cut conclusions on the impact of CSR activities on the subject matter, we avoided the biasness of choosing of observables by matching on the possibility of the treatment (covariates *X).*
Hence, the PS was defined as a Vector X to represent thus:

$P(X) = Pr (Z = 1/X),$ (2)

In equation (2), the Z represents the treatment pointer equating to 1 if the chosen individual rural woman has received direct CSR enablement aimed at bettering rural women enterprises, and zero otherwise. Since the propensity score is a balancing score, the observables *X* will be dispersed same for both treatment and control and the variances are seen as to the feature of treatment. To aid us in getting this unbiased impact evaluations, we adapted a four steps that is popular in the literature(Kefyalew *et al*, 2016).In this steps, we first admitted that, the likelihood of receiving CSR intervention of the MOCs is predicted by a binary response with suitable observable features; so two separate groups (treatment and control) were pooled. After this, we evaluated the logit model of CSR receipt or not as a role of some socio-economic characteristics variables that comprises of individual, family (household) and community variables following equation 3 as shown below:

$$P(x)=Pr(Z=1/X)=F(\alpha_1 x_1\ldots\ldots\ldots+\ldots.\alpha_n x_n)=F(x\alpha)=e^{x\alpha} \qquad (3)$$

From this, we allocated a propensity score to each woman as we generated value of the likelihood of getting CSR from the logit regression. Therefore, the women in the control group with very low propensity score not within the range found for those in the treatment group were put aside. Therefore, for each woman in the treatment, a woman in the control that has the closest propensity score as calculated by absolute variance in score (nearest neighbour) was acquired. For this reason, we made use of the nearest five neigbours to make the evaluation more demanding. We then calculated the mean values of the result of pointers (indicators) for the nearest five neigbours to get the variance between treatment and control groups which is assessed by the average treatment effect on the treated (ATT).
The true ATT, based on PSM is written thus:

$$ATT_{PSM} = E_{p(x)}\{E(y_1/Z = 1, P(x) - E(y_0/Z = 0, P(X)\}, \qquad (4)$$

In equation 4, EP(X) stands for anticipation with respect to the sharing of propensity score in the population. The true ATT shows the mean variance in the enterprises competence of the rural women in agricultural value chain. In this, we attain a suitable match of a partaker with his counterfactual in as much as their observable features are identical. We put to test three different matching techniques (methods): the nearest neighbour matching (NNM), radius matching (RM), and kernel-based matching (KM) to acquire the matched pair. These

techniques have disparities in terms of bias and efficiency. The fourth step for us was to check the matching estimators' quality by standardized variances in observables' means between treatment and control. Representing variance in percent after matching with X for the covariate X, the variance in sample means for treatment as ($\acute{X}_1$) and matched control as ($\acute{X}_0$). In line with Tura *et al* (2010), the sub-samples as a percentage of the square root of the average sample variances is written as: ($\int_1^2 and \int_0^2$.).

Hence:

$$|SD = 100 * \frac{(\acute{x}1 - \acute{x}0)}{\left(.05 \int_1^2 and \int_0^2 .)1/2\right)} \qquad (5)$$

We recognised the remaining bias as below 5% after matching, thus, taking as a sign that the balance among the varied observable characteristics between the matched groups is adequate. Generally, because there may be a probability that unobservable factors may influence the treatment decision, we evaded the problem of hidden bias by making use of bounding approach. This is the reason we complemented equation 3 with the logit model to evaluate propensity score by a vector *U*. This vector comprises of all unobservable variables and their effects on the possibility of treatment. It is captured by γ and stated as follows:

$$P(x)=Pr(Z=1/X)= F(X\alpha + U\gamma) = e^{X\alpha U\gamma} \qquad (6)$$

Finally as the unobservable variable is a binary variable taking values 1 or 0, we examined the strength of the impact of γ on getting CSR with sensitivity analysis to be able to lessen the effect of acquiring CSR on potential results. To this, the treatment possibility of both women is applied in line with the bounds on the odds ratio stated in equation 7 as follow:

$$:\frac{1}{e\gamma} \leq \frac{P(Xm)(1-P(Xn))}{P(Xn)(1-P(Xm))} \leq e\gamma \qquad (7)$$

In line with Rosenbaum and Rubin (1983), with the above, we could claim that all respondent women have the same likelihood of getting CSR , as long as they are identical in X, only if$e$□□□1

3.5 SCOTDI

The MOCs actively involved in the Niger Delta carry on facing the issue of how to ascertain the success or failure of their CSR initiatives either as it concerns its effect on community

advancement or it's bearing on corporate-community relations. In addressing this issue, MOCs in 2013 made functional the Shell Community Transformation and Development Index (SCOTDI). It is an innovative structure that puts together and adapts a number of international principles into a merged index in a way that is responsive to local context (SPDC, 2013). The structure (framework) is made use of here to access and rank the result of the disparate GMoUs clusters in the communities MOCs cover.

