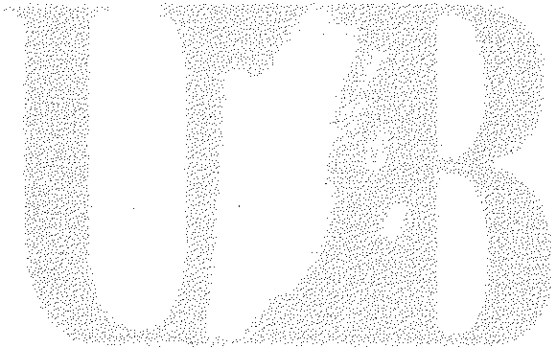


University of Belize  
Faculty of Management and Social Science  
UNDERGRADUATE THESIS



***THE ECONOMIC IMPLICATIONS ON THE  
GOVERNMENT OF BELIZE ENGAGING IN OFFSHORE  
OIL EXPLORATION AND DRILLING***

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## **ABSTRACT**

Though it has been almost sixty years after the first attempt to explore for oil offshore in Belize, the Government of Belize is once again planning to engage in such venture. Therefore, this research paper discusses the overall implications that the Government of Belize could possibly experience once it engages in offshore oil exploration and drilling.

To undertake this research, a representative sample of the Belize District residents were interviewed in order to determine their personal opinion about offshore oil exploration and drilling in Belize. In addition, the Director of Geology & Petroleum Department was interviewed so as to compare the Department's views regarding said issue.

Based on the sample population analyzed for this research, the findings indicated that it is not feasible for the Government of Belize to engage in such venture. The survey results also indicated that such venture will not be beneficial to the Belizean Society, and therefore, the Government should put a ban on such activity. Moreover, the findings also indicated that major damages could be made to marine life, ecosystems and the environment in the event of an oil spill.

As a result of the main findings, the research aims to provide relevant recommendations to the Government of Belize in order to address the issue of whether it should engage in such venture.

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# 1- INTRODUCTION

## *1.1 Background*

Offshore oil exploration and drilling is basically drilling for oil or natural gases in an ocean, gulf or sea, usually on the outer continental shelf. There are several types of platforms for carrying out offshore drilling activities, such as shallow-water steel jackets and jack-up barges, as well as floating semi-submersibles and drill ships that can operate in very deep waters. Offshore drilling activities create many environmental challenges, both in the ocean or sea, and close to the shores ([oilglossary.com/development.html](http://oilglossary.com/development.html)).

Since the 1950's, many oil companies have been granted oil concessions and carried out oil exploration activities in Belize, but only found minimal crude oil; nothing near to commercial production. In 2000, the Geology & Petroleum Department approved an oil concession to the Belize Natural Energy Ltd. (BNE) for onshore oil exploration and drilling and in 2005, this company made the first discovery of petroleum and gas deposits in Belize in the community of Spanish Lookout, Cayo District. Presently, Belize Natural Energy Ltd. is the only company that is producing and exporting oil from Belize. This oil company has a 36% stake within the Belize and Cayo Districts and also has an interest in the Toledo block of US Capital and West Bay block in Orange Walk District. The latest discovery that was made by this company was in January 2010 when an oil field at Never Delay, near Belmopan, was declared commercial (© Copyright 1994 - 2010 [Belize.com](http://Belize.com) Ltd.).

On June 15, 2010, the Director of Geology & Petroleum Department, Mr. Andre Cho, made a presentation to Cabinet and indicated that Belize's offshore potential is estimated at approximately US \$912.5 million yearly or over BZ\$1.8 billion.

In addition, it is very likely that Belize's offshore oilfields could net approximately 150 million barrels of oil at an estimated production rate of 50,000 barrels a day with a market price of US\$50.00 per barrel ("Amandala Belize Newspaper," 2010, June 20, pp. 4). Moreover, it is claimed that if the oilfields are found and properly produced, it could generate significant revenues which could in turn help to develop and boost up Belize's economy, especially now that the poverty rate has been declared at 43% ("Belize's Country Poverty Assessment Report," 2009).

Mr. Cho also stated that between the period 1958 and 2007, 16 wells have been drilled offshore by oil companies, namely Shell, Esso, Texaco, among others at places such as Turneffe Atoll and the Basil Jones area of San Pedro Ambergris Caye and found "live" oil shows. Furthermore, indications were made that oil has been washing up for a very long time in the Rocky Point area of San Pedro Ambergris Caye and more likely it is coming from deep offshore oil seeps ("Amandala Belize Newspaper," 2010, June 20, pp. 4).

Presently, there are eighteen companies that have been granted concessions by the Geology & Petroleum Department for oil exploration and drilling. Eight of these companies fall within the sea. For instance, a license was issued to Island Oil and OPIC Resource Corporation to carry out oil exploration and drilling in the Sapodilla Cayes and off the shores of Belize City and Stann Creek Districts respectively ("Amandala Belize Newspaper," 2010, June 20, pp. 4).

In addition to that, the Belize Barrier Reef has been parceled off into blocks for possible offshore drilling as early as 2012. Since the offshore region of Belize has estimated significant potential for large oilfields, the Government of Belize is now planning to engage once more in offshore oil exploration and drilling.



## *1.2 Statement of the Problem*

Most of Belize's 8,867 square miles of territory and much of the waters offshore have been allocated out in oil concessions that were issued by the Geology & Petroleum Department. Due to these concessions issued, several environmental organizations, as well as activist groups, are very much concerned about the tremendous negative impact that this venture could have on Belize's economy. Many fishermen livelihood depend on shrimp, lobster and fish. Likewise, Belize depends heavily on tourism as the primary source of income.

Based on a study that was conducted by the World Resources Institute (WRI), it was indicated that the systems of shoreline mangroves and coral reef contributes approximately between US\$150-196 million a year only on tourism and recreation activities, while fisheries generates approximately US\$164 million per year. Additionally, it was discovered that between the tourism and fishing industries, approximately 24,000 people are employed.

There is also a growing concern that the risks associated to Belize's diverse and rich marine resources, as well as reef and atolls, far outweighs any social benefit from this venture.

If there should ever be an offshore oil spill, the offshore beds would be contaminated and all of them would be shut down immediately. As a result, both industries would suffer major economic losses and this would definitely lead to the downfall of Belize's economy. Moreover, this could change the fundamental concept of what many Belizeans have come to know, love, nurture and even cherish as their prestigious Belize. Therefore, this study will examine the problems and prospects of offshore oil exploration and drilling on Belize's economy.

### ***1.3 Purpose of the study***

- a) The intention of this research is to gather information in order to provide policy makers with ideas of how major actors involved in their policies and proposed project can have either a negative or positive impact on policy or project success.
  
- b) The researcher intends to do a financial analysis so as to compare the economic benefits from oil exploration and drilling with the economic value of the marine and barrier reef systems so as to determine if it is feasible for the Government of Belize to engage in such venture.
  
- c) Examine specific environmental problems that are associated with the process of oil exploration and drilling. Furthermore, the researcher intends to create public awareness of the tremendous danger that this venture can cause to the environment.

### ***1.4 Significance of the study***

The results from this research will be beneficial to the Belizean society, as well as policy makers. The Government of Belize will be able to utilize the data presented in order to develop and implement more efficient strategies, whereas the Belizean society can use the data to unite their efforts in order to request from the Government of Belize to ban any possible offshore oil exploration and drilling.

## ***1.5 Research questions***

For the purpose of this research, the researcher will focus on the following questions:

- 1) Is it feasible for the Government of Belize to engage in offshore oil exploration and drilling activities?
- 2) Does offshore oil exploration and drilling activities have a negative impact on the environment?
- 3) What will be the benefit of offshore oil exploration and drilling to the Belizean society?

## ***1.6 Hypothesis***

### **Null**

- 1) It is feasible for the Government of Belize to engage in offshore oil exploration and drilling activities.
- 2) Offshore oil exploration and drilling has a negative impact on the environment.
- 3) The Belizean society will benefit from oil exploration and drilling.

### **Alternative**

- 1) It is not feasible for the Government of Belize to engage in offshore oil exploration and drilling activities.
- 2) Offshore oil exploration and drilling does not have a negative impact on the environment.
- 3) The Belizean society will not benefit from oil exploration and drilling.

### ***1.7 Limitations of the study***

As with much research, there are certain constraints that minimizes what the study has intended to achieve. Such limitations included the following:

- 1) Due to limited financial resources, the researcher will not be able to carry out a more in-depth research in all the districts.
- 2) The researcher will not be able to cover the entire country in order to determine all the problems and prospects of offshore oil exploration and drilling.
- 3) Since this research focused only on a limited sample size in Belize City, there will not be any representation from the other districts.

