Perceptions of Food Retailers Regarding Climate Change and Greenhouse Gas Emissions

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ABSTRACT

Objective – This paper sets out to assess perceptions of food retailers regarding climate change, greenhouse gas emission and sustainability in the Nelson Mandela Bay region of South Africa. The primary objective of this study is to investigate the food retailers' greenhouse gas emissions strategies. Climate change catastrophic potential and the harmful effect that it has had on the community and businesses has led to it being given attention from social media and in literature.

Methodology/Technique – This paper covered a literature review that provided the theoretical framework. The empirical study that was carried out included self-administered questionnaires which were distributed to 120 food retailers who were selected from the population using convenience sampling.

Findings - The results revealed that most of the respondents were neutral towards the impact of operational factors regarding GHG emission in the food retail sector.

Novelty - There is limited research that has been conducted among food retailers from the designated population. The study provided guidelines that will be of assistance to food retailers when dealing with climate change and greenhouse gas emissions impact in the food retail sector.

Type of Paper: Empirical.

JEL Classification: L66, Q54, Q59.

Keywords: Climate Change; Food Retailers; Greenhouse Gas Emissions; Perceptions; Strategies; Sustainability

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1. Introduction

There has been a debate for several years in literature about the effects of Greenhouse gas (GHG) emission (Hoffman, 2011:5 and Whitmarsh, 2011:690). The yearly changes in the atmosphere, interactions between the atmosphere and chemical, biological and geographic factors within the earth's system are referred to as climate change (Jackson, 2016).

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According to Pachauri and Reisinger, (2007:7), the main cause of climate change is the earth's atmosphere warming which affects the aspects of life. There seem to be limited studies on the measure of greenhouse gas emissions arising from the whole food chain globally but there have been GHG emissions estimates which are attributable to the agricultural production globally (Garnett, 2011:23). Tassou, Hadawey and Marriott, (2011), highlight that energy consumption not only increases overhead costs, it also leads to GHG emission which has now become one of the biggest challenges for food retailers. GHG emissions are produced at all the stages of the food chain life cycle, including the process of farming and its inputs to the manufacturer, the distribution, refrigeration, retailing, preparation of food and disposal of waste (Garnett, 2011). In as much as the technological improvements are necessary, they will however not be enough for reducing the GHG emissions. The cuts that managerial and technological innovation can achieve are highlight undermined by the combination of several things such as the population growth and the rising capita anticipated consumption of dairy products and meat.

The attention towards the GHG emissions arose in the last few years in South Africa, but there is still not a framework to reduce GHG emissions that food retailers can use to assist them in South Africa (Tassou et al. 2007:2988). Several studies argue that food, drink, transportation and consumption industry sectors are regarded as the sectors which contribute the most to GHG emissions (Environment Commission, 2006; SEI, WWF & CURE, 2006 and UNEP, 2008). This has resulted in significant changes in food production. According to Hellen Keoleian and Rose (2020:5), the production of food is very important as it contributes to several environmental issues which include land and water scarcity, biodiversity loss, water pollution and climate change. Roelich, (2008) alleges that the food production on farms have gradually mechanised, specialized and become large scaled and the food supply chains have become more complex and transport concentrated. Electricity usage through air conditioning, backing, lighting, refrigerator equipment, heating and other secondary services are the main contributors to GHG emissions in food retailing. According to Tassou et. al. (2011) the problem is there is no general policy or plan that food retailers can use to reduce GHG emissions and there is not enough research that has been conducted in this sector. Furthermore, Jagarnath and Thambiran, (2018:191) emphasise that the focus of current emissions accounting method is on the entire city and cities are usually seen as the largest GHG emissions with no difference within them. It is for this reason that it makes it very challenging to identify the mitigation strategies which can decrease emissions and minimise the challenges of climate change.