4. Results and Discussion

4.1 Descriptive Analysis

To analyse the data produced from the study, we began by describing some of the respondents' social (education), economic (occupation, family earnings) and demographic (age, marital status, family size) characteristic. We saw these features as being very essential because it allows our understanding of the variances in the socio-economic and demographic status of the CDB women in comparison to their counterpart in the non-CDB communities.

Table 2. Socio-economic characteristics of women in the Niger Delta Region.

	Treatment Group			**Control Group**		
Variables	**Freq**	**%**	**Cum**	**Freq**	**%**	**Cum**
Age of Respondents						
Less than 21 years	6	2	2	14	4	4
21 - 30 years	159	41	43	117	30	49
31 - 40 years	131	34	77	154	40	74
41 - 50 years	71	18	96	83	22	96
Above 50 years	17	4	100	16	4	100
	384	**100**		**384**	**100**	
Level of Education						
None	19	5	5	47	12	12
FSLC	183	48	53	182	47	60
WAEC/WASSCE	134	35	88	127	33	93
Degree and above	48	13	100	28	7	100
	384	**100**		**384**	**100**	
Marital Status						
Single	62	16	16	70	18	18
Married	238	62	78	250	65	83
Widow	37	10	88	33	9	92
Divorced/Separated	47	12	100	31	8	100
	384	**100**		**384**	**100**	
Household Size						
1-4 Person	235	61	61	206	54	54

5-9 Person	94	24	86	114	30	83
10-14 Person	47	12	98	52	14	97
15 Person and above	8	2	100	12	3	100
	384	**100**		**384**	**100**	
Primary Occupation						
Fishing	65	17	17	61	16	16
Trading	74	19	36	86	22	38
Farming	146	38	74	162	42	80
Paid Employment	38	10	84	28	7	88
Handicraft	43	11	95	32	8	96
Others	18	5	100	15	4	100
	384	**100**		**384**	**100**	
Annual Income						
1000 - 50,000	8	2	2	42	11	11
51,000 - 100,000	45	12	14	85	22	33
101,000 - 150,000	104	27	41	115	30	63
151,000 - 200,000	83	22	63	67	17	80
201,000 - 250,000	76	20	82	43	11	92
251,000 - 300,000	46	12	94	26	7	98
Above 300,000	22	6	100	6	2	100
	384	**100**		**384**	**100**	
Value of receipts Through CSR						
1000 - 50,000	12	3	3			
51,000 - 100,000	33	9	12			
101,000 - 150,000	59	15	27			
151,000 - 200,000	70	18	45			
201,000 - 250,000	75	20	65			
251,000 - 300,000	101	26	91			
Above 300,000	34	9	100			
	384	**100**		-		

Source: Computed from the field data by authors

Analysis (Table 2) reveals that in the treatment group about 43% of the respondents are between the ages 30 years or below while about 34% are in the age range of 31 – 40 years. While 18% are between the ages of 41 – 50 years, just about 4% of the respondents are more than 50 years. This also reveals that while the average age of the respondent in the control group is about 36 years that of the treatment is 32 years. In the control group, while about 49% are not up to or are actually 30 years of age, about 04% are within the ages of 31 – 40 years. Moreover, while about 22% falls within the ages of 41 – 50 years, just about 4% of the respondents too are more than 50 years. Concerning the level of education, just about 12% of the control group lack basic formal education while for treatment it is 5%. It also makes it

clear that while 95% of the respondent in the treatment can engage in reading and writing, the number drops to88% for the control group showing that basic education is not a big issue in the region among women. Looking at primary occupation (job) and employment status, while about 10% of the CDB women are engaged by others, government or private sectors, the number drops to 7% for the control group. Taking this analysis further, it will be seen that the treatment group has about 17% involved fishing, 38% in farming , 19% in trading, plus11% who are into one handicraft or the other. For the control group, it flows thus: 16% into fishing, 42% into farming, 22% into trading, 8% into one handicraft or the other, and just as low as 4% involved in others. This reveals that, because the women in the treatment had more access to finance, a large percentage has carried on into their own handicraft business. However, engagement (employment) status of the respondent is almost the same. Essentially, both the treatment and control groups are still impoverished as many live under the poverty line. Irrespective of acquiring or not acquiring CSR, the average annual earnings of both groups is still very poor (low). In the treatment group, the average income is as low as₦200, 000 (about $400) yearly, while that of control is ₦90, 000 (about $180) per annum concurring that there is high level of indigence.

4.1.1The intensity of MOCs' CSR investment in empowering women in agricultural development in the Niger Delta region of Nigeria

We executed a detailed valuation of the sectors that the MOCs have been active in in the past few years so as to ascertain the intensity of MOCs' CSR investment in the area of custodians of seed, food and traditional knowledge for climate change resilience in the this study.We also looked at how the females and males have gained from the interventions.

