Transdisciplianry Journal of Education and Sustainable Development Studies, *Vol. 1, No. 3, December 2025*
A publication of the Department of Education Geography & Sustainable Development Studies, ISSN: 1595-8051 EISSN: 3092-9571
University of Calabar, Nigeria

Location; a Determinant of Biogas Technology Awareness Level as a Biodegradable Waste Management Strategy in Calabar, Cross River State, Nigeria.

(https://tjesds.org.ng/index.php/home/article/view/43)
DOI: https://doi.org/10.60787/tjesds.vol1no3.43
(https://doi.org/10.60787/tjesds.vol1no3.43)

James, Ofonmbuk Okokon
Department of Geography and Sustainable Development Studies
University of Calabar, Calabar.

Abstract
The general objective of this study was to assess location as a determinant of biogas technology awareness level as a biodegradable waste management strategy in Calabar Cross River State, Nigeria. The specific objective was to show how location (urban, semi-urban and rural areas) affect adoption of biogas technology in the study area. The research adopted survey research design and the population of study was men and women residents in Calabar, Cross River State. The instruments for data collection were rapid assessment form and semi-structured questionnaire for respondents from the three locations (urban, semi-urban and rural). The structured questionnaire was responded to by community dwellers in the study area. 300 people were randomly selected for the study. Hypothesis was tested using one-way analysis of variance (ANOVA). Significant findings of the study shows that there is a significant influence between awareness level based on exhibition on biogas technology and location (urban, semi urban and rural). Based on the findings of this study it was recommended that Calabar Urban Development Agency and other concerned bodies as well as individuals to invest in biogas technology seeing its two way advantage of serving as energy source and waste management strategy.
Keywords: *location, biogas technology, awareness level, and waste management.*

Introduction:

Energy is one the most essential requirements for sustainable development after water and land (Barau, 2006). It is needed daily for various industrial and domestic activities. Energy can be used at home for activities such as cooking, heating, lighting and other similar domestic chores. Recently, domestic energy has been discovered from plant and animal materials, hence the name biogas. Biogas according to the American Heritage Dictionary of the English Language (2009) is the mixture of methane and carbon dioxide produced by bacterial degradation of organic matter and used as a fuel.

Methane gas, the primary component of natural gas (98%), makes up 55-90% by volume of biogas, depending on the source of organic matter and conditions of degradation. Biogas is produced in all natural environments that have low level of oxygen (O_2) and have degradable organic matter present. These natural sources of biogas include: aquatic sediments, wet soils, buried organic matter, animal and insect digestive tracts, and in the core of some trees (Abdulkarimm, Lambu, Ahmed &Sheriff, 2013).

Biodegradable waste management in many parts of the world is a big challenge which if not properly taken care of can cause a lot of health and environmental problems (Oyeleke, Onibagjo & Ibrahim, 2003). Large volumes of biodegradable wastes are generated from households and industries. For example animal manure and food waste which are on the increase are disposed into landfills or applied to the land without treatment (Kaygusuz & Kaygysuz, 2002). This unutilized source of energy could be used to produce biogas while at the same time solving the problem of biodegradable waste management.

Family-type small biogas systems predominantly exist in the rural areas with capacities ranging from 1 to 10 m^3 biogas per day. Animal manure and agricultural wastes are primarily used as feed stocks in household biogas digesters, producing biogas and bio-slurry that can be used as organic fertilizers. Mostly small-scale plants are managed by individual households to generate energy for self-consumption. On the other hand, large and industrial-scale biogas plants with capacity above 5000 m^3 biogas per day largely utilize municipal or industrial organic wastes to generate biogas which can further be utilized for electricity generation, heat and transport fuel. Family-type biogas plants are managed by the individual households requiring financial investment but only yielding non-monetary benefits i.e. biogas used as cooking fuel substituting gathered fuel wood, whereas large-scale commercial biogas plants, managed by entirely private or public-private partnership aim to yield financial benefits by selling end-products i.e. electricity, transport fuel or heat. Factors such as the macro environment, scale of production, utilization area and feedstock type differ widely between two biogas systems in India (Song, Zhang, Yang, Feng, Ren & Han, 2014). Given the differences between two biogas systems, the present study concentrates on the small scale biogas which is managed at household level and involves mostly domestic wastes.