Popp et. al. (2010:451) indicated that most of the non-CO2 emissions are released by food and energy sources. Due to the population that is consistently growing and to the dietary preferences for food that have high emission content, it creates challenges within the food sector in managing the demand within the required carbon tax bracket. According to Hoolohan et. al. (2013:1065), there is a need for downward pressure on GHG emissions in all economic activity sectors and especially when these activities results to the direct combustion of fossil fuels (e.g. manufacturing, transport, electricity generation and space heating). Furthermore, there are substantial indirect sources of GHGs in some economic sectors and the methods for measuring and reducing GHG emissions are not easily available. The main objective of this study is on determine what impact the operational factors have on GHG emission and climate change more specifically focusing on the food retail sector in Nelson Mandela Bay. To achieve the main objective, there was a formulation of the following secondary objectives:

1. To review the literature on greenhouse emission strategies and climate change.
2. To conduct an empirical study to assess the greenhouse emissions strategies Nelson Mandela Bay of food retailers.
3. To formulate the general guidelines which will assist organisations in reducing greenhouse gas emissions for food retailers.

2. Literature Review

2.1 The history of GHG emissions and climate change

Stern et. al. (2007) indicate that the climate change and GHG emissions produced in the atmosphere are linked. Furthermore, the natural process which takes place in support of the earth in heating the atmosphere and the surface is known as the greenhouse effect. According to Henson (2006), less energy can escape into the atmosphere because of more GHG emissions sent by the earth into the atmosphere leading to the earth becoming warmer over time. The Intergovernmental Panel on Climate Change (IPCC), the Kyoto Protocol, and the United Nations Framework Convention on Climate Change (UNFCCC) are the three main international systems which were introduced to minimize the climate change major concerns.

The World Meteorological Organisation and United Nations Environmental Programme (UNEP) created the IPCC in 1988. The first report was issued in 1990 and this report reported on four hundred scientists' views who recognized climate change as a reality rather than it being something that needs to be done. Based on the findings and the views of the 400 scientists, the government globally was encouraged to form the UNFCCC which was initiated on 21 March 1994 and has been supported by 191 countries globally. This framework seeks to have a reduction in GHG emissions to the extent where no further harm to humans and the earth could be done in the future.

The countries that are more industrial oriented are the main focus because they have been known to contribute the most to GHG emissions currently and in the past (UNFCCC, 2007b). According to Richter, (2010), the Kyoto Protocol builds to the UNFCCC as it is a global agreement that was enforced from 1998. The Kyoto Protocol which sets goals which are legally binding and it is for minimising GHG emissions in countries was signed by 172 countries (UNFCCC, 2007a). The main focus of the Kyoto Protocol is on six GHG emissions which are, Hydrofluorocarbons (HFCs), Carbon dioxide (CO₂), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆), Methane (CH₄) and Nitrous oxide (N₂O).

Climatelinks.org (2016) states World Resources Institute Climate Analysis Indicator Tool indicated that GHG emission profile in South Africa is mostly dominated by the energy sector emissions because there were 84% total emissions in 2012. From this, 60% of energy emissions were from heat and electricity and construction and manufacturing accounted for 15% whilst transportation and the other energy subsectors accounted for 12% each. The second highest sector was the Agriculture sector which accounted to 7% of the total GHGs and from there, fermentation accounted for 42%, 33% was due to manure left on pasture and other agricultural subsectors accounted for 25%.

Rennkamp and Marquard (2017) state that with South Africa's global GDP of only 0.6% the GHG emissions account for 1.1% of the global emissions. There has been a revolution of energy and other climate-related technologies in the last decade due to the critical need to prevent catastrophic climate change and decarbonize the world economy. The challenge that South Africa is faced with is that the key issue now is no longer cost of electricity but rather the challenge of shifting from the current high-carbon energy system to a carbon electricity system in the future. Zhang, Dai and Song (2015) states that South Africa as a developing country its economic growth has occurred along with rising energy-related CO₂ emissions levels. Global warming is as a result of the anthropogenic GHGs which are caused by the accelerating use of fossil fuels. Carbon dioxide is the largest contributor to the GHG effect among the six different GHGs.

2.2 Factors influencing GHG emissions and climate change

Climate change science is very complex and it is still emerging however, the challenges that have been experienced are a result of known factors affecting climate change (Raubenheimer, 2011). These factors include geophysical and geological processes, solar radiation, human activity, the orbital parameters of the

earth changes and galactic cosmic rays changes as they are the main factors that contribute to the current climate change challenges (Nikolov & Petrov, 2014:1445). According to Hutchins (2009), the human activities that affect climate change are activities such as gas, coal and extraction and use of oil have led to a massive amount of Carbon Dioxide discharge within the earth atmosphere increasing the atmospheric temperature (Hutchins, 2009). Moreover, several GHG emissions have several bearings on economic and socio-environmental life but the emissions vary when it comes to their impact and how important they are in each sector or within the value chain (Nolt, 2011:4). When assessing the food retailers and their food chain, it is evident that in this sector the human activity has added to the warming effect. Garnett (2011:23) alleges that within the food chain the GHG emissions are produced throughout the different phases of the food chain life cycle including the inputs and farming process, production, delivery, refrigeration, retail, preparation of food and disposal contribute the carbon footprint globally.