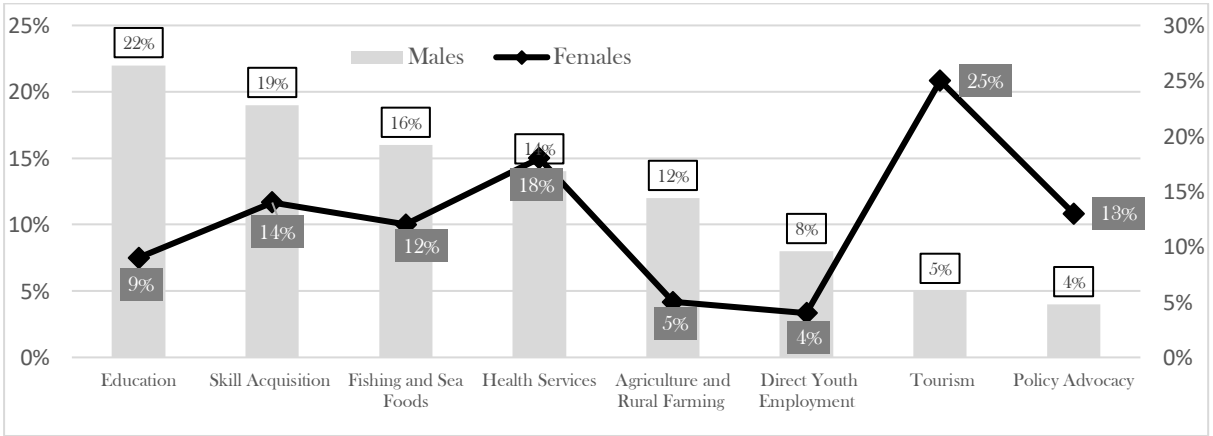

Figure 2. Percentage distribution MOCs' CRS using GMoUs by sectors as they affect men and women in the Niger Delta.

Source: Computed from the field data by author.

Analysis (Figure 2) displays that the respondents have enjoyed several kinds of CSR intervention. While some have gained from one single type, others have enjoyed multiple types. This is a suggestion that the MOCs have made CSR interventions in several sectors utilising the GMoUs in impacting on males and females. In the direct personal intervention in education sector (bursary, scholarships, overseas training etc.), 22% of men received the intervention, while only9% of women enjoyed same. In agricultural services and rural development (including its value chain), the men enjoyed 12%, leaving just about 5% for the women. On the side of skill acquisition, men received 19%, while women got about 14%. As it were, in accessing healthcare services women got 18% which is higher than the rating of men14%. For the interventions in the area of provision for fishing and sea food, women got 12% which is lower than 16% men got. Others areas of intervention include, direct employment of youths: men 8% and women 4%; tourism development and empowerment: men 5%, women hitting high again with about 25%. This shows that though in small measure, the multinationals oil companies have actually been involved in plethora of CSR interventions in the Niger Delta region.

Analysis (Figure 3) indicates that the CSR interventions of the multinational oil companies have been enjoyed by the respondents in the treatment in one form or the other. The range of the receipt reveals that about 22% of the women have been given between ₦ 1,000 – ₦ 100,000 ($2 -$200). Data also reveals that only 7% of men received same value of CSR intervention. Moreover, while about 24% of the respondent women have been given between ₦101,000 – ₦ 200,000 ($202 -$400), only about 21% of the men have received same amount. Furthermore, while about 31% of the women have been given between ₦201,000 to ₦ 300,000($402 -$600), 28%of men are in same category. Also, just about 16% of the women have been given₦301,000 to ₦ 400,000 ($602 -$800), men got more (24%).

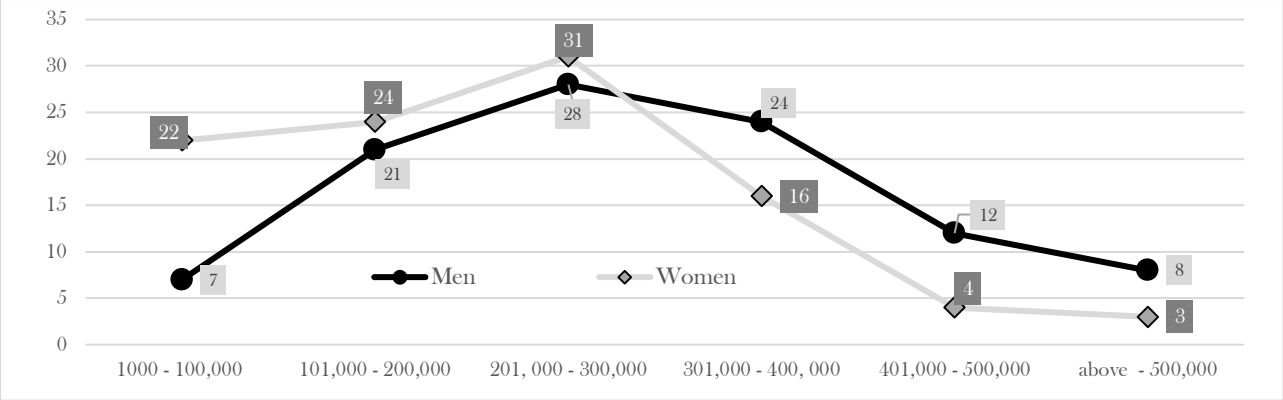

Figure 3. Rate of receipt of direct CSR intervention by gender from MOCs in the Niger Delta.
Source: Computed from the field data by authors

