Notre Dame University
Faculty of Business Administration & Economics
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&

Bordeaux Management School
Institute of International Business

Sustainable Building in Lebanon, Are We Ready?

A Thesis Submitted in Partial Fulfillment of the Requirements for the Joint Degree of the Master of Business Administration (M.B.A.) and the Master of Science in International Business (M.I.B.)

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NDU-Lebanon
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DECLARATION

I hereby declare that this Thesis is entirely my own work and that it has not been submitted as an exercise for a degree at any other University.

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ABSTRACT

As the world is in an accelerating transformation towards sustainable development, the Lebanese population seems to be concerned about the environment and ready to invest in sustainable buildings. This study assessed the understanding on sustainability among the Lebanese population and checked to which extent they are ready to invest in green buildings.

The research was conducted online using an online survey engine and reached more than 400 respondants all over the Lebanese territory in a descriptive and experimental approach. The results were analysed using the SPSS statistical package and the online survey engine tools in a cynergic combination to get the most accurate results and the best description. Descriptive statistics were involved at a first stage in order to understand the current position of the sample population. In the second part, the respondants were assigned randomly to one of two groups, an informed group to which a short presentation about green buildings was displayed, and a non informed group that was left with their own understanding of the concept.

The levene's test of equality of variances demonstrated a remarkable increase in the willingness to invest in green buildings among the informed segment. Finally, and in order to give this study a practical dimension, the respondants were asked to rank the incentives that were the most important for them to inverst in a green house. The top ranked answer was the personal knowledge aboout the topic followed by financial incentives. In marketing terms, the green building in Lebanon is a star and could be soon moving to the cash cow position. In this environment, the study opens the door to future plans in which the private sector plays a catalysing role in the sustainble development in Lebanon.

Keywords: Sustainable Buildings – Lebanon – Banking – Knowledge – Awareness

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ACKNOWLEDGMENTS

The completion of this thesis would not have been possible without the big support of

Dr Souha Abdelnour Fahed.

Her involvement at the academic and the interpersonal level were at the core of success of this thesis.

I thank her for her smooth, professional and positive contribution.

I thank

Dr Jad Saadeh

for his support and valuable input to this thesis.

Last but not least, I thank all the academics who put efforts at NDU since I enrolled in the Bachelor of Engineering until this day to make sure that NDU is constantly moving forward and that every student has the necessary pack to draw a

successful path for his life.

DEDICATION

I dedicate this thesis to everyone who cares about bringing back human life to some harmony with nature, who can tell the difference between success and greed and always remember that the earth is not ours, it is just our home for a couple of years.

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Chapter 1

1. INTRODUCTION

1.1.Need for the study

Human life cannot keep going without the natural resources; therefore sustaining these resources is a must. Everyone should be involved using their capabilities and power however important they were. The construction sector constitutes around 10% of the Lebanese GDP, residential construction being the major type of constructions reaching more than 80% of the construction industry in years 2008 through 2011 (BlomInvest, 2011, p. 12). It seems very important to look for ways to reduce the environmental footprint of this sector in the country. Fourteen million square meters have been registered in the Lebanese Order of Engineers and Architects in Lebanon (OEA)-Beirut branch only (OEA, 2011). Noting that all constructions above 200 square meters in Lebanon must be registered in the OEA, these figures show clearly the significant volume of the residential construction sector In Lebanon. The impact of such an industry on the environment cannot be disregarded. On the other hand, the same reports show that the distribution is uneven; in fact most of the construction is in the district of Mount Lebanon. A new problem arises from this concentration. Urban concentrations are by themselves unsustainable as noted by, Williams Rees and Mathis Wackernagel. In their paper titled: "Urban Ecological Footprints: Why Cities Cannot be Sustainable-and Why They are a Key to Sustainability" they wrote: as nodes of energy and material consumption, cities are causally linked to accelerating global ecological decline and are not by themselves sustainable. At the same time, cities and their inhabitants can play a major role in helping to achieve global sustainability. Another point to mention is that governments around the world failed to force sustainable development. The same applies to international environmental organizations that lack the power and authority to force any environmental practice. Owing to the inefficiency of international organizations and international environmental conventions and agreements in regulating environmental management and their inability to put a stop to deforestation in particular, much hope has been invested in market-based mechanisms, particularly environmental certification schemes. The origin of environmental certification lies in the activities of private bodies. Environmental movements, expertise groups and business companies started to develop environmental labeling systems based on consumer awareness. Simultaneously, northern NGO groups started to support southern indigenous people's NGOs to save the forests for local people (Palmujoki, 2006, p. 11).

This global public inefficiency leads to the necessity of finding incentives to the private sector to invest in sustainability in an efficient way. Specifically in Lebanon, the absence of any regulations related to sustainability and the decision of building sustainable, is restricted to owners and engineers. Some effort has been done by the ministry of energy and water which issued recommendations focusing on the installation of solar water heaters and energy saving light bulbs. Some municipalities in turn have regulated the sanitary waste disposal. In fact a settling tank and a soaking pit are now requirements in a couple of areas in the country. Such efforts still lack seriousness and power and most important, they are just considering a couple of minor aspects of the sustainable building concept. But this is not sufficient. The bulk of residential buildings are still non green constructions. With the exception of the major constructions in the capital, all of the constructions in Lebanon are conventional to traditional buildings. The engineering of these buildings is mostly conventional with the decision of whether to introduce the sustainable building concept restricted to the engineer's and owner's point of view

Another important factor related to this study is fact that financing the construction sector is almost restricted to the banks. In fact, in 2009 for example, 7.295 billion Lebanese liras were issued in credit for at total added value of 6.698billion Lebanese liras in the construction sector. (MOF, 2009) This leads us to recognize how important is the role of the banking sector in the real estate in Lebanon and the power it can have as a strong private sector player. "It is widely known that banks' financing decisions affect and are affected by the level of environmental performance of the corporations they lend money or associated with" Therefore a good tool to push forward sustainability in Lebanon would be to find a common ground for investors, individuals and banks and to promote a win-win situation in which all parties are satisfied and the environment is protected.