According to Vermeulen, et. al. (2012:195), even though all the different stages of the food chain have been identified to contribute to producing GHG emission, the stage that contributes the most has been identified as the agricultural stage (raw materials/farm stage). Most of the current literature centers on the whole of the retailers supply chain as the main source of GHG emissions with not much information on how supermarkets and other retailers contribute when it comes to GHG emissions. There are factors which contribute to GHG emissions that are emitted by the food retailers. These are referred to as direct emissions and they include; air conditioning and refrigeration as well as indirect emissions which include ventilation, heating, lighting, backing and food wastage (Friel, et.al. 2009:2016-2025 and Tassou et al, 2011:147). Figure 1 shows operational factors which contribute to GHG emission in the food retail sector.

Figure 1. Factors contributing to GHG emissions in the food retail sector

Source: Own Construction

3. Research Methodology

3.1 Research paradigm and method

The research approach adopted in the study is the quantitative approach where the GHG emissions strategy of the Nelson Mandela Bay region food retailers was assessed. Two main research methods were identified in this study. These are part of the positivistic methodology and they are exploratory research and descriptive research. When a researcher wants to simplify unknown circumstances and to discover concepts that might be opportunities for the business they use exploratory research especially if it is in a fairly new area of research but it was not the case for this study. This study adopted descriptive research which explains the features of the environment, people, groups, organisations and objects to explain a given situation as the study seeks to describe the perceptions on GHG emission food retailer strategies in Nelson Mandela Bay.

3.2 Population and sampling

The food retailers in Nelson Mandela Bay were the selected population for the study. The technique that was adopted for this study was the non-probability sampling. Non-probability sampling is the procedure where one composes a sample that does not give a chance to some elements in the population to participate (Daniel, 2012). The sample size was only restricted to 120 respondents who were selected at Nelson Mandela Bay food retail.

3.2 Data collection

In collecting the secondary data, a comprehensive literature review was conducted. The primary data was collected in a form of a survey which was in a form of a self-administered structured questionnaire that was given to respondents. The researchers distributed 150 questionnaires, from that, only 120 questionnaires were returned making the actual response rate to be 80%.

3.2 Data analysis

The data collected were coded and transferred to an excel spreadsheet. A statistical tool Statistics computer program was used to analyse data. To measure central tendency (mean), frequency distributions and variability (standard deviation), descriptive statistics were used. Cronbach's alpha coefficient with validity measurement through exploratory analysis was conducted to test for reliability.

4. Results

4.1 Demographic profile of respondents

Table 1: Demographic profile of respondents

Characteristic	Category	%
Position in organisation	Employee	37
	Owner	27
	Manager	36
Period of current employment	< 1 year	21
	1-5 years	41
	6-10 years	23
	11-15 years	10
	16 years +	5

Size of organisation	Small (≤ 50 employees)	74
	Medium ($51 \leq 200$ employees)	23
	Large (> 200 employees)	3
Length of organisation's existence	< 1 year	12
	1 to 5 years	29
	6 to 10 years	24
	11 to 15 years	13
	16 to 20 years	10
	21 years +	12
Form of ownership	Sole trader	38
	Public company	5
	Close corporation	4
	Sole trader	38
	Partnership	35
	Private company	12
	Other	6
Type of food industry/sector	Fast food restaurant	33
	Restaurant	33
	Food retailer	34

Table 1 shows how the respondents are distributed in terms of the position that they hold in an organisation as being almost even where employees are (37%), owners are (27%) and managers are (36%). The majority of respondents have been employed by their current employer for a period which is between one and five years as there is (41%) and those employed between six and 10 years are (23%). Most respondents belong to small organisations with employment size of less than 51 (74%) and employees in medium-sized organisations amount to (23%). The majority of respondents belong to organisations that have a period of between one and five years of existence and that is (29%) and between six and 10 years which is (24%). Most of the respondents are employed as sole traders as they are (38%) and partnerships account for (35%). The distribution is even in terms of the type of industry/sector of restaurants, fast food restaurants and food retailers.