On the part of receiving large value of intervention, the percentage changes to favour men. While 4% of the women got between ₦401, 000 to ₦ 500, 000 ($802 -$100), 12% of the men enjoyed same level of assistance. For amount above ₦ 500,000 ($1000), only about 3% of the women have received such, but 8% of the men got such huge amount. The implication here is obvious: about 20% of the men have received direct CSR intervention in the excess of ₦401, 000 ($802), but only 7% of the women are in the same category. Men, clearly have an upper hand here, but women can be said to have received noteworthy CSR intervention.

Table 3. Percentage rating of MOCs' CSR in helping women with agricultural value chain enterprises development in Niger Delta.

Activities	Chevron	Exxon Mobil	Total E&P	Agip	Shell	Others	Average Filed	Average by MOCs
Provision of seed grant for women entrepreneurs	16%	14%	16%	16%	17%	15%	16%	19%
Provision of seed storage facilities	9%	5%	7%	9%	10%	10%	11%	14%
Training on information management	9%	13%	12%	11%	12%	10%	20%	22%
Inclusive business development targeting women	5%	7%	7%	6%	7%	11%	7%	11%
Provision of food processing and preserving facilities	17%	13%	16%	14%	13%	13%	14%	18%
Provision of short loans to only women	20%	18%	17%	17%	16%	18%	18%	21%
Skill acquisition for climate change resilience	21%	24%	20%	21%	17%	18%	20%	19%
Advocacy visits to relevant stakeholder	3%	6%	5%	6%	8%	5%	6%	8%
	100%	100%	100%	100%	100%	100%		

Source: Computed from the field data by authors

Analysis (Table 3)indicates the percentage rating of CSR investment in helping rural women to excel in their enterprises. The major MOCs were rated on the basis of the following: provision of food processing and preserving facilities; setting up of short loans to only women; provision of seed grant for women entrepreneurs; setting up of seed storage facilities; training on information management; inclusive business development targeting women; skill procurement climate change resilience, and advocacy visits to relevant stakeholder. The finding shows that among the major MOCs, setting up of seed grant for women entrepreneurs averaged 16% as against 19% proposed by the MOCs. Provision of seed storage facilities has an average of 11% based on the field reports while the MOCs recorded an average of 14%. For education of the rural women on information management in order to disseminate their traditional knowledge on how to manage climate change and improve resilience averaged20% as against 22% proposed in the secondary data from the MOCs. As it concerns inclusive business development aiming at women, the average of the rating is 7% as against 11% proposed by the MOCs in the secondary data. In continuation, the average rating of provision of food processing and preserving facilities is 14%, but secondary data has it on 18%. Provision of short loans to only women has an average of 18%, against 21% projected by the MOCs. Skill acquisition climate change resilience averaged 20%, which is against 19% projected by the MOCs. For advocacy visits to relevant stakeholder to improve on women enterprises and agricultural development, the average field data score is 6% as against 8% estimated by the MOCs. Obviously, the analysis reveals that the MOCs are making noteworthy efforts to empower women in enterprise development particularly as it concerns agricultural enterprises value chain. These findings share the same view with Lompo and Trani (2013), in that the intensity of MOCs' CSR investment in endowing women in enterprise development, particularly as related to agricultural value chain development in Niger Delta is poor (low) when placed under comparison with their investment in other sectors within the same region.

4.1.2Level of Gender Participation in the CSR Intervention of the MOCS

To realise the objective establishing the level of gender involvement in the study, we probed the level of women's contribution in the CSR activities of the MOCs making use of the GMoU in the cluster development boards.

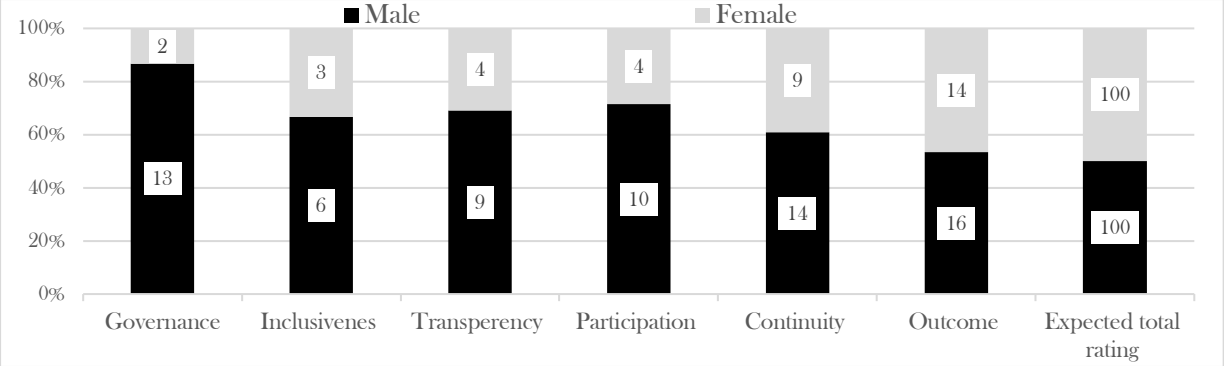

Figure4: Rating of male and female participation in the MOCs' CSR through the CDBs