Adoption of biogas technology could be influenced by awareness and location in that, although urban people are seen as preexisting and gain more experience with any with existing technologies than the rural dwellers. Location of individual household may not have significant effect on adoption of biogas technology except for the fact that households located in the rural regions may not be well exposed to new technologies as they are usually launched and setup in the urban areas. However, the present study is designed to assess the gap in

ISSN: 1595-8051 EISSN: 3092-9571

location as a determinant in biogas technology awareness in Calabar, Cross River State, Nigeria.

Statement of problem

Perennial increase in magnitude of household waste as well as recent increase in animal and crop wastes due to the proliferation of animal and crop production in urban, semi-urban and rural communities of Nigeria have led to increased interest in waste management and renewable energy sources. There is a growing concern over the potential impact of wastes on environmental quality and socio-economic consequences. Despite government effort in waste management, example, provision of receptacle bins at street corners, road junctions, markets and other corporate places, some people still find it difficult to dispose their wastes into the bins for easy transportation to dumpsites. To addressed the afore mentioned waste management challenges, several innovations and technology has been put in place such as waste reuse, reduction, recycling and biogas technology among others.

However, biogas technology has been noted to be ecofriendly, still biogas energy production and utilization do not receive much needed attention in Nigeria and the socio-economic and environmental potential of the technology has largely remained elusive. The reasons for this trend still remain obscure especially with limited studies which have failed to provide answers to these key questions. It is against this backdrop this study seek to assess location as a determinant in biogas technology awareness in Calabar Education Zone, Cross River State, Nigeria.

Purpose of the study

The purpose of the study is to location as a determinant in biogas technology awareness in Calabar Education Zone, Cross River State, Nigeria. The specific objective is:

1. To ascertain the difference between awareness level based on exhibition on biogas technology and location (urban, semi-urban and rural areas).

Research question

Following the objective of the study the following research question is posed:

1. How does location (urban, semi-urban and rural areas) affect adoption of biogas technology in the study area?

Statement of hypothesis

To attain to the research question, the following null hypothesis is formulated:

1. Location (urban, semi-urban and rural areas) of individuals does not significantly affect adoption of biogas technology in the study area.

Review of Related Literature

Biogas technology is one of the renewable energy with various benefits and the ability to provide an alternative to the more expensive hydro-electric power as well as waste management. Levels of adoption of biogas technology in different regions (rural and urban) are worth knowing so that appropriate strategy will be put in place by relevant bodies. In a study by Njoroge, Nyonje and Gakuu (2018), which sought to investigate how location of respondents influence adoption of biogas technology projects. Descriptive research design targeting 6,956 households in Lanet Location, Dundori Division of Nakuru North District was employed. A sample size of 364 households was selected proportionally and systematically from two sublocations forming Lanet location (Mereroni & Muruyu). Descriptive statistics were used to analyze the data. The study established that only 24.1% of households had adopted biogas technology. The adoption levels between urban and rural households were found to be 41 (12.7%) and 37(11.4%) respectively. Among the household heads with positive attitude towards biogas technology protects, only 18.8% had actually adopted the technology. Of those who had not adopted the projects, 37% had neutral attitude towards the technology. Iqbal, Anwar, Akram and Irfan (2013) on the impact of locations such as urban and rural on the adoption of biogas technology in Pakistan administered 100 copies of questionnaire on the respondents. Information elicited from the instrument was analyzed using binary logit statistics. The results found locations of potential adopters of biogas technology to be positively related to adoption. It was revealed that the people who lived in the cities or urban areas were 0.26 times less likely to incline towards the adoption of the biogas in comparison to the peoples who lived in the rural communities.

The study by Mengistu. Simane Eshete and Workneh (2016) examined the factors that influence households' decisions on adoption of biogas technology in northern Ethiopia. It involved 179 biogas-user and 179 non-user sample households. They were selected using proportionate simple random and purposive sampling techniques, respectively. Data were collected mainly using semi-structured questionnaires. Data analyses employed logistic regression model. The results of the study showed significant ($p < 0.01$) spatial variations between the two study sites (Ofla and Mecha Districts). Due to larger number of biogas installations in Ofla District, initially it was expected that households in Ofla District were better in biogas technology adoption features than Mecha District. However, the results of the logistic regression model indicated that households in Mecha District were found to have more favorable biogas technology adoption characteristics than those households in Ofla District.