4.2 Descriptive statistics: Perceptions regarding climate change, GHG emission and sustainability

Table 2 indicates the descriptive statistics and frequency distributions of items related to climate change, GHG emission and sustainability (Section A and B).

Table 2. Descriptive statistics: Climate change, GHG emission and sustainability

Factors	Mean	Standard deviation	Disagree%	Neutral %	Agree %
Section A: General perceptions regarding climate change and greenhouse gas emission	3.45	0.55	11	60	29
Section B: Perceptions regarding sustainability	3.20	0.56	12	67	21
Economical aspects			16	54	30
Social aspects			16	52	32

Environmental aspect			12	67	21
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Table 2 clearly shows that the mean values for perceptions regarding climate change and GHG emission and sustainability cluster around point three (neutral) on the scale. There also appears to be not much difference around the mean scores (standard deviation scores are relatively low). It appears that most respondents are neutral regarding these aspects in the food retail sector. It thus clearly indicates that these aspects regarding climate change, GHG emission and sustainability are not yet all implemented within this sector.

4.3 Descriptive statistics: Operational factors impacting GHG emission

Table 3 indicates the descriptive statistics regarding operational factors impacting GHG emission (Section C).

Table 3. Descriptive statistics: Operational factors impacting GHG emission

Factors	Mean	Standard deviation	Disagree%	Neutral %	Agree %
Section C: Perceptions regarding operational factors impacting GHG emission	3.49	0.43	18	45	37
Refrigeration			4	28	68
Air conditioning			16	42	42
Lighting			4	28	68
Baking			9	40	51
Heating			16	52	32
Waste			18	45	37

Table 3 shows that the mean values regarding factors impacting GHG emission in the food retail sector cluster around point three (neutral) on the five-point Likert scale. A relatively low standard deviation score (0.43) indicates not much variability around the mean score. It appears that respondents agree with factors such as refrigeration, lighting and baking as impacting most on GHG emission in the food retail sector (highest agree scores on the scale).

4.4 Reliability of the measuring instruments

Table 4. Internal reliability (Cronbach's alpha) for Sections A to C of the questionnaire

Section	Aspect	Variables	Cronbach's alpha
A	General perceptions regarding GHG emissions and climate change	A1-A10	0.87
B	Perceptions regarding sustainability	B1-B9	0.88
C	Perceptions regarding factors influencing GHG emissions and climate change	Refrigeration (C1-C3)	0.71
		Air conditioning (C4-C6)	0.84
		Lighting (C7-C9)	0.70

		Baking (C10-12)	0.45
		Heating (C13-C15)	0.89
		Waste (C16-C18)	0.58

A calculation of Cronbach's alpha was conducted to confirm the internal reliability of factors. Hair, Anderson, Tatham and Black (2006) advocate that 0.7 is acceptable as a threshold however, Athayde (2003:10), view is that even 0.50 can be accepted as a threshold in exploratory research. The various factors reliability coefficients of Cronbach's are all above 0.5 meaning that the reliability measurement is reliable.

5. Discussion

The results reveal that aspects regarding climate change, GHG emission and sustainability are not at all implemented within this sector. The operational factors impacting GHG emission identified by respondents that are impacting the most on GHG emission are refrigeration, lightning and backing. Due to the vulnerability of the food sector, has a significant contribution to the climate change negative effects. Within the whole food chain, the agricultural stage is the one that is seen to be contributing the most to the GHG emission. This was not only evident in the empirical study but in literature as well as literature findings revealed that there must be more focus on the early stages of the food chain such as raw materials extraction and processing of products etc. to minimise GHG emissions and eventually reducing climate change. Food retailers can minimise waste from packaging, reduce electricity consumption, recycle, encouraging sustainability, choose locations efficiently as well as design buildings, operate fleet vehicles efficiently, use refrigeration gas systems that are less harmful less harmful and enforce the reduction of GHG emissions by employing policies in the business. Since operational factors such as heating, baking, lighting, energy usage, refrigeration and air conditioning were identified as contributing factors to GHG emissions in the food industry, food retailers must consider these factors when reducing GHG emissions.