1.2.Purpose of the study

Studies have shown that the Lebanese population is concerned about the environment and ready to take action (Djoundourian, 2007). However, In the absence of any serious governmental attempt to release any green legislation, I believe that the solution is via the private sector. In fact the private sector have proved itself as an essential player. The study seeks a way to join hand between the individual and the financial institutions to transform the construction sector in Lebanon to a sustainable sector. The ultimate goal of the research is to set a common ground between the consumer willing to buy a house and the financing institution. If we could prove that the consumer is interested in greening his house and that a service related to sustainable building offered by a bank is an incentive, then we would build a win-win situation between the two parties hoping that all of the banking sector implements this sustainability plan on the housing loans as a standard service. The research will identify parameters that are of importance to Lebanese consumer and that affect their decision regarding buying a sustainable house. The private sector, hence financial institutions, can use the results to set a marketing strategy that is based on greening the Lebanese construction sector as a contribution from the private sector in Lebanon to the improvement of the quality of life as well as saving the planet. Future research could consider the increase in sales of house loans as well as the participation in building a better image for the bank, being a pioneer in this and the intangible benefits (brand image).

The study will test the following hypothesis:

Hypothesis 1: The population is not aware that the built environment is among the major causes of environmental damage.
Hypothesis 2: Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).

Hypothesis 3: The population, if well informed is more willing to invest in green building
Hypothesis 4: Financial incentives are amongst the most important for the Lebanese consumer to invest in sustainable buildings.

1.3.International perspective/application

The problem of environmental degradation is a global issue in which there are no geographical islands. And the effects of the global environmental problems do not differentiate between the originator and the receiver. The global warming is affecting the whole globe regardless of the source of the pollution. Chemical, nuclear, and all kinds of toxic wastes, if they are not well disposed, would leak into the environmental channels and circulate around the whole globe. Resources from their side are limited. A shortage in fresh water, oxygen, fossil fuel, copper, gold or any other resources will occur around the globe. Climate change is already recognized by any citizen in the modern world. Hence, at the time of globalization, sustainability too, is global. Any action taken anywhere in the world counts. The goal of sustainable development is to enable all people throughout the world to satisfy their needs and enjoy a better quality of life, without transferring problems to people in other parts of the world or compromising on the quality of life of future generations. Lebanon is no exception to this fact. On the contrary, Lebanon plays a major role in leading the region to the highest ethical and technological standards. Although understanding of the sustainable development might differ from country to another, models can be drawn out of this study and developed and verified for other countries especially those in the neighborhood.

1.4.Brief overview of all chapter

In the litterature review, a reliable general knowledge about topic was built. this helped to refine the ideas and build a strong research case. The search was divided into two major subjects. The first was about the sustainable buildings around the world, how they developed and why. A concept that emerged from the global environmental awareness and that integrated the technical issues to health, attitude, comfort. The green buildings are in fact a refinement of all technical, environmental, behaviorial and operational aspects that are involved in a building. The quest harmonize the built environment with the natural enviroment is the ultimate goal of sustainable buildings. At least minimize the damage and why not, get back to live in haromny with nature. The second dimension involved a research about the integration of sustainable buildings around the world. How the concept was accepted by different cultures and how it evolved from a concept to a reality. Different behaviorial studies yield very similar results about the main drivers for the individuals towards green development. Beliefs, education, availability, information, are among many other drivers. Authorites and private sectors have been involved in promoting green buildings around the worlds with stories of success and others less successful. This study tried to extract what could be significant to the Lebanese case and use it for the research questions. On the ground of this litterature, a methodology has been developped in chapter two in order benefit from the global experience for the Lebanese case. The Lebanese population is concerned about environmental issues but seems to have biased information about green buildings. The following step is about testing the importance of the information factor in an experimental approach. A small informative message was presented to half of the respondants and all repondants were asked about their willingness to invest in making their house a sustainable house. The difference in the mean of the responses suggests and higher tendency to invest in green buildings among the informed segment. Finallly, a set of options was suggested to the respondants and asked them to rank them as incentives to invest in green buildings. Technically, the study was carried out online via an online survey engine and included 27 questions. The survey made an excellent use of the options provided by the online survey engine and the results were analysed using both the online tools and the SPSS package. The results confirmed the expectations about the position of the Lebanese population when it comes to knowledge and affinity to sustainable development. The experiment confirmed as well that the information factor is very important in boosting the willingness of the individuals to invest in green. Finally, the financial incentives had a prominent importance among many other incentives suggested to the respondants. To conclude: In a country where the population cares about the environment and where the role of the governmental authorities and institutions is hardly noticeable, the private sector is expected to carry that load. So could the banks play an effective role to boost the concept in Lebanon?

Chapter 2

2. REVIEW OF LITTERATURE

2.1.Climate Change

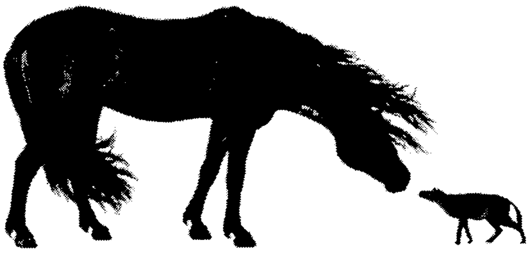


Figure 1: An illustration of the earliest-known horse Sifrhippus, dwarfed next to a modern domestic horse. CREDIT: Danielle Byerley, Florida Museum of Natural History. (Live Science, 2012)

“Animals 'shrinking' due to climate change” this was a title published on the Washington Telegraph, on October 16, 2011 (Collins, 2011). The article was based on a report in the Nature Climate Change journal. The report states that the mammals on earth are shrinking in size and relates this to the global warming taking place. In fact, a recent discovery published on February 24, 2012 by the science magazine found a major reduction in size in mammals during the Paleocene era. The Paleocene era is a time, around 56 million years ago, where research had indicated that in the course of a few thousand years—a mere instant in geologic time—global temperatures rose five degrees Celsius, marking a planetary fever known to scientists as the Paleocene-Eocene Thermal Maximum, or PETM. A high-resolution record of continental climate and equid body size change shows a directional size decrease of ~30% over the first ~130,000 years of the PETM, followed by a ~76% increase in the recovery phase of the PETM (Ross Secord, 2012). Co-author Jonathan Bloch of the Florida Museum of Natural History said:”Because it's over a long enough time, you can argue very strongly that what you're looking at is natural selection and evolution - that it's actually corresponding to the shift in temperature and driving the evolution of these horses." (Kerry Sheridan, 2012)"This has implications, potentially, for what we might expect to see over the next century or two, at least with some of the climate models that are predicting that we will see warming of as much as four degrees Centigrade over the next 100 years," co-author Ross Secord of the University of Nebraska-Lincoln said. (Kerry Sheridan, 2012). The

2.2.Environmental Responsibility

2.2.1. Beginnings

It was Tolstoy who wrote that the greatest threat to life is habit. Habit, he argued, destroys everything around us, because it familiarizes us to the point that we no longer really see things (Martin, 2005, p. 165). In fact we have had the habit to use the earth's resources to the point where, during the 20th century, we did not notice that we are consuming the resources irresponsibly and we did not recognize that the earth itself has limited capabilities. Billions of years took the earth to complete its transformation to reach a state at which life could be sustained. Life, the way we know it, is based on a balance of cycles including: water cycles, temperature drafts, air movement, fossil transformations and many others. It is true that natural transformations happen, however, the human activity is now dramatically affecting the natural environment. In fact, during the beginnings of the 20th century, the industrial revolution started a chaotic consumption of the earth's resources. This trend lead at the same time to the depletion of the resources and to an environmental impact that could not be recognized until the late 20th century. By then, the harm was already done. That's when the international community started to join efforts to recover.