### ***1.8 Definition of Terms***

The following terms are defined for the benefit of readers:

Offshore: Located at a distance from the shore.

Oil Drilling: Pumping of oil from underground wells.

Financial Analysis: Assessment of the viability, stability and profitability of a business or project.

Feasible: Possible of being achieved.

Concession: An official license that is granted by government to allow work, such as drilling for oil, to be carried out in a specific area of land or sea.

## II – LITERATURE REVIEW

### 2.1 Offshore oil drilling

“*Offshore oil drilling*” refers to the discovery and development of oil and gas resources which lie underwater, such as an ocean, gulf or sea. The first stage of drilling is called “*spudding*” and this stage starts when the drill bit is lowered into the seabed. There are two types of bits, a roller cone or rock bit and a diamond bit. The roller cone or rock bit usually has three cones that are armed with steel or tungsten carbide teeth, or buttons, whereas the diamond bit is imbedded with small industrial diamonds. The drill bit is normally attached to a drill pipe and is rotated by a turntable on the platform floor. Extra lengths of drill pipe are then attached as the hole gets deeper.

Whenever drilling activities are carried out onshore, the ground provides a platform from which the oil company can drill. Whereas, with offshore drilling, an artificial platform must be constructed in order to carry out such activity. Construction of the artificial platform depends on the well and also on the depth of the water. When offshore drilling first started, explorers used to build in a derrick on a barge and towed it to their site. In this modern era, offshore rigs are now used to drill or explore wells. Four types of drilling rigs that are presently in existence are drilling barges, jack-up rigs, submersible rigs and semisubmersible rigs.

“*Drilling barges*” are mostly used when drilling will be carried out at inland, shallow waters. These barges are large floating platforms which are normally towed by a tugboat from one targeted location to the next location. Secondly, the “*jack-up rigs*”, are similar to drilling barges.

The only difference is that a jack-up rig is towed to the drilling site, where three or four legs are placed on the sea floor. Instead of a floating barge, the working platform rests outside of the water, which makes it safer to operate. Thirdly, "*submersible rigs*", are like jack-up rigs because it comes in contact with the ocean or sea floor. These rigs are comprised of platforms that have two hulls located on top of one another. The upper hull includes the living quarters for the crew, and also the actual drilling platform, whereas the lower hull works almost the same as the outer hull in a submarine, that when the platform is being shifted from one place to another, the lower hull is filled with air. Finally, "*semisubmersible rigs*" are the most common type of rigs that are used for offshore drilling activities. This type of rig is similar to the submersible rig with the only difference being that when the air is let out of the lower hull, the rig does not sink to the sea floor; instead it is partially submerged, but still floats above the drill site. As of June 2010, there are over 620 mobile offshore drilling rigs, which are comprised of jack-ups, barges, submersibles and semisubmersible rigs (Natural gas.org).

Drilling for oil offshore may take weeks or even months before the targeted location is actually reached. Whenever a well has been drilled to its target depth, a production casing is set and is then cemented. Offshore drilling work actually started in 1869 when one of the first patents was granted to T.F. Rowland for his offshore drilling rig design and the first offshore well was drilled in Summerland Field under the Santa Barbara Channel in California around 1896. Thereafter, wells were drilled along the Texas and Louisiana gulf coast. Today, the main offshore oil fields exist in the Gulf of Mexico, Brazil, Newfoundland and Nova Scotia, Nigeria, Angola, South East Asia and Russia (Natural gas.org).

With regards to Belize, sixteen offshore wells were explored and drilled during the period 1955 to 2007 by oil companies such as Phillips, Island Oil, Esso, Marathon, among others. Results were that three out of the sixteen wells had live oil shows, but no production testing was carried out. Another four of the wells had dead oil shows, and likewise, no production testing was conducted. Furthermore, no production testing was conducted in five other wells that were drilled.

Presently, most of Belize's 8,867 square miles of territory and much of the waters offshore have been allocated out in oil concessions, whereby eight companies have been granted concessions by the Geology & Petroleum Department to carry out offshore oil exploration and drilling work. For instance, a company such as the Princess Petroleum Limited, which is owned by Princess Hotel and Casino, as well as SOL Oil Belize Limited, PetroBelize Company Limited and Providence Energy Belize Limited, have all been granted concessions to explore for oil which are scheduled to commence as early as 2012 (Mr. Andre Cho, Director of Geology & Petroleum Department).

## ***2.2 Onshore oil drilling***

*"Onshore oil drilling"* refers to boring through various layers of the earth's surface for the discovery of petroleum oil hydrocarbons wells. A hole is drilled below the earth, as far as the pre-set depth, which is somewhere above where the oil trap is located. Whenever drilling starts, a large drill bit is attached to a drill-string and a drill-pipe that is comprised of tubular elements that are normally screwed on as the drilling advances. The drill-string is suspended and controlled from the working area on the rig, which is the derrick.

The well-bore is then cased with steel casing and cemented in place so as to control the fluids that are released from the well. As the drilling work advances, the diameter of the cased hole declines, and therefore, smaller drill bits are used. Moreover, as the drilling advances, a drilling log is kept for the recording of the drilled depth, the nature of the rock, and fluids found.

Onshore drilling activities actually started in Beaumont, Texas in 1901 as a result of oil blowing up approximately 50 meters into the air. Thereafter, in 1906 and 1908, wells were drilled in Alberta, Canada and Southwest Iran respectively, when the highest quality of oil was discovered (GEO ExPro, November 2008). Additionally, wells were also drilled in Miri, Sarawak, as well as in Qatar in the Middle East in 1910. Presently, the main onshore oil deposits are located in the United States, Angola, Iran, Iraq, Kuwait, Venezuela, Mexico and Saudi Arabia.

With respect to Belize, this small Central American country has always been dependant on imported oil. Since the 1950's, there has been approximately fifty wells drilled in Western Belize by several foreign oil exploration companies, such as Esso, Phillips and Placid, but only found minimal crude oil; nothing near to commercial production. Until fifty years after the first attempt, an oil concession was approved to a foreign company that is backed up by Irish and American investors, namely Belize Natural Energy Ltd. (BNE), to explore 595,000 acres of land. In 2005, this company successfully made the first discovery of petroleum and gas deposits in the community of Spanish Lookout, Cayo District. Today, Belize Natural Energy Ltd. is the only oil company that is producing and exporting oil from Belize.



The latest discovery that has been made by this company was in January 2010 when an oil field at Never Delay, near Belmopan, was declared commercial (Copyright © 2010 Belize Natural Energy Limited). Since the discovery of onshore oil in Belize, several oil companies, such as Spartan Petroleum Corporation and SOL Oil Belize Limited, are very much interested in exploring once more for oil onshore.

### ***2.3 Oil concessions***

An “*oil concession*” is when a private company is being granted legal permission by a government to explore, produce and market natural resources in a given geographical area for a specific period of time and in exchange for specific payments, either in cash or in kind. In the early 1970’s, the global oil production was controlled by a small number of Transnational Corporations (TNC’s). These corporations had the right to explore, produce and market the resources for periods ranging from 40 to 75 years and it had secured rights over large tracts of land, sometimes even extending throughout the country. Many of these old style concession agreements ended with decolonization and the creation of the Organization of Petroleum Exporting Countries (OPEC). Today, the extraction of oil and gases are now regulated by different types of partnership agreements; most often with state-owned oil or gas companies of host developing countries (Natural gas.org).

Four types of oil concessions that now exist worldwide in the petroleum industry are a) exploration and production contracts; b) production-sharing agreements; c) joint ventures; and 4) service contracts. The most relevant agreements that are commonly used by governments are the production-sharing agreements and the service contracts (Omorogbe, 1997).

In Belize, the model of concession utilized is the "*exploration and production contract*." For example, an exploration and production contract was signed between the Government of Belize and Belize Natural Energy Limited on January 3<sup>rd</sup>, 2003 to conduct petroleum operations within a specific area in the Central and Western portion of the country. With this type of concession, Belize Natural Energy Limited has the authority to conduct petroleum exploration activities, such as exploration for development and extraction, for a period of eight years. This eight year period is divided into four 2 year periods, whereby at the end of every period the contractor has to apply to renew the contract and relinquish 25% of the original acreage. Additionally, this oil company was granted twenty-five years to produce each oil field, which can then be renewed for another twenty-five years. Furthermore, this concession details the different types of revenues that will be paid to the Government of Belize by this oil company (Mr. Andre Cho, Director of Geology & Petroleum Department).