A comparison between the barriers to small-scale biogas technology dissemination in rural areas and large-scale biogas technology dissemination in urban India was done by Mittala,

ISSN: 1595-8051 EISSN: 3092-9571

Ahlgrena and Shukla (2018). A qualitative and systemic approach was used to identify the barriers. In-depth interviews with selected stakeholders were conducted to get insights needed to understand the root cause of each barrier particularly for biogas adoption in the study areas. A logical problem tree was constructed to assess the linkages between barrier elements. The results revealed lower rate of biogas adoption in rural areas and the share of biogas in the fuel mix in rural households was insignificant at P>0.01.

Research design

The research design chosen for this study was survey research design. The choice of this design was because the research involved a representative sample of households sampled from the entire population of household (Isangedighi, Joshua, Asim & Ekuri, 2004). More so, at the end of the survey, inferences were drawn from the results of analysis of data obtained from the field. This design allows the collection of data that can accurately and objectively describe biogas technology as a waste management strategy in Calabar Education Zone, Cross River State.

Area of the study

The area for this study is Calabar Education Zone, Cross River State. The zone is located within seven (7) local government areas namely: Calabar Municipality, Biase, Akamkpa, Calabar South, Akpabuyo, Odukpani and Bakassi Local Government Areas. The zone is bounded by Yakurr Local Government Area to the North, the Atlantic Ocean to the South, the Cameroon Republic to the East and to the West by Akwa Ibom and Ebonyi states. Geographically, the zone is situated between latitudes 4º27' and 5º32' North of the Equator and longitudes 7º50'and 9º28'East of the Greenwich Meridian. It covers a total land mass of 23,07425 kilometers with a projected human population of approximately 1.6 million people (National Population Commission, 2017). Administratively, the zone has 86 wards where socio-political and economic activities take place. The zone also has 237 primary schools, 225 secondary schools and 6 tertiary institutions including the popular Hope Waddle Training Institution, Holy Child Institute, Duke Town Primary School. University institutions include University of Calabar (Unical), Cross River University of Technology (CRUTECH), College of Education Akamkpa, School of Health Technology, School of Nursing Calabar and the new Author Javic University Akpabuyo.

Calabar like other parts of Cross River State is a civil service region with few industries and corporations. Indigenous occupations are: fishing, farming, hunting, trading and tailoring. It is rich with cultural heritage and blessed with a lot of hospitability facilities both of local, national and international standards. These hospitality facilities of course, attract influx of people of different categories into the area. There are tourism attractions like Margaret Ekpo

International Airport, Nigeria Pioneer Free Trade Zone (FTZ), Tinapa African Business Resort, Marina Resort, Qua Falls in Akamkpa and Cross River National Park, International Museum and Monuments.

Traditionally and culturally, Calabar Educatoin Zone is expressed in two (2) languages: Efik, Efut and Qua. However other languages such as Bekwara, Ejagham and the formal English languages are spoken in the area. Different festivals, dressing, food and religious affiliation abound in the area. The zone falls within three (3) vegetation belt such as mangrove, tropical rainforest and guinea savanna. The area is described as Africa's remaining virgin forest habouring rare species of plants, animals as well as insects. The zone is blessed with a variety of forest product like rubber, palm oil, "afang", timber etc. including food crops like maize, cucumber, cocoa yam, cassava, banana, plantain, pineapple etc. These endowments make a good number of the population involve in subsistence agriculture.

Population of the study

The projected population of people residing in Calabar Education Zone in Cross River State according to National Population Commission (2017) is 1,563,452. The specific figures for the 7 local government areas that will be covered in the study are shown in Table 1. The study population included all the inhabitants of the urban, semi-urban and rural communities of Calabar Education Zone.

Table 1: Population figure of the seven LGAs in Calabar Education Zone

S/N	Local Government Area	Population figure (NPC, 2006)
1	Calabar municipality	236,175
2	Biase	222,735
3	Akamkpa	198,961
4	Calabar South	252,287
5	Akpabuyo	357,300
6	Odukpani	253,358
7	Bakassi	42,636
	Total	1,563,452

Sampling techniques

Random and purposive sampling techniques were adopted for the study. To select LGAs for the study, simple random sampling technique by balloting was used to select one Local Government Area, from each region (urban, semi-urban and rural regions) of the Calabar

ISSN: 1595-8051 EISSN: 3092-9571

Education Zone making a total of 3 LGAs. The names of the 7 LGAs were written out on pieces of papers and folded into paper balls and kept in three regions. One folded paper was picked out randomly from each group one after another without replacement. This was done to avoid picking two or more Local Government Areas from the same region. The three Local Government Areas picked were used for the study.