2.2.2. International Action

The international community first took action in the 1980s in order to assess the climate change and the way it could deal with it. In fact the first international conference was held in 1979. This first conference set the path for a series of actions related to the climate change and setting goal is to reduce the effect of human activity on the earth's climate. The international actions is until 2011 islisted in table: 1. In 2012, The "United Nations Framework Convention on Climate Change" was held in Qatar and resulted in an amendment of the Kyoto Protocol. It included a point that is very important to the subject of this thesis. A new work programme to build capacity through climate change education and training, create public awareness and enable the public to participate in climate change decision-making has been agreed in Doha. This is important to create a groundswell of support for embarking on a new climate change regime after 2020. (UNFCCC, 2012) . In fact, and the understading of the problem among individuals has been proven essential for sustainable development in this report.

(Essential Background, 2012)

This time line detailing the international response to climate change provides a contextual entry point to the Essential Background..

2011 — The Durban Platform for Enhanced Action drafted and accepted by the Conference of the Parties (COP), at COP17. More on the Durban outcomes.

2010 — Cancun Agreements drafted and largely accepted by the COP, at COP16. More on the Cancun Agreements.

2009 — Copenhagen Accord drafted at COP15 in Copenhagen. This was taken note of by the COP. Countries later submitted emissions reductions pledges or mitigation action pledges, all non-binding.

2007 — IPCC's Fourth Assessment Report released. Climate science entered into popular consciousness. At COP13, Parties agreed on the Bali Road Map, which charted the way towards a post-2012 outcome in two work streams: the AWG-KP, and another under the Convention, known as the Ad-Hoc Working Group on Long-Term Cooperative Action Under the Convention.

2005 — Entry into force of the Kyoto Protocol. The first Meeting of the Parties to the Kyoto Protocol (MOP 1) takes place in Montreal. In accordance with Kyoto Protocol requirements, Parties launched negotiations on the next phase of the KP under the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP). What was to become the Nairobi Work Programme on Adaptation (it would receive its name in 2006, one year later) is accepted and agreed on.

2001 — Release of IPCC's Third Assessment Report. Bonn Agreements adopted, based on the Buenos Aires Plan of Action of 1998. Marrakesh Accords adopted at COP7, detailing rules for implementation of Kyoto Protocol, setting up new funding and planning instruments for adaptation, and establishing a technology transfer framework.

1997 — Kyoto Protocol formally adopted in December at COP3.

1996 — The UNFCCC Secretariat is set up to support action under the Convention.

1995 — The first Conference of the Parties (COP 1) takes place in Berlin.

1994 — UNFCCC enters into force. An introduction to the United Nations Framework Convention on Climate Change.

1992 — The INC adopts UNFCCC text. At the Earth Summit in Rio, the UNFCCC is opened for signature along with its sister Rio Conventions, UNCBD and UNCCD.

1991 — First meeting of the Intergovernmental Negotiating Committee (INC) takes place.

1990 — IPCC's first assessment report released. IPCC and second World Climate Conference call for a global treaty on climate change. United Nations General Assembly negotiations on a framework convention begin.

1988 — The Intergovernmental Panel on Climate Change is set up.

1979 — The first World Climate Conference (WCC) takes place.

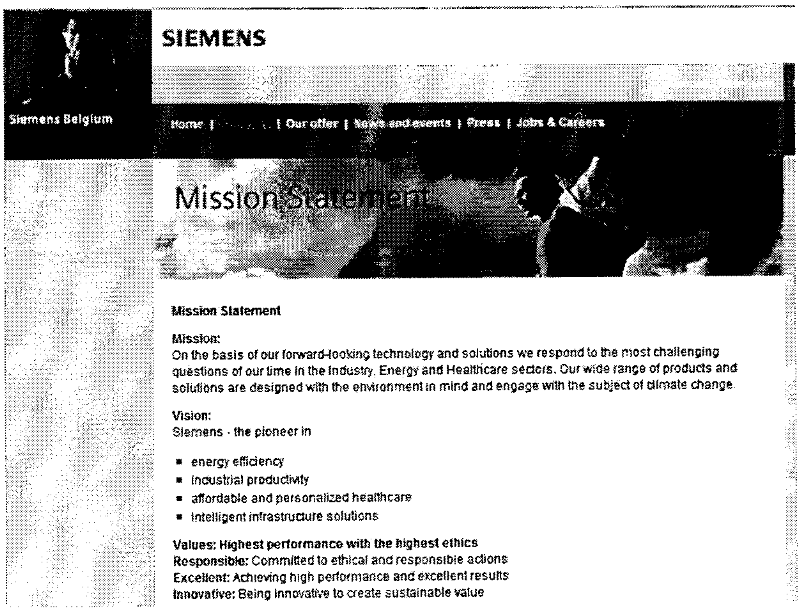
However, these international initiatives addressed mostly the industrial sector. Most of the restrictions were against emission form industrial plants or transportation vehicles including cars, ships, airplanes and trains. The residential sector has been forgotten and its only lately that its share of environmental damage was recognized. The first commitment period of the Kyoto Protocol started in 2008. Japan is required to cut down on greenhouse gases (GHGs), which have been the cause of global warming, by 6% on average, starting from 2009 and continuing until 2012. However, the carbon dioxide (CO_2) emissions in Japan have been showing a tendency to increase every year. According to the annual report of the Ministry of the Environment in Japan (2007), the industrial sector accounts for 35% of the total CO_2 emissions in Japan; however, the amount of emissions has been decreasing for the past few years largely owing to the active introduction of environmentally friendly techniques. On the other hand, the CO_2 emissions caused by the residential sector, such as consumers, which make up more than 10%, have increased by 37%compared to the emissions in 1990. Now the urgent problem is to reduce energy consumption not only in the industrial sector but also in ordinary households. (Nishio, 2010)