#### ***2.4 Environmental effects of offshore drilling***

Offshore exploration and drilling activities normally affect ecosystems, human health and the environment at every stage of the process; from finding the oil deposits to the disposal of the waste. Oil companies normally use seismic testing, along with satellite mapping techniques, to identify potential oil deposits.

Whenever oil deposits are identified, platforms and pipelines are built, and therefore, exploratory test wells are drilled. Once oil is discovered, exploration activities are expanded, hence more wells and infrastructure is needed.

Additionally, the physical appearance of the environment changes from exploring to drilling, and at times, the impacts are greater than a large oil spill. Major impacts caused to the environment can consist of the destruction of the ecosystem, chemical contamination of the water, long-term harm to animal population (especially migratory birds and marine mammals), as well as human health. For instance, Belize's Barrier Reef was inscribed as a World Heritage Site, but due to commercial developments, such as dredging and construction that have been made within the reef, UNESCO has placed this fragile ecosystem on the list of World Heritage Sites in danger. Now that the Government of Belize proposes to engage in offshore exploration and drilling activities, this may pose a greater threat to the reef.

As previously mentioned, oil companies engage in seismic surveys and these surveys use large vessels which tow a range of powerful air guns that generate sound waves by firing explosive blasts of air. The surveys last approximately two to three weeks, and this process, disorients marine life. Unlike humans and other terrestrial animals, marine mammals rely on sound instead of sight as their primary sense. Dolphins, whales and seals use their sense of hearing to locate prey, avoid predators, choose migration routes and communicate across long distances (Lokkeborg, 1993). Therefore, the noise that is related to the seismic surveys disrupts these animals' normal activities.

The powerful sound wave that is produced by seismic surveys also has harmful effects on plankton (drifting organisms), benthic organisms (bottom dwelling) and commercial fisheries (Anderson et al, 1999). Discharges of waste, such as drilling fluids, cuttings and produced formation water can have chronic or even fatal impacts, and the benthic organisms would have the largest impact. With regards to phytoplankton, it will not photosynthesize without light and will eventually die. Consequently, if there is no phytoplankton, herbivores won't have food. As for commercial fisheries, drilling fluids and cuttings can kill the adult fish, the larvae and the eggs. This can definitely reduce the adult population, cause deformities and have negative impacts on spawning and growth. Several studies have shown that in areas where seismic operations have occurred, fishing activities has greatly been reduced (Mario, 2002).

Marine life, birds, terrestrial wildlife, landscape, and even workers, can all be affected by offshore oil exploration and drilling. For every well that is drilled, about 8,000 square feet can be covered by as much as a meter thick of drilling waste, which can remain in the environment for at least two years (Jonathan, 2000). The draining of oil, grease, drilling fluids, lubricants, routine rig pollution, debris, cleaning solvents and other chemicals, as well as dredging of the ocean floor for locating pipelines, has a terrible effect on the marine environment. As Doyle (1994) noted, "during drilling, various mud, oily fluids, lubricants and other chemicals are used to cool the drill bit, stabilize the walls of the bore hole, or liquefy earthen cuttings. These fluids and additives accumulate in large quantities during the drilling process, and are often stored or finally disposed in waste pits." With this, it can clearly be seen that waste pits poses a great danger to animals and birds that would tend to mistake the pits for water holes.

Oil exploration and drilling can also lead to many acute and chronic health impacts. Humans tend to be diagnosed with several illnesses due to the consumption of mammals and fish that contain oil, mercury and other products that were brought to the surface during drilling activities. Moreover, many of the substances that are used in the extraction of oil causes dermatologic and pulmonary illnesses to workers. The most common dermatologic illnesses are contact dermatitis, acne, facial and neck lesions, perforating diseases and calcinosis of the hands and fingers. As for pulmonary illnesses, these include asthma, hypersensitivity pneumonitis and interstitial pulmonary fibrosis (D'Rourke & Connolly, 2003).

In terms of the marine flora and fauna, these are very much attracted to the structures of offshore oil drilling platforms that are beneath the ocean because it provides a safe haven and breeding grounds, just like any natural reef. Drilling fluids, such as mineral-based fluids, synthetic-based fluids and water-based fluids that are used in the oil industry are a major threat to the benthic flora and fauna, and therefore, the mortality rate of these species would be tremendous. In a study that was conducted by Dann, Booij, Mulder and Van Weerlee (1996) on the impact of type of oil-based fluid used at a site in the North Sea, it was discovered that the benthic fauna that was hundreds of meters away from the platforms were very much affected due to the discharge of oil-based fluids.

Approximately 300 to 500 oil spills occur every year on different scales and clean-up can sometimes take decades. Some of the major oil spills that have occurred since 1967 are off Tobago in the West Indies; 700 nautical miles off Angola; off Saldanha Bay, South Africa; and off Brittany, France with 287,000, 260,000, 252,000 and 223,000 tons of gallons respectively (Mr. Andre Cho, Director of Geology & Petroleum Department).

In the event of an oil spill during drilling, it is very difficult to clean up as the oil spreads very quickly on water. The main impacts would definitely fall on marine and coastal ecosystems, as well as birds, marine life and other wildlife. Some ecosystems, such as mangroves and coral reefs are very sensitive to oil spills and can take years to recover. In both the 1989 Exxon Valdez and the 1993 barer spills, fish, herring eggs and larvae had various lethal and sub-lethal effects. The pacific herring and pink salmon larvae suffered high mortality and high rates of physical deformity due to the exposure of the oil spill. As a result, the larval production dropped by approximately 50% (Brown, et al., 1996).

As for the British Petroleum oil spill that occurred on April 20, 2010, in the Gulf of Mexico, thousands of animals were confirmed dead. Animals that lived along the Gulf Coast were in their time of hatching or rearing. Species such as pelicans, shrimps and alligators, were all reproducing or preparing to do so. Birds were smothered in oil. Sea turtles, whales, dolphins and other marine animals were poisoned by the toxic spill (Fahrenthold & Eilperin, 2010). Similarly, in a Global Post article "*10 Animals Most at Risk from Gulf Oil Spill*" (Drapkin, 2010), it was stated that ten different species of animals, such as the bluefin tuna, whales, dolphins, pelicans, oysters, shrimp and blue crab, were in great danger. For instance, the bluefin tuna spawns in the Gulf of Mexico during the period April to June, and now that the waters were contaminated with oil, there is a high possibility of them becoming extinct. With regards to the whales and dolphins, these marine animals need to surface above the water in order for them to breathe fresh air. But now that the water has oil, these animals inhale the toxins from the oil and this poses a great threat to them. Likewise, the pelican breeding season is in the spring and their eggs were incubating. Again, the oil spill created a great threat to this bird.

The effects of oil on both marine and human lives are definitely caused by either the physical nature of the oil or by the chemical components. As Epstein & Selber rightly assert, “The general environmental effects of encroachment into natural habitats and the chronic effects of drilling and generating mud and discharge water on benthic (bottom-dwelling) populations, migratory bird populations and marine mammals, constitute serious environmental concerns for these ecosystems”. Therefore, the researcher will determine whether offshore exploration and drilling activities in Belize will have damaging consequences to marine life, the ecosystem, health, food chain, and even our diverse nature.

## ***2.5 Feasibility***

“*Feasibility*” is defined as the capability of being accomplished or brought about with a reasonable amount of effort, cost or other hardship. According to the study, “The Economic Contribution of Belize’s Coral Reefs and Mangroves” (World Resources Institute, 2008), Belize does not have the human nor financial and knowledge capacity that is required for any offshore exploration and development. Comparing Belize with the United States of America, whereby they have approximately 4,000 employees monitoring such activities, it is more likely that Belize won’t be able to monitor any such activity. Moreover, employment in the oil industry is low compared to the fishing and tourism industries.

## **2.6 Financial Analysis**

A “*financial analysis*” is an assessment of the viability, stability and profitability of a business or project. For the purpose of this study, the researcher will focus on a cost-benefit analysis to determine whether or not offshore drilling pays for itself and whether it will bring any economic benefits to Belize. Traditionally, Belize has always been dependent on agricultural exports for a large portion of its economic activities, until recently, when it began to diversify its economy towards tourism. Presently, tourism is one of the major industries in Belize. Now that Belize Natural Energy Limited struck oil for the very first time in Belize since 2005, the Government of Belize is now focusing towards the oil industry to play a major factor in its economy.