Source: Computed from the field data by authors

Analysis (Figure 4) indicates the conditions and the variables, rating them either none, very low, low, moderate, significant or excelling (soaring). The state of mind of the rural women on gender differences in GMoUs interventions was evaluated so as to be more informed. The opinions of the rural women were sampled using six essential criteria developed from SCOTDI which is an innovative structure that combines and adopts a number of international principles into a compound index in a way that is accessible to local context. From the SCOTDI examination, we noted and put into record the opinion of the women on issues of governance, continuity, transparency, inclusiveness, participation, and result of the CSR of MOCs using GMoUs in the Niger Delta region. The overall rating of the activities of the CSR in endowing rural women for enterprises development and general agricultural chain productivity is poor (low). While rating themselves as low as (2%) in governance of the CDBs, they rated men 13%.Also in the area of inclusiveness the women rated themselves 3% while rating men 6%. For transparency, the women rated themselves higher than men 9%; men got 4%. Nonetheless, transparency is generally low regardless of the sex involved. In participation, women rated men 10%, but gave themselves 4%. For continuity, women rated men 14%, but rated themselves 9%. Finally, for outcome, women rated men16%,but gave themselves 14%. These ratings by the women reveal that like any other socio-economic ventures, men again have shown total supremacy in the CDBs thereby taking the upper hand in choosing projects that MOCs will be involved in. Men end up favouring their interest. This finding agrees with Renouard and Lado (2012), in that GMoU of MOC programmes and projects in the Niger Delta region are to some degree gender insensitive, particularly in rural communities.

4.2Econometric analysis

To accomplish the aim of ascertaining the impact of CSR of the MOC using GMoU on improvement of enterprising rural women custodians of seed, food and traditional knowledge for climate change resilience as well as having an impact on gender in sustainable agriculture development in Nigeria's Niger Delta region, we evaluated a propensity score matching of the treatment and control groups. The study at first summarized the average variances in six basic scores and independent observable qualities between the women in CDB communities (treatment group) and the women in communities that are non-CDB (control group). In all (Table 4), the variances in means reveal that the score on access to seed maintenance facilities, access to food handling preservation facilities, general sustainable agriculture development and general wellbeing of the rural women, impacting traditional knowledge for climate change, maintaining climate change resilience are all significant at 5% significant level. The average difference is approximately, 9%, 14%, 23%, 14%, 6%, and 12%, respectively. Also, we summarised the picked observable characteristics, in this summary some qualities are positively significant at varied significant level. There are estimated per capita income of other household members with 2.01; estimated annual income of respondents with 8.16; primary occupation with 2.62, and means of education of the respondents with 5.62. On the other hand, there are some features that recorded negative significant mean. Such includes Sex of respondents (0.96), Household Size of respondents (1.76), Marital Status of respondents (4.21), and Age of respondents (0.22). In characteristics of the farm, the treatment group had positive records in land ownership type with mean variance of 7.15, number of transportation means with mean difference of 0.63, source of input with mean difference of 1.34, farming experience with mean difference of 0.74, and farm type with mean difference of 5.03. Based on this reason, observable participation encouragements can be identified, which accentuates the possibility that selective placement exists and as a result the requisite of applying propensity score matching.

Table 4. Comparison of mean knowledge score and observable characteristics across treatment and control (N = 768)

Access and Knowledge Score in Percentage of maximum score	Treatment	Control	Difference
Scores on access to seed preservation facilities,	26.42	17.35	9.07**
Scores on access to food processing preservation facilities	23.08	9.56	13.52**
Scores on access impacting traditional knowledge for climate change	15.73	9.68	6.050**
Scores on maintaining climate change resilience	24.32	12.78	11.54**
Scores on general sustainable agriculture development	38.62	15.34	23.28 **
Scores on general wellbeing of the rural women.	27.42	15.65	13.77**
Socio-Economic Characteristics			
Sex	10.51	11.47	-0.96
Age	18.23	18.45	-0.22
Education	20.83	15.21	5.62*
Marital Status	18.1	21.31	-4.21**
Household Size	8.32	10.08	-1.76
Primary Occupation	13.28	10.66	2.62*
Estimated Annual Income	32.32	24.16	8.16**
Income of Other Household Members	8.25	6.24	2.01**
Farm Characteristics			
Farm Type	10.31	5.28	5.03**
Land ownership type	20.8	13.65	7.15**
Source of Input	8.75	7.41	1.34*
Farming Experience	3.67	2.93	0.74***
Transportation means	6.91	6.28	0.63
Observation	**370**	**370**	

Source: Authors' compilation based on household survey.