2.3.Sustainability

For the first time, since the dawn of agriculture and the possibility of geographically fixed settlements 12,000 years ago, the aggregate scale of human economic activity is capable of altering global biophysical systems and processes in ways that jeopardize both global ecological stability and geopolitical security. (Wackernagel, p. 537)

Life and the earth's resources were sustained for the past 12000 years, but surprisingly, evidence show that during the past two hundred years, the negative impact of human development is comparable in size to the worst devastating natural phenomena that the earth has known since life has begun on the planet. But the impact came at a much faster rate, faster than what nature can take. In attempts to recover, through the past few years, terms like ecology, environmental awareness, recycling, CO2 emissions, green house gas and many others were discussed under the term of environmental responsibility. However, a new term has come to the public lately: "Sustainability". Sustainability somehow includes all of the previously mentioned terms. In fact, sustainability has been adopted on the international level for the first time in the Rio de Janeiro 1992 earth summit. Since then it has been a subject for extensive research and debates. The Environment Protection Agency (EPA) describes sustainability on its website: Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations. Sustainability is important to making sure that we have and will continue to have, the water, materials, and resources to protect human health and our environment (EPA). This simple description of sustainability does not make is so simple in practice. The fields of application and the parameters are infinite. They include almost everything we interact with on this planet. Sustainability is a complex phenomenon, having economic, environmental and social aspects. Any concept of sustainable urban development must incorporate sectoral concepts; These must be well integrated in the overarching urban, regional and governance policies. (Tosics, 2004)

Definitions and understandings of sustainability keep on changing. It's very normal for such a broad topic to have so many interpretations and understandings. Here is another interpretation of the term: Environmental sustainability means changing human activities so they no longer threaten the natural resource base and ecological systems upon which economic development, human health and social well-being depend. (Paul Raskin, 1998, p. ix). This time the interpretation is linked directly to the environment.



Mission Statement

Mission:
On the basis of our forward-looking technology and solutions we respond to the most challenging questions of our time in the Industry, Energy and Healthcare sectors. Our wide range of products and solutions are designed with the environment in mind and engage with the subject of climate change.

Vision:
Siemens - the pioneer in

- energy efficiency
- industrial productivity
- affordable and personalized healthcare
- intelligent infrastructure solutions

Values: Highest performance with the highest ethics
Responsible: Committed to ethical and responsible actions
Excellent: Achieving high performance and excellent results
Innovative: Being innovative to create sustainable value

Figure 2: Screenshot of Siemens Website, Mission Statement Page (Siemens Mission Statement)

As the popularity of the term grows, people are getting more aware about it and it is actually becoming a trend. As the global awareness about the climate change rises and as the consumers are realizing the importance of sustainable development, the term is becoming a marketing spot. It's being included in the visions of major companies and in the plans and marketing strategies of a huge number of companies ranging from small enterprises to conglomerates. Siemens for example notes a “Sustainable Value” on its mission and vision page on their website (Figure 2).

The Coca-Cola Company on their 2020 vision page state: “Planet: Be a responsible citizen that makes a difference by helping build and support sustainable communities.” (Coca-Cola mission, vision, values)

The understanding of sustainability principles and the application of sustainable practices are not straight forward. The applications range from the simplest act of individual environmental responsibility to the highest technological application, hence, the space debris problem. And the application is far from being a short term topic. Sustainability is a long process; it’s in fact a way of life. It is often the case that organizations are willing to consider an approach to sustainable development, but search for immediate benefits that are both visible and provide financial gain. Yet the true benefits of sustainable development may not be seen in the lifetime of the majority of professionals although tracking would doubtless identify significant movement and change over time (Martin, 2005, p. 169). It would have been much simpler if one could identify a major player in sustainable development, there isn’t. Everyone is a major player. Many institutions, NGOs and governmental authorities are playing an important role in promoting sustainability. Individuals do play a major role using their customer’s power.

2.3.1. Energy use in buildings.

In global terms, buildings account for roughly one-sixth of the world's freshwater consumption, one quarter of its wood harvest and two-fifths of its materials and energy flows (Roodman and Lenssen, 1995). The USGBC further reports that buildings in the United States consume more than one-third of primary energy, two-thirds of electricity, 12% of water and 40% of raw materials. The output from the aforementioned buildings includes 30% of gaseous emissions and they also generate 136 million tons of construction and waste demolition material. Evidently, building related activities significantly affect the receiving environment both directly and indirectly. (Estidama, 2008)

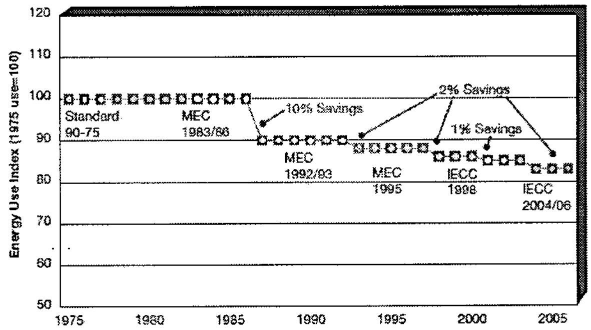
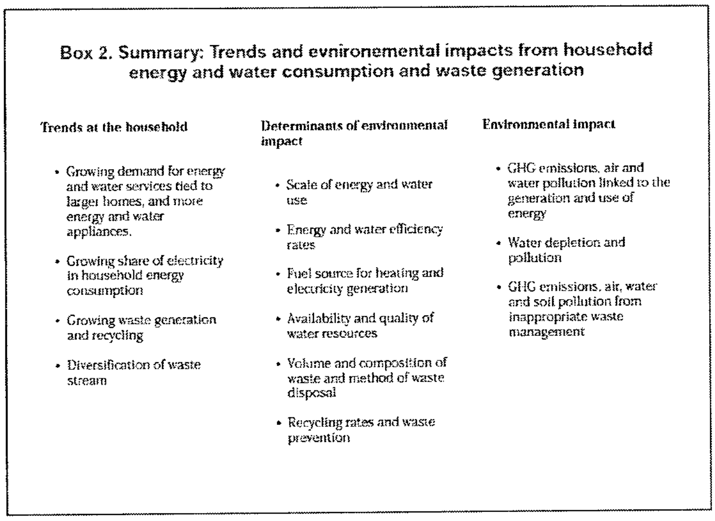