To select communities for the study, three (3) communities were purposively selected from each of the three local governments making a total of 9 communities in all. Thereafter, 50 households were also be chosen from each community making a total of 450 households for the preliminary study. Members of these households (one from each) specifically the heads or their representatives were rapidly assessed for their awareness on biogas technology using a rapid assessment form. Households with knowledge of biogas technology were excluded from the study while those without any previous knowledge of biogas technology were eligible for the study. The excess number of households chosen for the preliminary study was to make sure that the study has a sample size of 300 as shown below after the screening exercise. However, any extra households will be excluded in order to maintain the required sample size.

Sample

The Sample size was determined using Yamane's formula to ensure accurate representation of the target population. Number of households in each area that was used for sample size calculation will be as reported in Bassey (2017). The sample size for this study was 300 household head or their representatives and the proportionate sample size for each of the 9 communities chosen for this study was 37 for Marian, 33 for Satellite Town, 40 for Atimbo summing up to 110 for urban area, 33 for Ikot Offiong Ambai, 31 for Ikot Edem Odo, 30 for Akwa-Ikot Effanga summing up to 94 for semi-urban area, 32 for Mbarakom, 33 for Aningeje, 31 for Osomba summing up to 96 for rural area. The breakdown of the distribution of households is given in Table 2 shown below.

Instrumentation

The following research instruments were used to achieve the objectives of the study: Rapid assessment form, questionnaire and demonstration guide. A rapid assessment form that consist of 10 items to elicit information on whether households are aware of biogas technology or not was used. This was administered to the household heads or their representatives. This was used to select the households that are included in the study. A semi-structured questionnaire with three sections A, B and C was designed and used. Section A- Socio-economic/Demographic data make up of 6 items, Section B- consist of 10 items measuring Waste management method, 10 items measuring adoption of biogas technology

and 10 items measuring knowledge of waste management while section C consist of the biogas technology demonstration.

Randomized controlled trial design was used for the demonstration study. The 300 households were screened for inclusion criteria and those with knowledge of biogas technology will be excluded from the study and those without knowledge of biogas technology were included in the study. These will be summed up and randomized into control and demonstration group. The control group were not be exposed to biogas technology while the demonstration group were exposed to biogas technology. The researcher administered the same questionnaire to the two groups and data were collected and analyzed.

A 30-min biogas technology demonstration which was guided by 12 itemized practical manual aim at encouraging the use of biogas to manage domestic wastes was used. The demonstration was designed to increase biogas knowledge, strengthen best practices towards waste management including the belief that biogas technology if adopted and used can reduce domestic wastes and prevent associated ailments while fostering attainment of future environmental oriented goals.

Demographic characteristics of respondents

Below is the demographic information on the frequency and percentage of responses to the items of the questionnaire on waste management methods and adoption of biogas in Calabar Education Zone, Cross River State. Accordingly, 138 respondents representing 46 percent of the study sample were male while the remaining 162 respondents constituting 54 percent were female. The study also shows that 27 respondents representing 12.3 percent were between the age of 20 years and below, 61 respondents constituting 20.3 percent were between the ages of 21-30 years, 61 respondents representing 20.3 percent were between the ages of 31-40 years, 77 respondents representing 25.7 percent were between the ages of 41-50 years while 64 respondents representing 21.3 percent were above of 50 years of age.

For response base on educational level, 21 respondents representing 7 percent were illiterate, 90 respondents constituting 30 percent were elementary/primary school certificate holders, 74 respondents representing 24.7 percent were secondary school certificate holders, while 115 respondents representing 38.3 percent were tertiary certificate holders. The study revealed that 108 respondents which constitute 36 percent had 1-3 household members, 101 respondents which constitute 33.7 percent had 4-6 household members, 75 respondents which constitute 25 percent had 7-9 household members while 16 respondents which constitute 5.3 percent had 10 and above household members.