In deciding whether or not to venture into offshore oil exploration and drilling, it would be necessary to figure out if the costs, as well as the economic and ecological benefits, outweigh the benefits of producing offshore oil and gas. A preliminary study was conducted by an independent World Resources Institute (WRI) which gives an insight to this matter. Over 60% of Belize’s tourism is based around marine activities. According to 2008 figures, the reef and mangroves that are associated with tourism generates approximately US\$150 to 196 million, which accounted for 12 – 15% of Belize’s gross domestic product. In addition, the fishing industry generates US\$14 to 16 million annually. Furthermore, the reef protects the shorelines from erosion and wave-induced damage and that is valued at approximately US\$231 to 347 million per year. Therefore, the value of Belize’s coral reefs and mangroves amounts to an estimated US\$395 to 559 million annually (“The Economic Contribution of Belize’s Coral Reefs and Mangroves”, WRI, 2008).



On the other hand, based on an assessment that was carried out by the Geology & Petroleum Department, it is estimated that the possible offshore fields could net approximately 150 million barrels at an estimated production rate of 50,000 barrels a day with a market price of US\$50.00 per barrel. Therefore, the potential revenue could be estimated at US\$912.5 million yearly (see table on page 20).

Now considering the exploration costs that are required to drill offshore, such costs could amount from US\$2.1 to 3.6 million per drill. There is the possibility that offshore drills may not breakeven, and if no oil is found, then there isn't any profits, yet irreparable damages could be made to marine life, the reef and mangroves. Additionally, one of the greatest risks in offshore drilling is a blowout and this could be very costly. It could take several weeks to locate and activate a unit to drill a relief well. A relief well operation could take at least two or three months, or even up to a year, which means that the volume of the spill could be millions and millions of barrels. Hence, the potential costs to clean up an oil spill could be several billions or tens of billions of dollars.

In looking at the potential revenue that would be generated from offshore drilling, it seems as if though there is the possibility that Belize's economy could boost up tremendously. But what about the many risks that the tourism and fishing industries, as well as marine life, the reef, mangroves and the environment will be facing in the event of an oil spill? Obviously, the toll on the economy could be massive. The fishing and tourism industries could be severely affected; from hotels and restaurants to the retail and service industries. Revenues generated from sport fishing to scuba diving to snorkeling could also be severely affected.

Additionally, all nesting and feeding grounds for both birds and marine life that come in contact with the oil could also be greatly affected, which could eventually lead to extinction. Therefore, the researcher believes that the risks associated to Belize's diverse and rich marine resources, reef and mangroves, far outweighs any social benefit from oil exploration and drilling.

**Potential Revenues from a Hypothetical Offshore Oil Field in Belize with Reserves of 300,000,000 Barrels**

<b>YEAR</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>Daily Production</b>	20,000	30,000	50,000
<b>Annual Production</b>	7,300,000	10,950,000	18,250,000
<b>Price per Barrel</b>	75.00	80.00	87.00
<b>Annual Gross Revenue</b>	547,500,000	876,000,000	1,587,750,000
<b>Operating Expenditure</b>	70,000,000	90,000,000	100,000,000
<b>Capital Expenditure</b>	100,000,000	200,000,000	200,000,000
<b>GOB Working Interest</b>	54,750,000	87,600,000	158,775,000
<b>Contractor Working Interest</b>	492,750,000	788,400,000	1,428,975,000
<b>Royalty</b>	54,750,000	87,600,000	158,775,000
<b>GOB Production Share</b>	48,412,500	74,760,000	169,346,250
<b>Income Tax</b>	141,735,000	233,456,000	447,851,500
<b>GOB Working Interest Revenues</b>	13,260,250	19,018,400	51,177,725
<b>Contractor Net Income</b>	119,342,250	171,165,600	460,599,525
<b>GOB Net Income</b>	258,157,750	414,834,400	827,150,475
<b>Contractor Net Income</b>	31.61%	29.21%	35.77%
<b>GOB Net Income</b>	68.39%	70.79%	64.23%

## 2.7 Sampling

A "sample" is a finite part of a statistical population whose properties are studied to gain information about the whole (Webster, 1985). When dealing with people, sample can be defined as a set of respondents that are selected from a larger population for the purpose of a survey. A population is a group of individual persons, objects or items from which a sample is taken for measurement. For the purpose of this research paper, the known population will be the residents of Belize City since most of the waters offshore in this area have been parceled off for oil companies to carry out oil exploration and drilling. The sampling frame will be a list of all the residents, who are 18 years and older, residing in Belize City and this listing will be acquired from the Statistical Institute of Belize in the City of Belmopan. The sample size will then be determined from the sample frame. According to the Statistical Institute of Belize, approximately 80,000 people, who are 18 years and older, reside in Belize City. This means that the sample size will be 382 people with a margin of error of 5%. The formula for calculating the sample size of a known population is as follows:

$$SS = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:

Z = Z value represents 90% confidence level, which is the level of success.

P = represents the probability of success because in every probability of an event, there can be two outcomes, which are success or failure.

.10 = represents 10% level of failure.

C = margin of error

### **III – METHODOLOGY**

For the purpose of this research study, the research design will basically focus on collecting quantitative data of the economic implications on the Government of Belize engaging in offshore oil exploration and drilling. The research will utilize a survey questionnaire because the researcher believes that this type of method will adequately collect the pertinent research data that will address the variable which is being studied.

#### ***3.1 Population***

The sample population that was identified for this research study will be the residents of Belize City since most of the offshore waters in this area have already been parceled off for the exploration and drilling of oil. The research paper will focus on the listing of residents that is available at the Statistical Institute of Belize in the City of Belmopan, which is comprised of approximately 80,000 residents.

#### ***3.2 Sampling***

The target population size is 80,000 residents that are presently residing in Belize City. In order to select a sample, an updated listing of residents, which will serve as the sampling frame, was obtained from the Statistical Institute of Belize in the City of Belmopan. The Simple Random Sampling method will be used in this research so that it allows each resident in the sample to have an equal opportunity of being chosen. As a result, a sample size of 382 residents will be targeted. This method ensures a 5% margin of error by maintaining a confidence level of 90% which is acceptable for social research.

### ***3.3 Procedure***

The steps that will be taken to collect data from the sample population will be based on self-administered questionnaires (appendix 1). The questionnaire designed clearly indicates the purpose of the survey and includes a disclaimer whereby each subject is informed that the information obtained will be solely used for the purpose of this research and that all data collected will remain confidential. The questionnaire is comprised of closed ended questions only. The sample population will be given three days to respond to the questionnaire. The information collected will be quantitatively analyzed in order to obtain statistics and percentages and therefore be able to develop graphics.

### ***3.4 Instrument***

Upon receipt of completed questionnaires from the sample population, the data collected will be divided by the questions of the survey instrument. All the data from the matrix will then be entered into the SPSS computer software program. For the purpose of the data analysis, all categories will be coded and the data will be entered accordingly into the software.

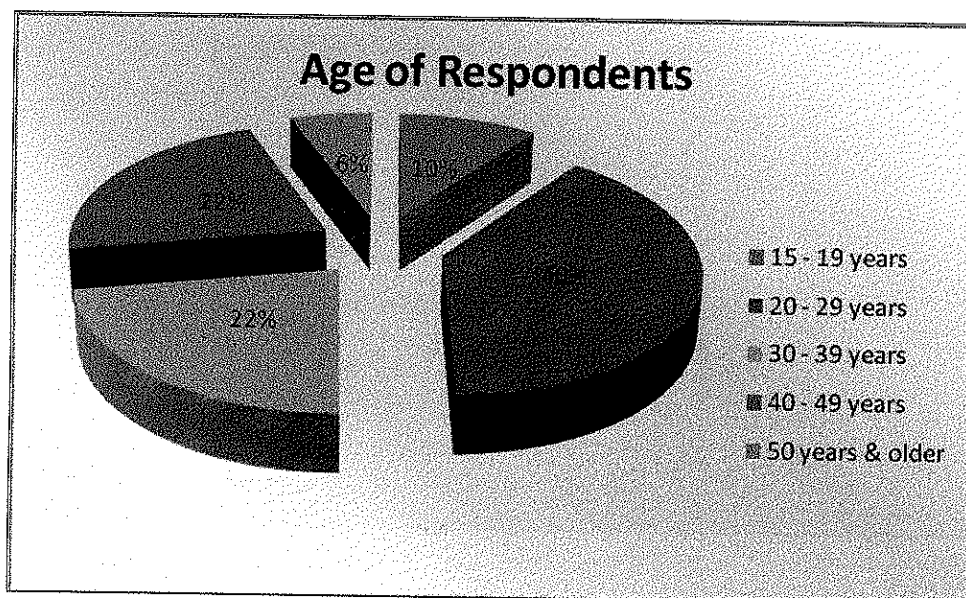
## IV –RESULTS AND DISCUSSION

### *4.1 Analysis of questionnaire results*

This chapter provides an analytical view of the responses that was gathered as a result of the study conducted by the researcher. The information represents the collective opinions of the respondents as it relates to the issue concerning the economic implications on the Government of Belize engaging in offshore oil exploration and drilling. It is worthy to note, however, that while the researcher intended and attempted to obtain the view of a representative sample from Belize City, by selecting three hundred and eighty-two individuals, three hundred and fifty-five of the three hundred and eighty-two questionnaires issued were successfully returned. Therefore, this resulted in a ninety-three percent response rate and the margin of error was retained at seven percent. Hence, the result can be considered as having a positive impact on the reliability and validity of the data collected.