Figure 3: Residential Energy Code Stringency (Measured on a Code-to-Code Basis) (Energy Efficiency Trends in Residential and Commercial Buildings. 2008)

Those figures are not easily recognizable by the public. Industrialized countries, large factories and transportation are held much more responsible regarding the environmental damage they cause. Consumers rarely realize the load they put on the environment just to live in a decent house, or in a sophisticated residence. As many of the study examples have shown, however, some consumers still have biased views about the relation between environmental protection and quality/ efficiency; and/or they lack knowledge about environmental problems. (Nishio, 2010) .In addition, very few realize the fact that the initial cost of the building is less than 2% of its life cycle cost. It is worth to mention here that: Viewed over a 30-year period, initial building costs account for approximately just two percent of the total, while operations and maintenance costs equal six percent, and personnel costs equal 92 percent. Recent studies have shown that green building measures taken during construction or renovation can result in significant building operational savings, as well as increases in employee productivity. Therefore, building related costs are best revealed and understood when they are analyzed over the life span of a building (Sustainable Building Technical Manual, 1996). The concept of energy savings in the built environment has been in the market for few decades. At that time, the concept was very much related to the financial savings and to the reduction of waste and emissions. Results of the work done on energy savings for example is now proven. Figure 3 shows projected savings from improvements in the leading national (USA) residential energy efficiency code from 1975 to 2005. The advent of U.S. residential energy codes was ASHRAE Standard 90-75 in 1975. In 1983, code official organizations issued the first edition of the Model Energy Code (MEC), renamed the International Energy Conservation Code (IECC) in 1998. Most states have incorporated some version of the IECC into their residential building energy code (...)The 2006 IECC allows approximately 14 percent less energy use for code-regulated end-uses than the original code in 1975.. (Energy Efficiency Trends in Residential and Commercial Buildings, 2008). Many other authorities have introduced different ratings for the reduction of energy use in the built environment. Energy Star in the USA is one of the major rating systems.

One widely known measure of buildings energy performance is the ENERGY STAR label, introduced by the Environmental Protection Agency (EPA) for commercial buildings in 1999. Buildings achieving a score of 75 or higher (on a 1–100 scale) are eligible for the ENERGY STAR label, indicating that they are among the top 25 percent in the country for energy performance. EPA reports that commercial buildings that have earned the ENERGY STAR label use on average 35 percent less energy than similar buildings Green building. (Energy Efficiency Trends in Residential and Commercial Buildings, 2008)



Box 2. Summary: Trends and evnironemental impacts from household energy and water consumption and waste generation

Trends at the household	Determinants of environmental impact	Environmental impact
• Growing demand for energy and water services tied to larger homes, and more energy and water appliances. • Growing share of electricity in household energy consumption • Growing waste generation and recycling • Diversification of waste stream	• Scale of energy and water use • Energy and water efficiency rates • Fuel source for heating and electricity generation • Availability and quality of water resources • Volume and composition of waste and method of waste disposal • Recycling rates and waste prevention	• GHG emissions, air and water pollution linked to the generation and use of energy • Water depletion and pollution • GHG emissions, air, water and soil pollution from inappropriate waste management

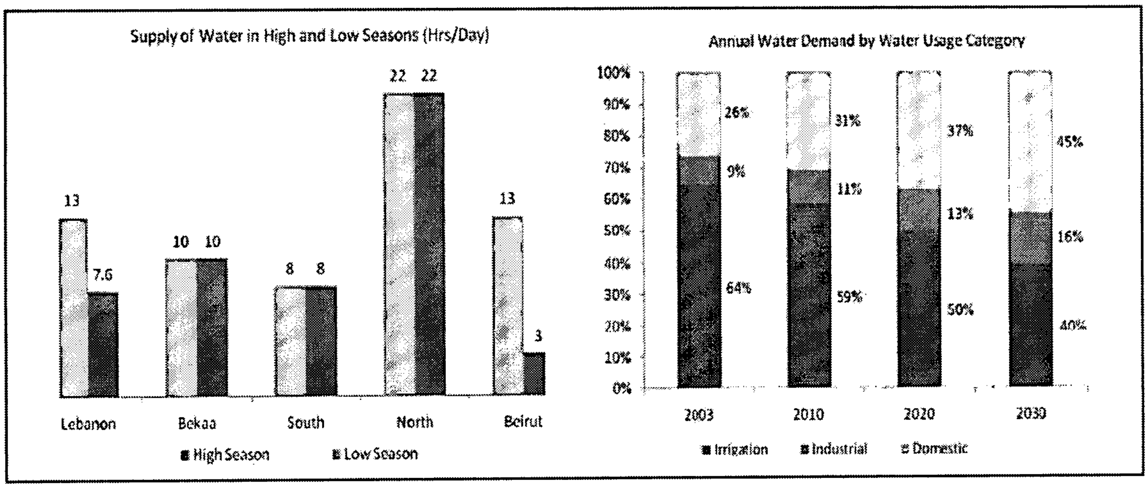
Figure 4: Trends and environmental impacts from household energy and water consumption and waste generation. (OECD, 2002)

Exhaustive studies have been worked out to understand the energy consumption in building and to identify patterns that could help reducing the operating and maintenance costs. Issues related to the occupational comfort have been as well studied and results of studies of this kind can be found in almost every country of the developed world Figure 4: Trends and environmental impacts from household energy and water consumption and waste generation. (OECD, 2002) published by the OECD framework summarize the trends and environmental impact of household water consumption and waste generation. One problem of urban development as described by William Rees and Mathis Wackernagel is directly related to the high concentration of buildings in cities which creates an unequal distribution of population in a way that nature cannot cope with. That's why our responsibility and awareness are crucial in order to reduce the damage that we are doing and hopefully soon get back to a lifestyle in harmony with nature; Of course without any cost to pay in terms of comfort, technology and modern life standards. Another term is Sustainable Consumption first introduced in the Rio De Janeiro Conference in 1992. Sustainable consumption (SC) has attracted considerable attention in recent years as is evidenced. The discussion has developed from the wider debate on sustainable development (SD), which has been on the international political agenda since the 1980s. More specifically, household consumption in industrialized countries has been identified as a key contributing factor to global problems addressed in the SD debate, such as climate change, depletion of energy resources and biodiversity loss. (Jessica Pape, 2010)

These concepts are at the core of the sustainable building concept sometimes called green building. Sustainable building incorporates many technological and behavioral sciences in an interdisciplinary approach in order to reach a healthy built environment with the least damage to the natural environment.