6. Conclusion

In understanding and developing climate change worldwide the concept of GHG emission and the effects associated with it are essential. Climate change consequences are visible is many levels. Changing lifestyles, the development of forests and the establishment of laws and regulations which will enforce change are measures that will slow climate change citizens, government and businesses play an important role as they have to be united to reduce the impact of climate change. When reducing GHG emissions the food retailers disregard and are failing to implement many aspects in their organisation. There are several aspects that food retailers should take note of as it will assist them in formulating and implementing a better strategy so they can reduce GHG emissions. These aspects include:

1. that the food retailers should understand the impact that GHG emissions could have on their business as it could affect their business image and sustainability;
2. they must have strategies in place which will assist them to reduce GHG emissions and in ensuring that they are compliant with the law and societal expectations;
3. they need to start using solar energy even though it is viewed as being expensive it will, in the long run, save them money;
4. they need to find ways to reduce food wastage as this will reduce GHG emissions; and
5. they need unite with the whole food chain to ensure that the GHG emissions reduction plans are implanted accordingly.

7. Recommendations

The importance of increasing productivity as a means to GHG mitigation should be emphasised by the food retailers. Having better relationships and coordination between retailers and manufacturers could be used as an approach to reduce food waste. There must be industry agreements which are voluntary, public awareness campaigns and packaging that will extend the lifespan of products. A paradigm shift with regards to national energy and infrastructure policies is needed in order to achieve extreme reduction on CO₂ emissions. The sustainability of the sourcing strategies needs to be assessed by the food retailers so that the use of GHG emission-intensive products such as meat can be avoided. The production and distribution of food needs to be addressed taking into account the eating habits of consumers and human nutrition. Measures must be put in place to decrease the refrigeration emissions and this can be done by ensuring that the energy used is efficient, there is correct specification of new equipment, using alternatives to hydrofluorocarbons and taking action of eliminating the refrigerant leakage. There must be a shift to using less GHG intensive modes of transport. To summarise the options for reducing GHG emissions there is a need for energy efficiency, resources efficiency and cleaner and renewable fuels. The decision makers need to consider the importance of ensuring that there is more healthful, resilient and morally attentive system in food consumption and production.

The limitations of the study is that the population was restricted to only one region in South Africa and this was a quantitative study only. It would be interesting to conduct the study using qualitative methods to get an in-depth understanding of the perceptions of GHG emissions in food retail. It is advised that future studies include all regions in South Africa.

References

- Climatelinks.org. (2016). Greenhouse gas emissions in South Africa. USAID, Washington.
- Guinée, J., Heijungs, R., De Koning, A., Van, L., Geerken, T., Van Holderbeke, M., ... & Delgado, L. (2006). Environmental Impact of Products (EIPRO) Analysis of the life cycle environmental impacts related to the final consumption of the EU25. <https://doi.org/10.1.1.400.4293>
- Friel, S., Dangour, A. D., Garnett, T., Lock, K., Chalabi, Z., Roberts, I., ... & Haines, A. (2009). Public health benefits of strategies to reduce greenhouse-gas emissions: food and agriculture. *The Lancet*, 374(9706), 2016-2025. [https://doi.org/10.1016/S0140-6736\(09\)61753-0](https://doi.org/10.1016/S0140-6736(09)61753-0)
- Garnett, T. (2008). *Cooking up a storm. Food, greenhouse gas emissions and our changing climate*. Guildford, UK: Food Climate Research Network, Centre for Environmental Strategy, University of Surrey.
- Garnett, T. (2011). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)?. *Food policy*, 36, S23-S32. <https://doi.org/10.1016/j.foodpol.2010.10.010>
- Heller, M., Keoleian, G., & Rose, D. (2020). Implications of future US diet scenarios on greenhouse gas emissions. *Ann Arbor*. <http://css.umich.edu/sites/default/files/publication/CSS20-01.pdf>
- Henson, R. (2011). *The rough guide to climate change*. Dorling Kindersley Ltd. <https://www.worldcat.org/title/rough-guide-to-climate-change/oclc/68772464>
- Hoffman, A. J. (2011). Talking past each other? Cultural framing of skeptical and convinced logics in the climate change debate. *Organization & Environment*, 24(1), 3-33. <https://doi.org/10.1177/1086026611404336>
- Hoolohan, C., Berners-Lee, M., McKinsty-West, J., & Hewitt, C. N. (2013). Mitigating the greenhouse gas emissions embodied in food through realistic consumer choices. *Energy Policy*, 63, 1065-1074. <https://doi.org/10.1016/j.enpol.2013.09.046>
- Hutchins, C. (2009). *Climate change: Our warming world*. Bristol: Alastair Sawday.
- Jackson, S.T. (2016). *Climate change*. Encyclopedia Britannica. Available: <http://global.britannica.com/science/climate-change> (Accessed 4 April 2020).