ISSN: 1595-8051 EISSN: 3092-9571

As regards occupation, it was observed that 68 respondents which constitute 22.7 percent were farmers, 37 respondents constituting 12.3 percent were businessmen, 147 respondents constituting 49 percent were civil servants, 23 respondents constituting 7.7 percent were clergymen while 16 respondents constituting 5.3 percent choose others. The study also revealed that 49 respondents representing 16.3 percent under study had less than 5000 monthly income, 56 respondents representing 18.7 percent under study had between 5000-10,000 monthly income, 118 respondents representing 39.3 percent under study had between 10,00020,000 monthly income while 77 respondents constituting 25.7 percent had above 20,000 monthly income (Table 3).

Table 3: Demographic information of respondents

Demographic characters	Frequency	Percentage
Sex Male		
	138	46.0
Female	162	54.0
Total	300	100.0
Age		
Less than 20 years	37	12.3
21-30 years	61	20.3
31-40 years	61	20.3
41-50 years	77	25.7
Above 50 years	64	21.3
Total	300	100.0
Education		
Illiterate	21	7.0
Elementary/primary	90	30.0
Secondary	74	24.7
Tertiary	115	38.3
Total	300	100.0
Household size 1-3		
	108	36.0
4-6	101	33.7
7-9	75	25.0
Above 10	16	5.3
Total	300	100.0
Occupation Farmer		
	68	22.7

Business	37	12.3
Civil servant	147	49.0
Clergy	23	7.7
Others	25	8.3
Total	300	100.0
Income		
Less than 5000	49	16.3
5000-10000	56	18.7
10000-20000	118	39.3
Above 20000	77	25.7
Total	300	100.0

Presentation of results

There is no significant influence of location on the awareness level based on biogas technology of residence in Calabar education zone. The independent variable is location categorized into rural, semi-rural and urban while the dependent variable is awareness level of biogas technology. To test the hypothesis, the data collected were analyzed using One-way Analysis of Variance (ANOVA). The result in Table 8 shows that the calculated F-value of 65.518 is significant at p-value of .000 with 2 and 297 degrees of freedom at .05 level of significance. With this result, the null hypothesis is rejected. This result therefore implies that location has a significant influence on the awareness level on biogas technology of residence in Calabar education zone.

In order to determine the strength of the influence of which locations have on awareness level on biogas technology of residence of Calabar education zone, a Fisher Least post-Hoc test was conducted (Table 9). It can be seen from Table 6 that residence leaving in semi-urban areas provides more influence on the awareness level of biogas technology than people leaving in the rural areas (mean difference = 1.12, $p > .05$).

ISSN: 1595-8051 EISSN: 3092-9571

Table 8: Summary of data and one-way analysis of variance (ANOVA) on the influence of location on the awareness level based on biogas technology of residence in Calabar education zone.

Location	**N**	**X**	**SD**
Rural	91	24.75	7.49
Semi-rural	137	25.87	5.38
Urban	72	34.11	2.78
Total	300	27.51	6.78

Sources of	**SS**	**DF**	**MS**	**F**	**P variation**
Between groups	4201.054	2	2100.527		
				65.518	.000*
Within groups	9521.933	297	32.060		
Total	13722.987	299			

P< =.05, DF =2, 297.

Table 9: Post Hoc tests on the influence of location on the awareness level of biogas technology of residence in Calabar education zone

(I) Location	(J) Location	Mean Difference (I-J)	Sig.
Rural	Semi-rural	1.12136	.144
	Urban	9.36386*	.000
Semi-rural	Rural	1.12136	.144
	Urban	8.24250*	.000
Urban	Rural	9.36386*	.000
	Semi-rural	8.24250*	.000

*The mean difference is significant at the 0.05 level

In the same vein residence leaving in urban areas provides more influence on the awareness level of biogas technology than people leaving in the rural areas (mean difference = 9.36, p <05). Moreover, residence leaving in urban areas provides more influence on the awareness level of biogas technology than people leaving in the semi-rural areas (mean difference = 8.24, p <.05). However, the difference between residence leaving in semi-urban area and rural areas was not significant at .05 level of significance.