2.3.2. Sustainable Development-Sustainable Building

The major sources of pollution in terms of generated waste, emissions, greenhouse gases, chemicals and other pollutants are thought to be the industrial plants, heavy machinery and transportation. Remarkably researches have shown that the built environment and more specifically the household contribute seriously to the degradation of the environment and to the global warming phenomena that we are encountering nowadays. For example, The burning of coal and natural gas to supply buildings with electricity, coupled with direct burning of natural gas, makes buildings responsible for the largest share of U.S. carbon dioxide emissions. With the increase in buildings electricity consumption, that proportion has risen from about one-third of the total in 1980 to almost 40 percent in 2005 (Energy Efficiency Trends in Residential and Commercial Buildings, 2008). In Lebanon, numbers published by the World Bank show that domestic water consumptions constituted in 2005 around 27% of the total water consumption of the country. It is expected to reach about 31% in 2010 (Figure 5) and that the energy consumption per capita was at 2817 kwh/year (Annual energy consumption per inhabitant, 2008)

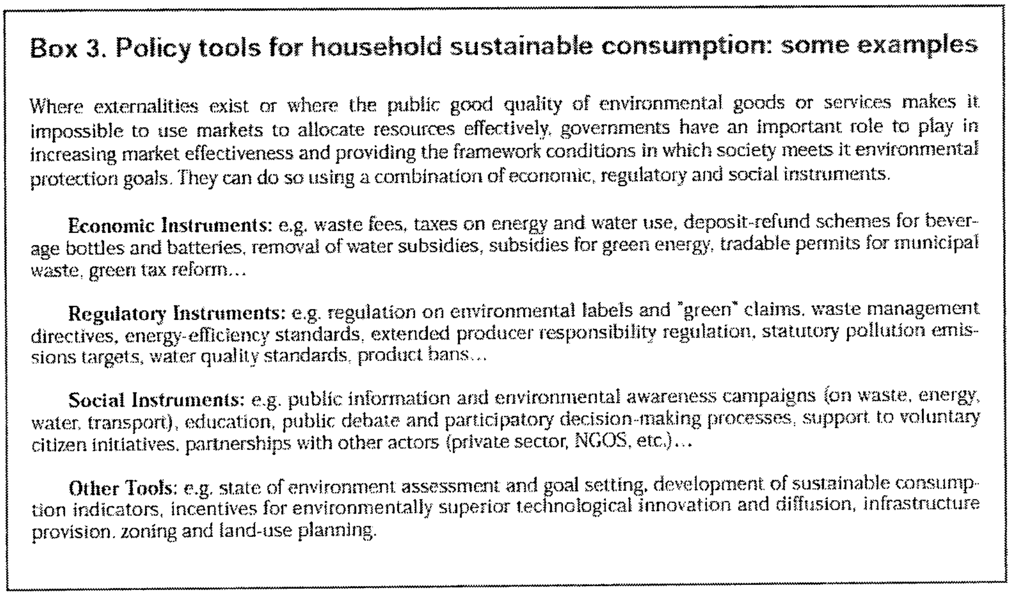


Source: World Band

Figure 5: Water demand per sector in Lebanon. (Hawa, 2010)

Lots of researches relate urban sustainable development to the welfare of the occupants. It is one of the most questionable environmental topics since the ozone depletion problem. From a financial angle, the same book writes that the major cost of a building is in fact related to the operation of the building rather than to the initial construction cost. In other words, the money needed to operate and maintain a building or to ensure proper indoor environment is much more than that required for its construction, around 98%. The point here is to reduce this operational cost, hence improving the life quality inside a building and reducing the operational costs at the same time. This achievement contributes significantly to the minimization of the environmental impact. Other issues concerning the human attitude in the built environment are as important as the technical side of the problem. More specifically, household consumption in industrialized countries has been identified as a key contributing factor to global problems addressed in the sustainable development debate, such as climate change, depletion of energy resources and biodiversity loss (Jessica Pape, 2010 .

For the purpose of this paper we will be focusing on one broad branch of sustainable development, the sustainable building branch. We will be approaching the problem from a technical point of view and from a consumer behavior point of view in order to study the position of the Lebanese consumer in terms of awareness, understanding and involvement in sustainable development and the readiness of the consumer to invest in sustainable building and what kind of incentives can encourage him to invest in such a field. The Organization for Economic Cooperation and Development (OECD) initiative in many European countries "Towards Sustainable Household Consumption" has identified and summarized the factors that play a role in household consumption. This model is consistent with the literature. In the framework suggests solutions to boost sustainable consumption. In it suggests policies that could be applied by the government. The results of this framework will be used as a reliable example for our study.



Box 3. Policy tools for household sustainable consumption: some examples

Where externalities exist or where the public good quality of environmental goods or services makes it impossible to use markets to allocate resources effectively, governments have an important role to play in increasing market effectiveness and providing the framework conditions in which society meets it environmental protection goals. They can do so using a combination of economic, regulatory and social instruments.

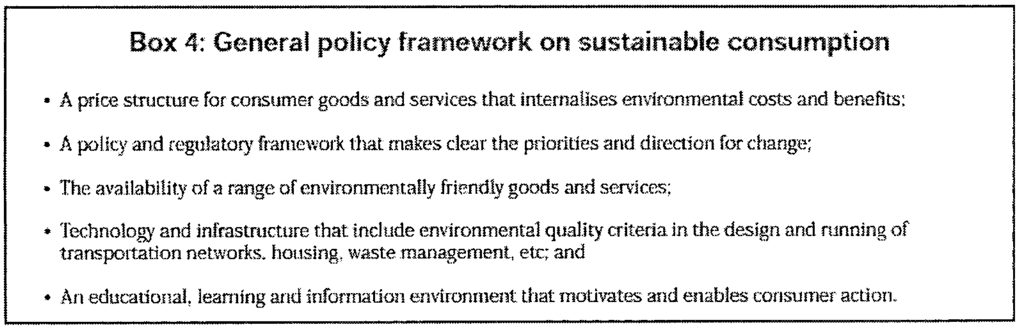
Economic Instruments: e.g. waste fees, taxes on energy and water use, deposit-refund schemes for beverage bottles and batteries, removal of water subsidies, subsidies for green energy, tradable permits for municipal waste, green tax reform...

Regulatory Instruments: e.g. regulation on environmental labels and "green" claims, waste management directives, energy-efficiency standards, extended producer responsibility regulation, statutory pollution emissions targets, water quality standards, product bans...