- Jagarnath, M., & Thambiran, T. (2018). Greenhouse gas emissions profiles of neighbourhoods in Durban, South Africa—an initial investigation. *Environment and Urbanization*, 30(1), 191-214. <https://doi.org/10.1177/0956247817713471>
- Nikolov, T., & Petrov, N. (2014). Main factors influencing climate change: a review. *Compt. rends. Acad. bulg. Sci*, 67, 1455-1476.
- Nolt, J. (2011). How harmful are the average American's greenhouse gas emissions?. *Ethics, Policy and Environment*, 14(1), 3-10. <https://doi.org/10.1080/21550085.2011.561584>
- Pachauri, R. K., & Reisinger, A. (2008). Climate change 2007. Synthesis report. Contribution of Working Groups I, II and III to the fourth assessment report. <https://www.osti.gov/etdeweb/biblio/944235>
- Popp, A., Lotze-Campen, H., & Bodirsky, B. (2010). Food consumption, diet shifts and associated non-CO2 greenhouse gases from agricultural production. *Global environmental change*, 20(3), 451-462. <https://doi.org/10.1016/j.gloenvcha.2010.02.001>
- Raubenheimer, S. (2011). Facing climate change: Building South Africa's strategy. African Books Collective.
- Rennkamp, B., & Marquard, A. (2017). South Africa's multiple faces in current climate clubs. *South African Journal of International Affairs*, 24(4), 443-461. <https://doi.org/10.1080/10220461.2017.1421479>
- Richter, B. (2010). Beyond smoke and mirrors: Climate change and energy in the 21st Century. Cambridge University Press. <https://doi.org/10.1017/S1537592710003622>
- Roelich, K. (2008). Food and Drink Industry Supply Chain Resource Efficiency. s.l. Ove Arup and Partners. s.l. European Commission. (Accessed: 15 April 2020).
- SEI, WWF & CURE. (2006). Counting consumption - CO2 Emissions, material flows and ecological footprint of the UK by region and devolved country. Published by WWF-UK, Godalming, Surrey, UK. <https://opus4.kobv.de/opus4-hsog/frontdoor/index/index/docId/1924>
- Stern, N. H., Peters, S., Bakhshi, V., Bowen, A., Cameron, C., Catovsky, S., ... & Zenghelis, D. (2006). Stern Review: The economics of climate change (Vol. 30, p. 2006). Cambridge: Cambridge University Press.
- Tassou, S. A., Chaer, I., Sugiarta, N., Ge, Y. T., & Marriott, D. (2007). Application of tri-generation systems to the food retail industry. *Energy Conversion and Management*, 48(11), 2988-2995. <https://doi.org/10.1016/j.enconman.2007.06.049>
- Tassou, S. A., Ge, Y., Hadawey, A., & Marriott, D. (2011). Energy consumption and conservation in food retailing. *Applied Thermal Engineering*, 31(2-3), 147-156. <https://doi.org/10.1016/j.applthermaleng.2010.08.023>
- UNFCCC. (2007a). The Kyoto Protocol. Available: http://unfccc.int/kyoto_protocol/background/items/2878txt.php (Accessed 27 May 2020).
- UNFCCC. (2007b). The United Nations Framework Convention on Climate Change. Available: http://unfccc.int/essential_background/2627txt.php (Accessed 27 May 2020).
- Vermeulen, S. J., Campbell, B. M., & Ingram, J. S. (2012). Climate change and food systems. *Annual review of environment and resources*, 37, 195-222. <https://doi.org/10.1146/annurev-environ-020411-130608>
- Zhang, M., Dai, S., & Song, Y. (2015). Decomposition analysis of energy-related CO2 emissions in South Africa. *Journal of Energy in Southern Africa*, 26(1), 67-73. http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1021-447X2015000100008