In line with the features that we chose that has the treated and control's relevant observable variances, the likelihood of receiving CSR was anticipated; the Logit model which we built from equation 3 was utilized (Table 5). In this examination, the projected coefficients were expressed; the odd ratios expressed in terms of odds of *Z=1*, the marginal effect, in addition to the standard error were expressed. We explored the single observables and noted that primary work (job), the women's level of academic attainment, how the respondents understood MOC's CSR using GMoU, and the size of farm are factors that in the positive affect the rural women's sustainable agricultural value chain improvement and management of climate change. Also, the rural women's sustainable agricultural value chain improvement and management of climate change were adversely affected considerably by farming

experience, estimated per capita income of other members of the household, age of respondents and projected annual revenue.

Table 5. Logit model to predict the probability of receiving CSR conditional on selected observables

Variables	Coefficient	Odd Ratio	Marginal Effect	Std. Error
Constant	1.816	5.131	.00261	.667
PriOcc	.319	.962	.120*	.142
MS	.-013	1.930	.00135	.130
Exp	.-021	1.810	-.054**	.132
Age	.-037	.983	.009	.019
Perception of CSR	1.241	11.143	.061*	.052
Edu	.007	1.017	.051**	.012
Farm size	.017	.954	.0511**	.053
HHcom	-.319	.562	.0012	.205
AY	.-016	.908	.00114	.042
Inpsou	.451	1.31	.0521	.013
Observation	768			
Likelihood Ratio - LR test (ρ=0)	□□2 (1) □1345.23*			
Pseudo R^2	0.34			

*= significant at 1% level; ** = significant at 5% level; and * * * = significant at 10% level

Source: Authors' compilation based on household survey.

Following the possibility of getting CSR anticipated in the model, we evaluated CSR impact on rural women's sustainable agricultural value chain improvement and controlling of climate change by the average treatment effect (ATT)as outlined in equation 4. This evaluation was done having certified judiciously the arbitrariness of the observations and that the sharing of propensity scores has no large discrepancies. With this, we observed that the highest and most significant treatment effect projected was formed by the nearest neighbour matching (NNM) in access to seed maintenance facilities, access to food handling preservation facilities, general sustainable agriculture development, general wellbeing of the rural women, impacting traditional knowledge for climate change, and maintaining climate change resilience.

Table 6. Estimated impacts of CSR interventions of the MOCs using GMoU rural women's sustainable agricultural value chain development and management of climate change using different matching algorithms

Description	**Access and Knowledge Score in Percentage of Maximum Score**		**Average Treatment effect on the treated**
	Treatment	**Control**	
Nearest neighbor matching Using single nearest or closest neighbor			
Scores on access to seed preservation facilities	26.42	17.35	9.07**
Scores on access to food processing preservation facilities	23.08	9.56	13.52**
Scores on access impacting traditional knowledge for climate change	15.73	9.68	6.050**
Scores on maintaining climate change resilience	24.32	12.78	11.54**
Scores on general sustainable agriculture development	38.62	15.34	23.28 **
Scores on general wellbeing of the rural women.	27.42	15.65	13.77**
Observations	**370**	**370**	
Radius matching **Using all neighbors within a caliper of 0.01**			
Scores on access to seed preservation facilities	22.14	20.12	3.02**
Scores on access to food processing preservation facilities	31.16	22.34	8.82**
Scores on access impacting traditional knowledge for climate change	17.41	13.13	4.28**
Scores on maintaining climate change resilience	21.43	15.22	6.21**
Scores on general sustainable agriculture development	15.53	10.42	5.11**
Scores on general wellbeing of the rural women.	12.42	8.66	3.76**
Observations	**384**	**384**	
Kernel-based matching **Using a bi-weight kernel function and a smoothing parameter of 0.06**			
Scores on access to seed preservation facilities	22.02	12.14	9.88**
Scores on access to food processing preservation facilities	19.23	14.31	4.92**
Scores on access impacting traditional knowledge for climate change	16.35	13.14	3.21**
Scores on maintaining climate change resilience	13.33	11.44	1.89**
Scores on general sustainable agriculture development	20.61	14.16	6.45**
Scores on general wellbeing of the rural women.	19.32	17.34	1.98**
Observations	**379**	**384**	

*= significant at 1% level; ** = significant at 5% level; and * * * = significant at 10% level

Source: Authors' compilation based on household survey.