The results presented below will provide an illustrative view regarding the respondents' opinions on the significant research questions. Additionally, the findings will provide evidence as to the status of the research hypothesis in regards to whether it should be accepted, rejected or whether it's inconclusive. Moreover, the following charts point to the demographic features of the survey sample population that provides a visual view of the subjects who participated in the research study.

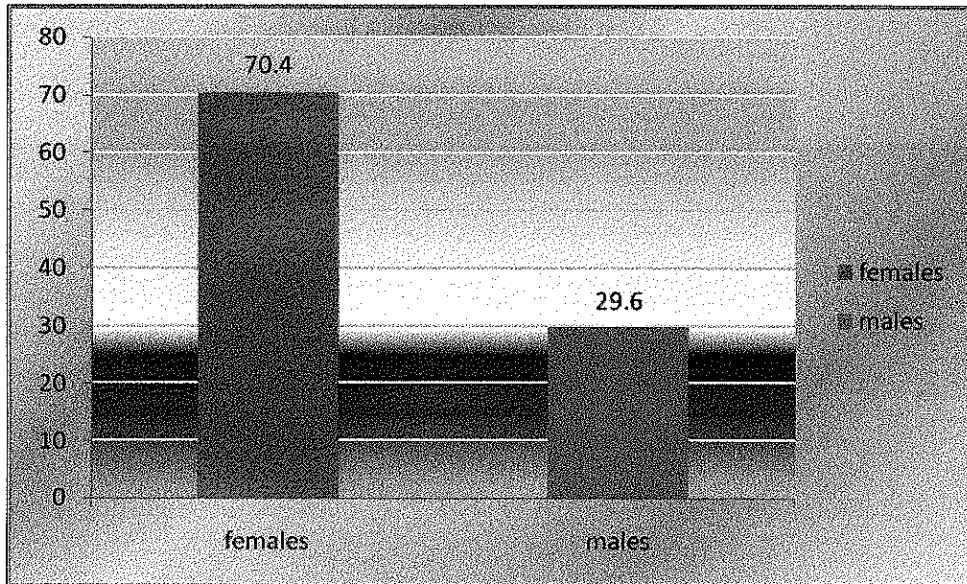
*Figure- 1: Age of respondents*



The information presented in Figure-1 shows that the age range of the respondents from whom the most responses were received was between 20 – 29 years old with 40%, followed by 30 – 39 years old with 22% and also 40 – 49 years old with 22%. This was then followed by 15 to 19 years old with 10% and the 50 years & older age range with 6%.

It was quite interesting to note that most of the respondents were females as can be seen in Figure-2 with 70.4% and the remaining 29.6% being males.

**Figure- 2: Sex of respondents**



As per Table-1 below, out of the 355 respondents, 115 or 32.4% of the respondents are employed under the secretarial/clerical field. This is followed by 96 or 27% of the respondents being classified as other, eg. student, then 54 or 15.2% being employed under the administrative field. Fifty or 14.1% of the respondents are unemployed and 21 or 5.9% are employed as manager/director. This is then followed by 12 or 3.4% being self-employed and the remaining 7 or 2% of the respondents having the post of lecturer.



**Table- 1: Respondents post**

Post	Frequency	Percent	Valid Percent	Cumulative Percent
secretarial/clerical	115	32.4	32.4	32.4
manager/director	21	5.9	5.9	38.3
self-employed	12	3.4	3.4	41.7
administrative	54	15.2	15.2	56.9
lecturer	7	2	2	58.9
unemployed	50	14.1	14.1	73
other	96	27	27	100
Total	355	100	100	

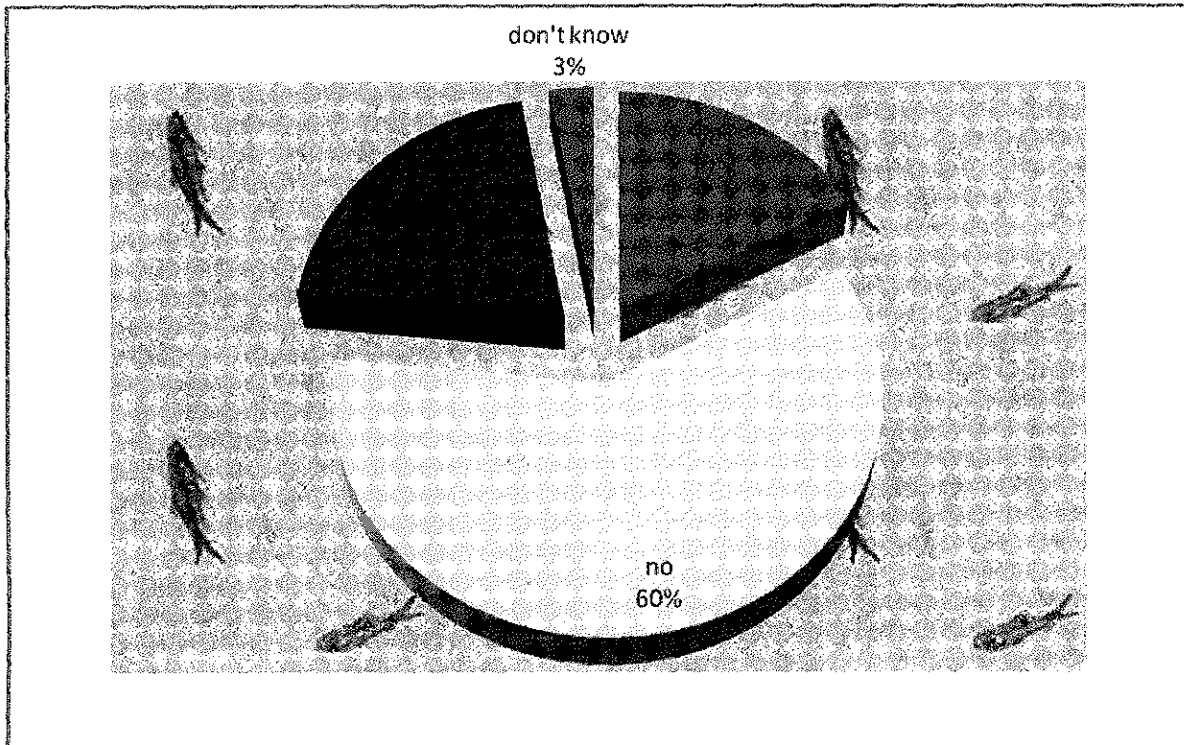
Reference Table-2 below, out of the 105 males that responded to the questionnaires, 30 of them reside in a village, whereas 25 and 50 of them reside in a town and city respectively. With regards to the female respondents, 46 of them reside in a village, whereas 85 of them reside in a town. The remaining 119 females reside in a city.