Social Instruments: e.g. public information and environmental awareness campaigns (on waste, energy, water, transport), education, public debate and participatory decision-making processes, support to voluntary citizen initiatives, partnerships with other actors (private sector, NGOS, etc.)...

Other Tools: e.g. state of environment assessment and goal setting, development of sustainable consumption indicators, incentives for environmentally superior technological innovation and diffusion, infrastructure provision, zoning and land-use planning.

Figure 6: Policy tools for household sustainable consumption. (OECD, 2002)



Box 4: General policy framework on sustainable consumption

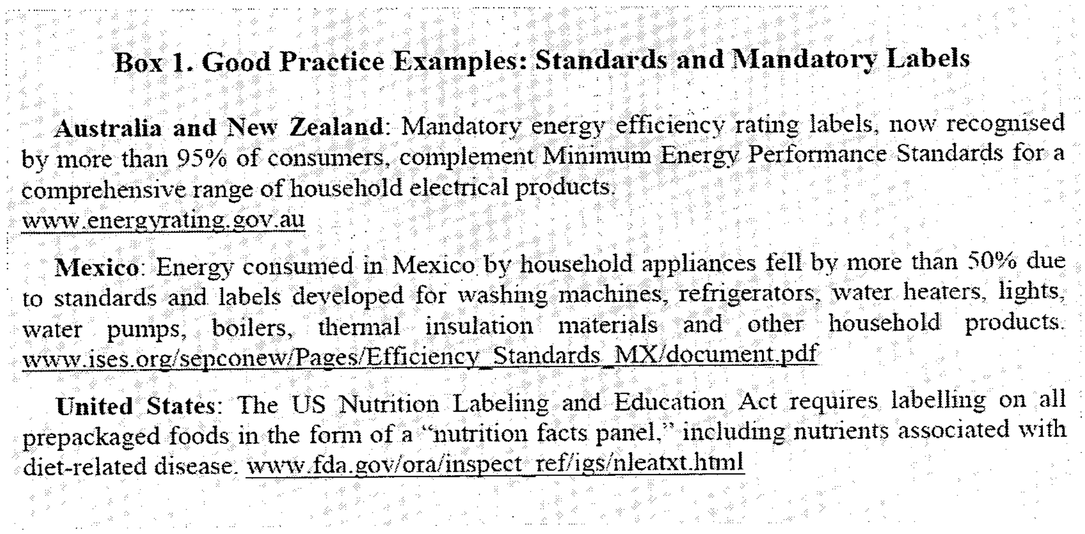
- A price structure for consumer goods and services that internalises environmental costs and benefits;
- A policy and regulatory framework that makes clear the priorities and direction for change;
- The availability of a range of environmentally friendly goods and services;
- Technology and infrastructure that include environmental quality criteria in the design and running of transportation networks, housing, waste management, etc; and
- An educational, learning and information environment that motivates and enables consumer action.

Figure 7: General policy framework on sustainable consumption (OECD, 2002)

The sustainable building science takes into consideration all the aspects of a building and assesses the extent to which they preserve the natural resources and ensures a healthy environment for the occupants. The philosophy behind it is to keep humans and nature in harmony.

2.3.3. Sustainable Building Rating Systems

Sustainable building rating systems exist around the world under different names but they all share the core values of a sustainable building concept. Experience in different countries have proven itself very beneficial as it is decribed in Figure 8:.



Box 1. Good Practice Examples: Standards and Mandatory Labels

Australia and New Zealand: Mandatory energy efficiency rating labels, now recognised by more than 95% of consumers, complement Minimum Energy Performance Standards for a comprehensive range of household electrical products.
www.energyrating.gov.au

Mexico: Energy consumed in Mexico by household appliances fell by more than 50% due to standards and labels developed for washing machines, refrigerators, water heaters, lights, water pumps, boilers, thermal insulation materials and other household products. www.ises.org/sepconew/Pages/Efficiency_Standards_MX/document.pdf

United States: The US Nutrition Labeling and Education Act requires labelling on all prepackaged foods in the form of a "nutrition facts panel," including nutrients associated with diet-related disease. www.fda.gov/ora/inspect_ref/igs/nleatxt.html

Figure 8: Good Practice Examples: Standards and Mandatory Labels (Promoting Sustainable Consumption-Good Practices in OECD Countries, 2008)

The following section will present some of the best known rating organizations and their rating systems around the world and will describe specific importance of each system.

- USA - United States Green Building Council (USGBC)

In their Sustainable Building Technical Manual, the USGBC explain that Sustainable development concepts, applied to the design, construction, and operation of buildings, can enhance both the economic well-being and environmental health of communities in the United States and around the world. The Union Internationale des Architects/American Institute of Architects (UIA/AIA) World Congress of Architects recognized that in its 1993 Declaration of Interdependence, which acknowledges that buildings and the built environment play a major role in the human impact on the natural environment and on the quality of life. If sustainable design principles are incorporated into building projects, benefits can include resource and energy efficiency, healthy buildings and materials, ecologically and socially sensitive land use, transportation efficiency, and strengthened local economies and communities. (Sustainable Building Technical Manual, 1996)

The Leadership in Energy and Environmental Design (LEED) is the rating system adopted by the USGBC. Figure 9: LEED Credit Categories shows the main categories in a green building design:
Sustainable Sites, Locations and Linkages, Water Efficiency, Energy & Atmosphere, Awareness & Education, Materials and Resources, Indoor Environmental Quality. Each category is studied in details and credits are given for various considerations in the design. A building is rated based on a hundred points scheme as: LEED Certified, LEED SILVER, LEED

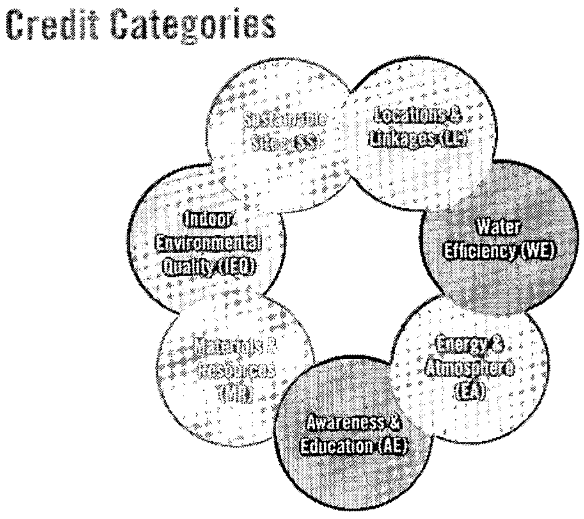

Credit Categories
Sustainable Sites (SS)
Locations & Linkages (LL)
Water Efficiency (WE)
Energy & Atmosphere (EA)
Awareness & Education (AE)
Materials & Resources (MR)
Indoor Environmental Quality (IEQ)

Figure 9: LEED Credit Categories (USGBC, 2012)

GOLD or LEED Platinum. Additional information can be found in appendix A.