The nearest neighbour matching evaluation of the rural women's access to seed maintenance (preservation) facilities due to CSR intervention by the MOC is about 9%. However, as shown in (Table 6) we checked the other two matching method (KM and RM) because the result of nearest neighbour matching technique appears to be somewhat not so good matches as a result of limitation of information. For the radius matching algorithm, the evaluated

effect is about3%, and Kernel-based matching algorithm yields a significant average treatment effect on the treated of about 10%, which is the utmost impact evaluation for the rural women's access to seed preservation facilities. For this outcome, we established that the CSR of MOCs using the GMoU has resulted in significant enhancement in rural women's access to seed preservation facilities which if in the end gets encouraged will better rural women's general agricultural value chain advancement. As suggested in the methodology, the third step in line with equation 5 was to check the disparity of single observable characteristics. We did so and found out that kernel-based matching and radius matching have much higher value than that of NNM in terms of the propensity score. Analysis (Table 7) abridged the statistics for the overall balance of all covariates between treatment and control groups. This summary endorses that the kernel-based matching and radius matching are of greater quality as both the mean and median of the absolute standardized variance after matching are lower than the threshold of 5%.

Table 7. Imbalance test results of observable covariates for three different matching algorithms using standardized difference in percent

Covariates *X*	**Standardized differences in % after**		
	Nearest neighbor matching	**Radius matching**	**Kernel-based matching**
Constant	41.6	2.8	4.7
Age	15.7	3.3	2.1
Edu	31.4	6.4	8.8
PriOcc	11.6	5.3	3.4
Farm size	12.6	2.7	0.5
Exp	31.4	2.4	4.3
MS	21.5	4.9	2.6
AY	9.5	3.8	2.1
HHcom	18.4	5.4	2.1
Perception of GMOU	76.4	5.5	6.3
Inpsou	22.5	4.1	1.9
Mean absolute standardized difference	26.60	4.24	3.53
Median absolute standardized difference	31.4	2.4	4.3

Source: Authors' compilation based on household survey.

Finally in the econometric valuation, we followed equation 7 to study the sensitivity of the significance levels. Being aware that it is the duty of a suitable control strategy for hidden bias, the sensitivity of treatment effects on the varied scores were put to comparison among

the three matching algorithms. In the matching, the sturdiness of outcomes produced by Rosenbaum's bounds are quite alike.

Table 8. Sensitivity analysis with Rosenbaum's bounds on probability values.

	Upper bounds on the significance level for different values of e^{y}				
	e^{y}= 1	e^{y}= 1.25	e^{y}= 1.5	e^{y}= 1.75	e^{y}= 2
Nearest neighbor matching	Using single nearest or closest neighbor				
Scores on access to seed preservation facilities	0.0001	0.0223	0.0231	0.0241	0.0411
Scores on access to food processing preservation facilities	0.0001	0.0012	0.0321	0.231	0.621
Scores on access impacting traditional knowledge for climate change	0.0001	0.0041	0.0634	0.418	0.871
Scores on maintaining climate change resilience	0.0001	0.0021	0.0031	0.0521	0.143
Scores on general sustainable agriculture development	0.0001	0.0017	0.0012	0.2121	0.2101
Scores on general wellbeing of the rural women.	0.0001	0.0016	0.0021	0.321	0.211
Radius matching	Using all neighbors within a caliper of 0.01				
Scores on access to seed preservation facilities	0.0001	0.0015	0.002	0.0312	0.0732
Scores on access to food processing preservation facilities	0.0001	0.0018	0.0021	0.141	0.026
Scores on access impacting traditional knowledge for climate change	0.0001	0.0011	0.0031	0.121	0.036
Scores on maintaining climate change resilience	0.0001	0.0002	0.0009	0.0081	0.0436
Scores on general sustainable agriculture development	0.0002	0.0012	0.0032	0.021	0.0731
Scores on general wellbeing of the rural women.	0.0004	0.0214	0.1634	0.628	0.091
Kernel-based matching	Using a bi-weight kernel function and a smoothing parameter of 0.06				
Scores on access to seed preservation facilities	0.0001	0.0011	0.0001	0.005	0.0218
Scores on access to food processing preservation facilities	0.0001	0.0071	0.0231	0.213	0.012
Scores on access impacting traditional knowledge for climate change	0.0001	0.0016	0.0012	0.0026	0.0114
Scores on maintaining climate change resilience	0.0001	0.0184	0.164	0.485	0.034
Scores on general sustainable agriculture development	0.0001	0.0315	0.012	0.0421	0.0432
Scores on general wellbeing of the rural women.	0.0001	0.0015	0.0013	0.0021	0.0134

Source: Authors' compilation based on household survey.