**Table- 2: Where respondents reside**

**SEX \* RESIDE Crosstabulation**

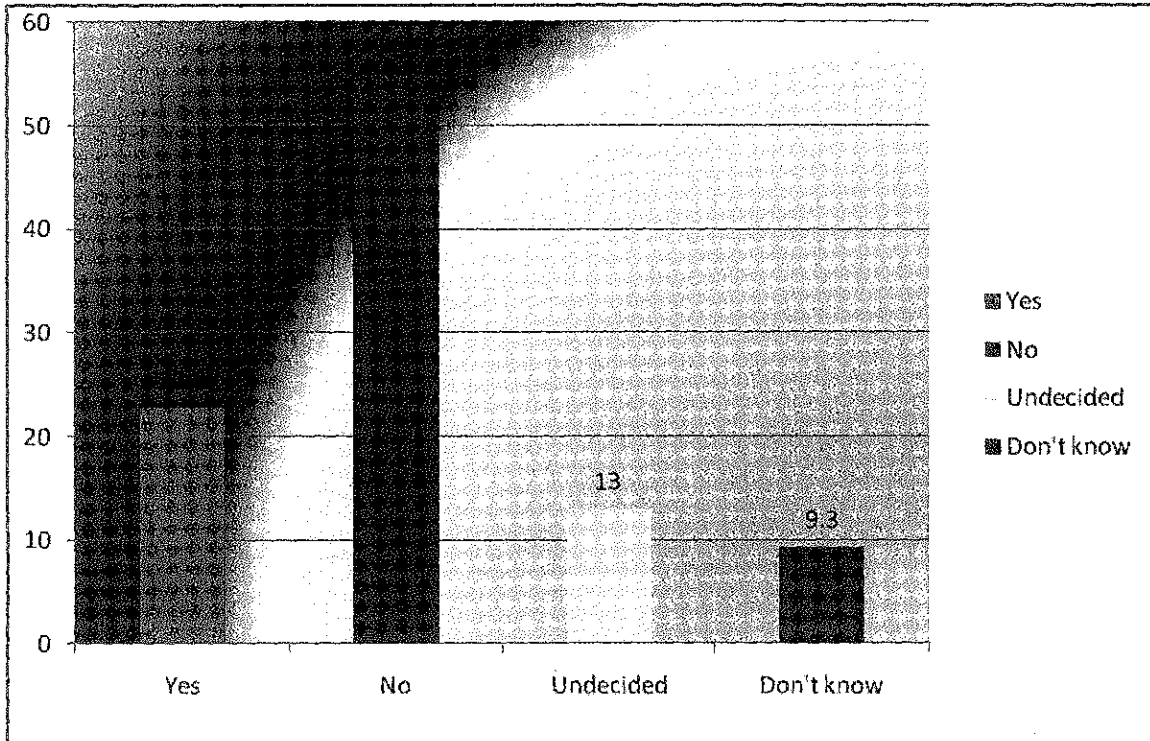
Count		RESIDE			Total
		village	town	city	
SEX	male	30	25	50	105
	female	46	85	119	250
Total		76	110	169	355

*Figure- 3: Respondents in favor of offshore drilling*



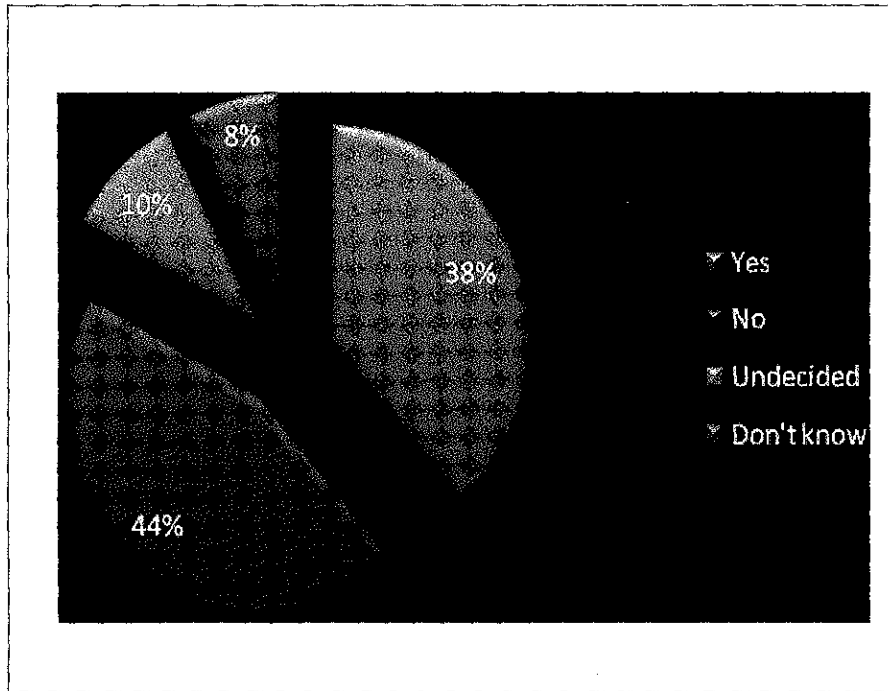
On the question to respondents of whether or not they are in favor of offshore drilling in Belize based on Figure-3, 212 or 60% of them are not in favor of offshore drilling. On the other hand, 73 or 20% of the respondents were undecided as to whether or not they are in favor, whereas 60 or 17% are definitely in favor of such venture. Lastly, 10 or 3% of the respondents don't know if they are in favor or not. This result clearly illustrates that the most of the respondents are not in favor of offshore drilling.

*Figure- 4: Feasible for the Government of Belize?*



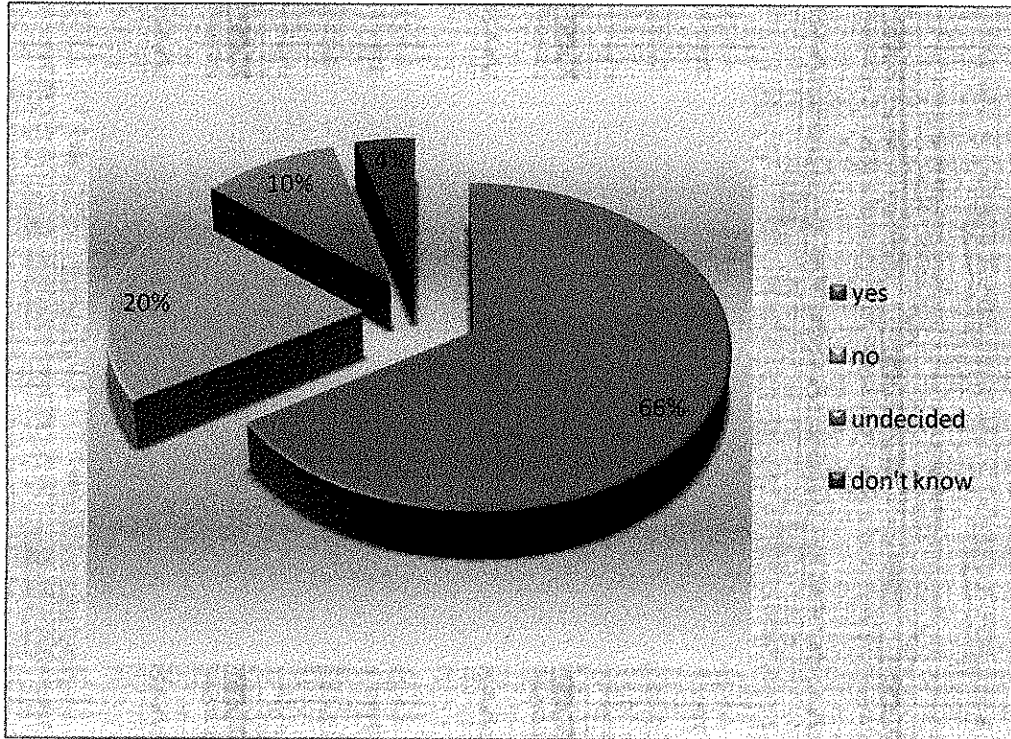
Next, on whether it is feasible for the Government of Belize to engage in offshore drilling in Figure-4, 195 or 54.9% of the respondents thought that it is not feasible for the Government to engage in such venture, whereas 81 or 22.8% of the respondents thought that the Government should engage in it. This was then followed by 46 or 13% of the respondents who were undecided and 33 or 9.3% of them with the opinion that they don't know if it is feasible or not to the Government. Therefore, this result indicates that it would not be feasible to the Government of Belize to carry out such venture.

*Figure- 5: Will the Belizean Society benefit?*



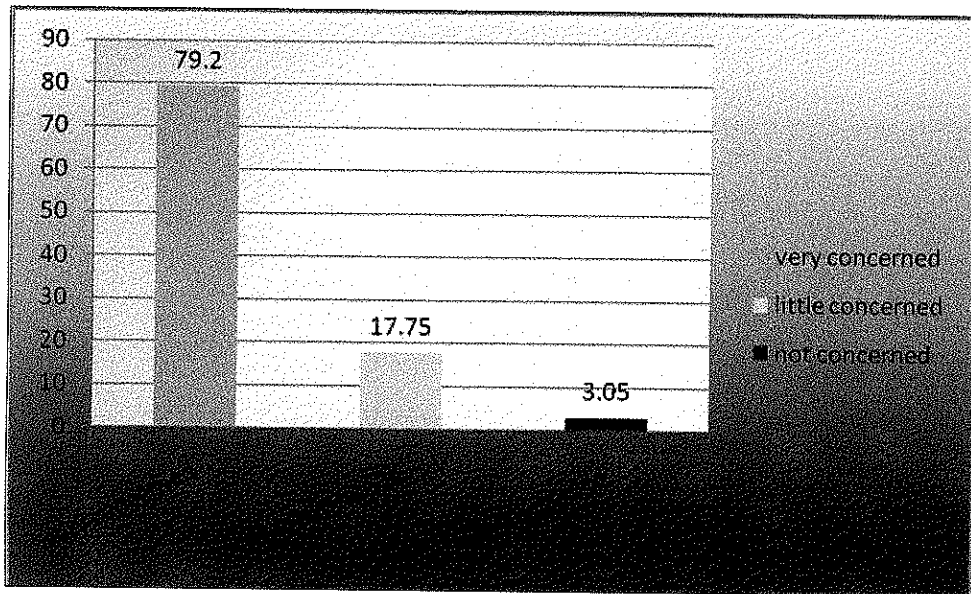
From the 355 respondents in Figure-5, 44% or 158 persons were of the opinion that the Belizean Society will “not” benefit in any way if oil is found offshore in commercial quantities. On the other hand, 38% or 136 persons were of the opinion that “yes”, the Belizean Society will benefit if such venture is carried out and oil is found in commercial quantities. This was followed by 10% or 34 persons saying that they were undecided and the remaining 8% or 27 persons don’t know if the Belizean Society will benefit in any way or not.