Discussion of findings

This research hypothesis which addresses the location and adoption of biogas technology among residence of Calabar Education zone Cross River State revealed that there is a

significant influence of location on adoption of biogas technology among residence of Calabar Education zone. The result supports Mingchai and Sangmane (2012) that though people in the rural areas may have heard about biogas technology they do not have enough knowledge hence the majority may not be convince of adopting the technology, stressing that Information sources on biogas energy is not always included in brochure, sensitization seminars, television, radio, religious organization, or other sources which could hinder its adoption. For people in the rural areas to be able to adopt biogas technology, NGO's, local authorities, media, family and friends should always play a major role in information dissemination since such outlets can be used to ensure that environmental issues are known to the general public. More enlightenment is needed to ensure that people irrespective of their location are made aware of the importance of biogas technology in the environment as well as its adoption.

Summary

The general objective of this study was to investigate the location as a determinant of biogas technology awareness in Calabar Education Zone, Cross River State, Nigeria. The specific objective was to show how location (urban, semi-urban and rural areas) affect adoption of biogas technology in the study area. The research adopted survey research design and the population of study was men and women residents in Calabar Education Zone, Cross River State. The two instruments for data collection were rapid assessment form and semi-structured questionnaire for respondents from the three locations (urban, semi-urban and rural). Data collected were analyzed using one-way analysis of variance (ANOVA). The Significant findings of the study shows that there is a significant influence between awareness level based on exhibition on biogas technology and location (urban, semi urban and rural).

Recommendations

Based on the findings of this study, the following were recommended:

1. To promote and maintain good health among households, the adoption and utilization of biogas in which the generated household waste are used to feed the digester instead of littering is a way forward.
2. This study is recommended to Calabar Urban Development Agency and other concerned bodies as well as individuals to invest in biogas technology seeing its two way advantage of serving as energy source and waste management strategy.

ISSN: 1595-8051 EISSN: 3092-9571

References

Abdulkarimm, I. A. Lambu, I. B., Ahmed, B. Y. & Sheriff, F. M. (2013). People's awareness and attitude on biogas as an alternative domestic energy in urban Kano. *Academic Research International*, 4(6), 625-635.

Barau, A. S. (2006). *An account of the high population in* Kano. A publication made for a non-governmental organization (Concern Group for Justice and Fairness; COGJAF).

Bassey, I. E. (2017). Effects of health education and promotion activities on the attitude and perceptions on HIV/AIDS control by rural communities of Cross River State, Nigeria. A PhD dissertation of the University of Calabar, Calabar, Nigeria. 159pp.

Iqbal, S., Anwar, S., Akram, W. & Irfan, M. (2013). Factors leading to adoption of biogas technology in Faisalabad District, Punjab, Pakistan. *International Journal of Academic Research in Business and Social Sciences*, 3 (11), 571578.

Isangedighi, A. J. Joshua, M. T., Asim, A. & Ekuri, E. E. (2004). *Fundamentals of research and statistics in education and social sciences*. University of Calabar Press, Calabar-Nigeria. 256-264.

Kaygusuz, K & Kaygysuz, A. (2002). A renewable energy and sustainable development in turkey. *Renewable energy*. E and FN spon Ltd, USA, 3, 431453.

Mittala,S., Ahlgrena, E.O. & Shukla, P. R. (2018). Barriers to biogas dissemination in India: A review. *Energy Policy*, 112, 361–370.

Njoroge, W. R., Nyonje, O. R. & Gakuu, M. C. (2018). Adoption of biogas technology projects among rural households of Lanet location, Nakuru County-Kenya. *African Journal of Project Planning and Management*, 51-74.

Oyeleke, S. B., Onibagjo, H. O. & Ibrahim, K. (2003). Degradation of animal wastes (cattle dung) to produce methane (cooking gas). *Proceedings of the 5th Annual Conference of Animal Science of Nigeria (SAN)*, 168-169.

Mengistu, M. G., Simane, B., Eshete, G. & Workneh, T. S. (2016). Factors affecting households' decisions in biogas technology adoption, the case of Ofla and Mecha Districts, northern Ethiopia. *Renewable Energy*, 93, 215-227.

Song, Z., Zhang, C., Yang, G., Feng, Y., Ren, G. & Han, X. (2014). Comparison of biogas development from households and medium and large-scale biogas plants in rural China. Renew. Sustain. *Energy Rev*. 33, 204–213.

The American Heritage® Dictionary of the English Language, Fourth Edition Houghton Mifflin Company. Updated in 2009. Published by Houghton Mifflin Company.