Analysis(Table 8) displays that the kernel based matching method formeda muchrobust treatment in comparison with the nearest neighbour matching technique and the radius matching as it concerns evaluations of hidden bias for access to seed maintenance facilities,

access to food handling preservation facilities, general sustainable agriculture development , scores on general wellbeing of the rural women, impacting traditional knowledge for climate change, and maintaining climate change resilience. There is a possibility that matched pairs may vary by up to 100% in unobservable features; while the effect of corporate social responsibilities on the above scores would yet be significant at a level of 5%:*p*-value = 0.0218 for access to seed preservation facilities; *p*-value = 0.012 for access to food processing preservation facilities; *p*-value = 0.0432, for general sustainable agriculture development,*p*-value = 0.0134 for Scores on general wellbeing of the rural women, ;*p*-value = 0.0114, for access impacting traditional knowledge for climate change, and *p*-value = 0.034, for maintaining climate change resilience. Same categories of awareness scoreare robust to hidden bias up to an influence of$\mathbf{e}^{\gamma=2}$ at a significance level of 10% in line with the radius matching technique.

Largely, the results of this study propose that, rural women are forced into smallholder agricultural enterprises as an only option out of poverty and way out of unemployment, and if given equal access to the opportunities available to men such as education, work experience and other resources they would equally grow their agricultural businesses for sustainable livelihood (Unger and Crawford, 1992; Fischer *et al,* 1993). The finding also shows that the relative priorities of MOCs' CSR intervention in the Niger Delta should vary from the classic, American ordering, as projected by Carroll (1991). Placing significance on a cultural context in ascertaining suitable CSR priority and programmes, as proposed by Visser (2006), is essential in the context of rural Niger Delta. Flexibility is also necessary, as suggested by Amaeshi *et al* (2006), in handling the distinctiveness of the socio-economic problems in the region, which take in closing the gender disparity in agriculture. But in addition, the findings of this study suggest that rural women, the custodians of seed and food, and their traditional diversity based seed, farming and knowledge systems, can make an essential contribution to regenerating the viability of the Niger Delta region of Nigeria. Given that the Niger Delta region is already experiencing the effects of environmental degradation and global climate change, the region needs to rapidly enhance its seed diversity and restore the resilience of its traditional regenerative farming systems. The greater the seed diversity, the more options there are to draw on for dealing with worsening environmental and climate instability. Cultivating diversity is the contribution that rural women in most traditions of this communities since the beginning of CSR intervention in agriculture in the Niger Delta. The intricate ecological knowledge and capacity of these rural women, together with their

communities, can enable them feed the growing population, and mitigate the impact of environmental and climate change in the region. Therefore, if we are to contribute on how CSR interventions can better gender equality in agriculture in the Niger Delta, we would claim that MOCs' CSR can play a vital role in bettering gender equality when investment in the area of custodians of seed, food and traditional knowledge for climate change resilience is arranged for the intricacies of real African rural life. It is our argument that the private sector, in general, is well positioned to address some of the logistical and cultural problems that face women' role in the custodians of seed, food and traditional knowledge for climate change in the Niger Delta. MOCs, specifically, are well placed for the transfer of business practices and values, technologies and infrastructure that expedite the crucial role that rural women play in most traditions in upholding and improving both crop variety and wild biodiversity across the Niger Delta region, in addition to the related awareness system. Hence, taking on gender equality in agricultural development ought to be prioritized in CSR practices in the Niger Delta because such action would contribute towards enhancing the environment for business activities in the gifted region.

5. Conclusion and policy

We scrutinised the effect of MOCs' CSR initiatives on improvement of enterprising rural women as custodians of seed, food and traditional knowledge for climate change resilience in the Niger Delta region of Nigeria. Outcomes from the use of a combined propensity score matching and logit model revealed that the paltry interventions of MOCs' CSR aimed at the enablement of rural women custodians of seed, food and traditional knowledge for climate change resilience yielded a significant success in bettering the role of women in agricultural production, especially in women's participation across value chains. This denotes that an upsurge in the MOCs' CSR directed at improving on rural women's access to seed preservation facilities, food treating(processing) facilities, extension system that results in strong body of knowledge cum the know-how that can be utilized in climate change mitigation, cutting down disaster and making available adaptation strategies, will improve on women's duties in families (households)cum communities, helping their roles as stewards of natural as well as domestic resources, positioning them well to add to maintenance strategies adapted to changing environmental actualities. The findings call for increased GMoUs interventions on vital contribution of rural women as custodians of seed and nutritional food, medicine and biodiversity, traditional knowledge to be re-valorised; it calls for both GMoUs practical and policy interventions for rural women, their communities and women's group for

a profound shift in agricultural and investment policies; so that women can be able to play a vital role in advocating for the systematic change required for a transition to an ecologically, socially and economically sustainable across the Niger Delta region.

On the implications for research, the study, though, reveals that CSR play a vital role in bridging the gender gap for agricultural development, it is necessary to spread out this research with a study that will ascertain whether CSR can be a substitute or a compliment for government actions cum responsibilities, especially in Nigeria. The main limitation of the study is that it is restricted to the scope of rural Niger Delta region. Therefore, the results cannot be widespread to cover other African countries with the same policy problems. In the light of this inadequacy, repeating the study in other countries is advisable in order to ascertain whether the established nexuses survive empirical examination in dissimilar rural contexts of Africa.

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No potential conflict of interest was reported by the authors.

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