*Figure- 6: Establishment of oil refinery*



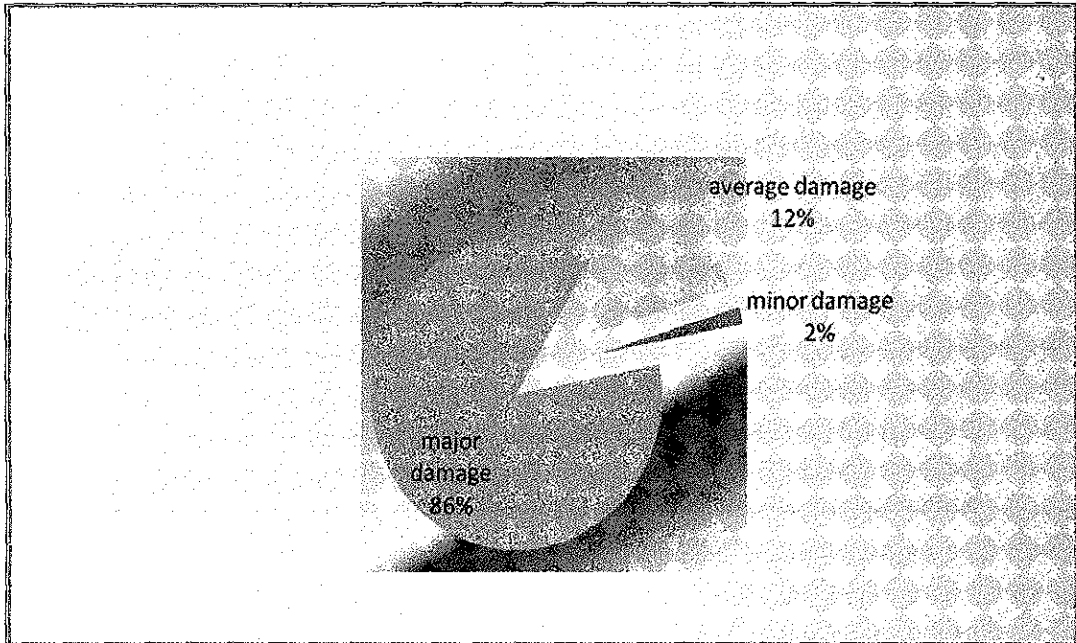
Having determined how many respondents were of the opinion that the Belizean Society will benefit from offshore oil drilling, the questionnaire also aimed to determine “if” an oil refinery should be established once oil is found in commercial quantities. Of the 355 respondents, 66% or 234 of them stated that “yes”, an oil refinery should be established, whereas 20% or 72 persons stated that “no” oil refinery should be established. Additionally, 10% or 34 of the respondents were undecided and the remaining 4% or 15 persons have no knowledge as to whether a refinery should be established. Figure-6 illustrates these findings.

*Figure- 7: Respondents concerns about the risks of offshore oil drilling*



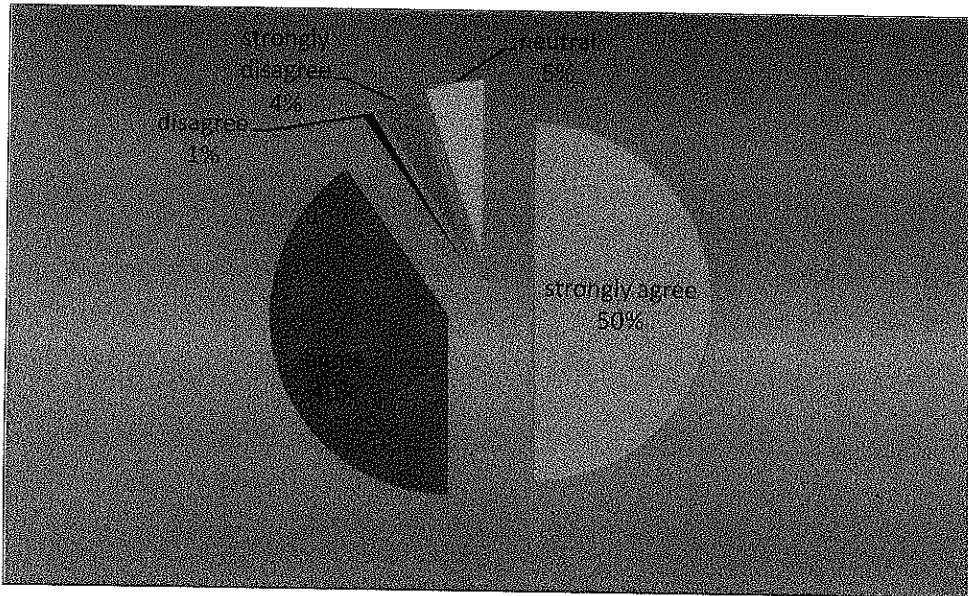
The research also aimed to determine “how” concerned the respondents were with regards to the risks that are associated with offshore drilling. Majority of the sample population, that is 79.2%, were very much concerned about the risks. On the other hand, approximately 17.75% of the sample population indicated that they are concerned just a little. As for the remaining 3.05% of the sample population, they indicated that they are not concerned. This result gives a clear indication that the majority of the respondents are definitely concerned about the risks that are associated with offshore drilling.

**Figure- 8: Impact of oil spill on marine life, ecosystems and the environment**



Out of the 355 sample population, data revealed that 86% of the respondents believe that in the event of an oil spill while exploring or drilling for oil, there will be major damage on marine life, ecosystems and the environment. On the other hand, 12% of the respondents stated that the damage on marine life, ecosystems and the environment would be at an average. The remainder, being 2% stated that the damage would be minor.

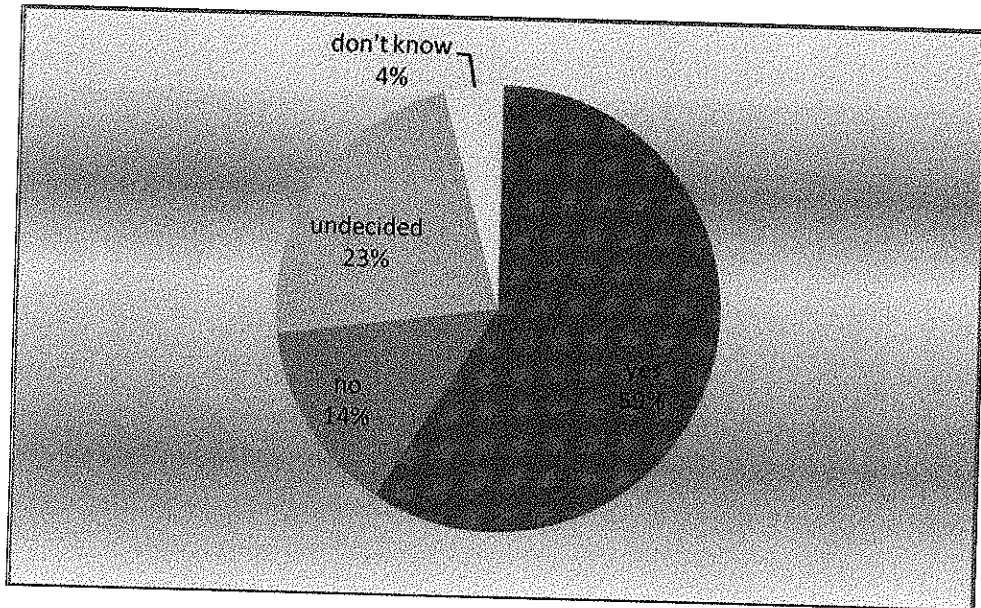
*Figure- 9: Protection from the impacts of offshore drilling*



Seeing that there could be a possibility of an oil spill while exploring or drilling for oil, it was asked that until Belize's coastline can be protected from the impacts of offshore drilling, the Government of Belize should not proceed to drill offshore. Half of the sample population (50%) indicated that they strongly agree and 40% stated that they agree. On the other hand, 5% were neutral whereas 4% and 1% strongly disagree and disagree respectively. Figure-9 above illustrates the results that clearly indicate how the respondents are expressing their feelings towards the issue being studied.

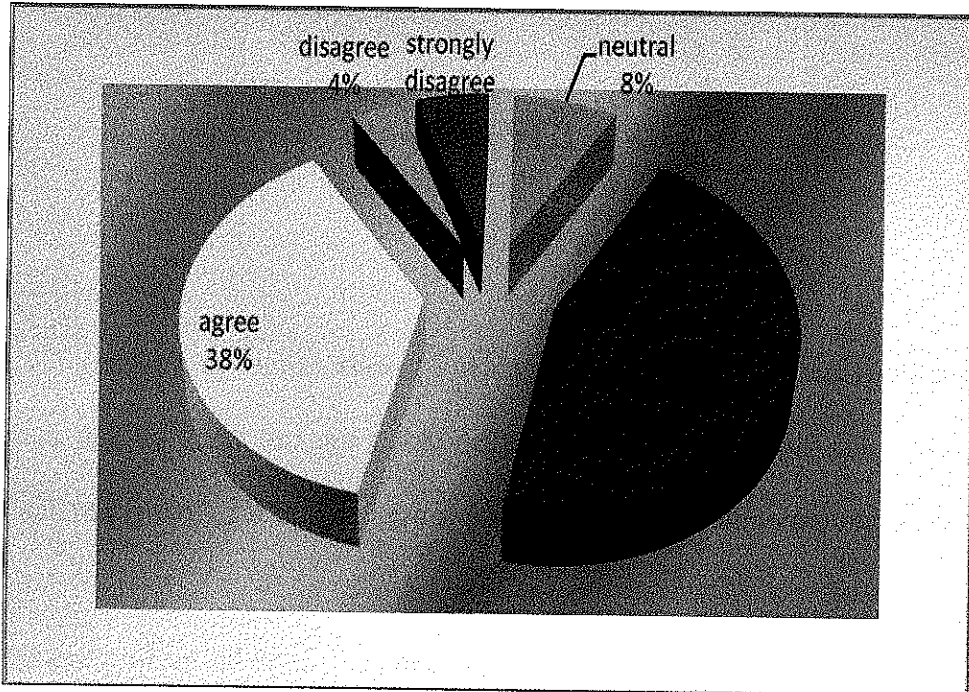


*Figure- 10: Respondents in support of ban on offshore drilling*



On the question of the Government putting a ban on offshore oil exploration and drilling in Figure-10 above, 209 or 59% of the respondents stated that “yes”, the Government of Belize should put a ban on offshore oil exploration and drilling in light of the oil spill that occurred in the Gulf of Mexico. This was followed by 81 or 23% who stated that they were “undecided” with respect to the question asked. While 50 or 14% of those responded “no”, 15 or 4% stated that they have no knowledge as to whether the Government should put a ban or not.

**Figure- 11: Complete safety of offshore drilling**



Finally, when asked if they believe that until the Government knows that offshore oil exploration and drilling is completely safe they should not engage in such venture, 45% individuals responded that they “strongly agree” to it. Additionally, 38% persons “agree” that the Government of Belize should not engage in said activity until it is completely safe to do so. This was then followed by 8% respondents stating that their opinion was “neutral” in terms of the question asked. On the other hand, 9% of the respondents, which are comprised of 5% and 4%, were of the opinion that they strongly disagree and disagree respectively. The result in Figure-11 once again clearly indicates that the people in Belize City are really expressing how they feel regarding the issue at hand.

## V – CONCLUSION

1. The Government of Belize should not engage in offshore oil exploration and drilling because that the risks that are associated to Belize's diverse and rich marine resources, reef and mangroves, far outweighs any social benefit from oil exploration and drilling.
2. In the event of an oil spill, the catastrophic damage to marine life, ecosystems and the environment is too high and can threaten the livelihoods and quality of life of the Belizean Society.
3. The Belizean Society will not benefit in any way from such venture, hence the Government of Belize should put a ban on offshore oil exploration and drilling.

## VI - RECOMMENDATIONS

1. The Government of Belize should conduct intense geological studies in order to develop a comprehensive feasibility study so as to look at the pros and cons of offshore oil exploration and drilling and determine whether it will be feasible and beneficial for them to engage in such venture.
2. The Government of Belize needs to ensure that proper Environmental Impact Assessments (EIA's) are done before any oil company engages in drilling activities.
3. The Government of Belize should ensure that proper mitigation mechanisms are put in place and that they are enforced once in existence. With appropriate mitigation measures, drilling activities are unlikely to cause significant adverse environmental effects.
4. The Government of Belize should develop a comprehensive oil spill contingency plan for Belize that comes as a result of public consultations and is well publicized, funded and adopted into law.

5. Last, but not least, the Government of Belize should put a temporary ban on offshore oil exploration and drilling until it is determined that such venture is completely safe.
  
6. Further research should be carried out by using a proper sampling technique, such as the multi-stage cluster sampling technique, in order to conduct a more in-depth study with the other five districts so as to determine if the Belizean Society is in favor of offshore oil exploration and drilling. In conducting a more in-depth study, the results would be more reliable and valid and could therefore be generalized to the entire Belizean population.
  
7. A cross tabulation should also be made between respondents with employment status and those who are unemployed to see who are in favor of such venture and who is against it.

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## VIII - INTERVIEW

1. Cho, Andre, Director of Geology and Petroleum Department, Ministry of Natural Resources & the Environment, (2010, October 22)



## XI - APPENDICES

Good day. My name is Laura Munoz and I am a bachelor student at the University of Belize. The following questionnaire is being carried out as part of the requirement for the final Seminar Paper at the University of Belize. The aim of the research is to determine whether it is beneficial for the Government of Belize to engage in offshore oil exploration and drilling. It would be greatly appreciated if you take some time to answer the following questions listed below as truthfully as possible. Your participation is voluntary and you may refrain from participating or from responding to any item in the questionnaire. This is a completely confidential survey and your anonymity is guaranteed.

### Instructions:

1. Please do not put your name on the form.
  2. Please put a checkmark in the box that is provided.
  3. Mark only one response for each question.
- 

### 1. Age at last birthday:

- 15 to 19 years  
 20 to 29 years  
 30 to 39 years  
 40 to 49 years  
 50 years and older

### 2. Sex Male Female

### 3. Kindly indicate with a checkmark your post

- Secretarial/Clerical  Administrative  
 Manager/Director  Lecturer  
 Self employed  Unemployed  
 Retired

Other: \_\_\_\_\_ (please indicate)

4. Where do you reside?

- Village  
 Town  
 City

5. Are you in favor of offshore drilling in Belize?

- Yes       No       Undecided       Don't know

6. In your opinion, is it feasible for the Government of Belize to engage in offshore drilling?

- Yes       No       Undecided       Don't know

7. If offshore drilling work is carried out in Belize and oil is found in commercial quantities, do you think that the Belizean Society will benefit in any way?

- Yes       No       Undecided       Don't know

8. If oil is found offshore in commercial quantities, do you think that an oil refinery should be established in Belize?

- Yes       No       Undecided       Don't know

9. How concerned are you about the risks of offshore oil drilling in Belize?

- very concerned       only a little concerned       not at all concerned

10. In the event of an oil spill while exploring or drilling for oil, what do you believe would be the magnitude of the impact on marine life, ecosystems and the environment?

- minor damage       average damage       major damage

11. Belize's coastline is home to many people who engage in fishing and tourism activities as their basic way of living. Until the Government of Belize knows that these communities can be protected from the impacts of offshore drilling, the Government should not drill offshore.

- agree                       strongly agree                       disagree  
 strongly disagree                       neutral

12. In light of the oil spill in the Gulf of Mexico, there have been some calls from environmentalist and active groups for the Government of Belize to put a ban on offshore oil exploration and drilling in Belize. Therefore, do you support a ban on offshore drilling in Belize?

- Yes                       No                       Undecided                       Don't know

13. It is the duty of our generation to leave a better place for our children and grandchildren. Until the Government of Belize knows that offshore drilling is completely safe, they should not engage in such venture.

- agree                       strongly agree                       disagree  
 strongly disagree                       neutral

This is the end of the questionnaire. Once again, thank you very much and I again wish to reassure you that all your answers will be kept confidential.