- New Zealand – The Building Research Association of New Zealand (BRANZ)

The Green Homes Scheme instituted by BRANZ describe their guidelines as follows: The Sustainable Home Guidelines provide a practical guide for good practice eco-building with up to date information about energy, water, materials, safety, waste and other eco-building issues to build your dream eco home or to simply make your existing home a little more sustainable. It will help you save money on energy and water bills, design a safer and healthier place to live and do your bit for the eco city vision. These guidelines are not just for building or renovating a house - much of the information is about simple things you can do in your everyday life to contribute to sustainability - saving energy or water, making your home safer and healthier or just more comfortable to live in. (The Sustainable Home Guidelines, 2012)

- UK – The British Building Research Establishment (BRE)

BRE have issued guidelines under the Environmental Assessment Method known as BREEAM. In their turn they rate sustainable buildings based on many parameters similar to the ones previously cited. The measures used represent a broad range of categories and criteria from energy to ecology. They include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes. (BREEAM, 2012)

- Australia – Green Building Council of Australia (GBCA)

The rating system adopted by the GBCA is called Green Star. And Why would you choose Green Star?, The GBCA answer on their website (Note the inclusion of the Corporate Social Responsibility and the Competitive advantage in the answer. Both concepts are of high significance for this paper.):

There are many business benefits for choosing Green Star for your next project including:
Lower operating costs
Higher return on investment

Greater tenant attraction
Enhanced marketability
Productivity benefits
Reduced liability and risk
A healthier place to live and work
Demonstration of Corporate Social Responsibility
Future proofed assets
Competitive advantage

Other councils and associations have different rating systems exist. Some are adapted from existing rating systems and others are issued as originals in different countries. Here is a list of some of the green building or sustainable building institutions around the world:

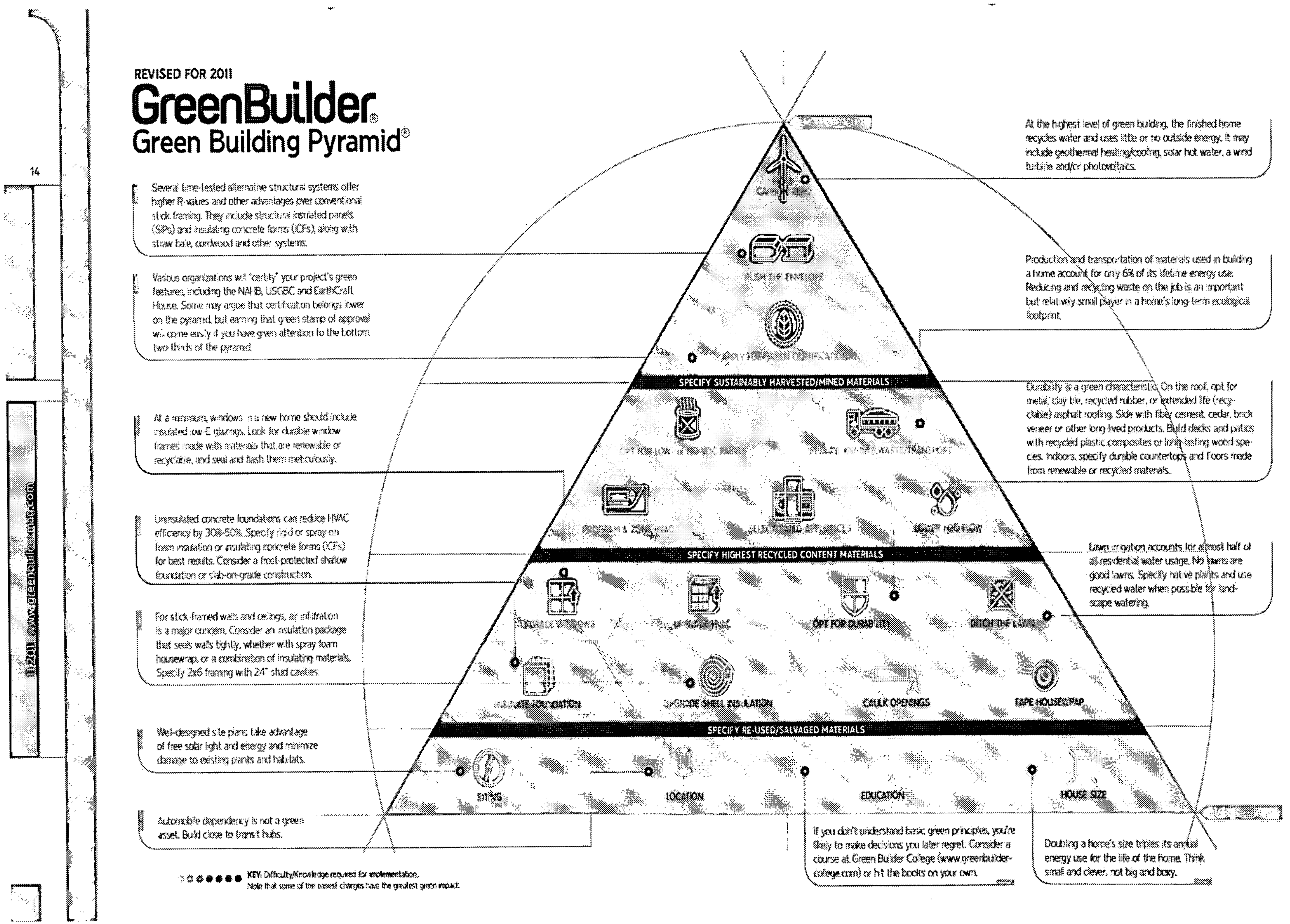
- Haute Qualite Environnementale (HQE) in France. (http://assohqe.org)
- The Green Building Council of Denmark (http://www.dk-gbc.dk/)
- German Sustainable Building Council – GeSBC (http://www.dgnb.de)
- Qatar Green Building Council – QGBC (http://www.qatargbc.org/)
- Abu Dhabi Municipality and Environment Agency issued their "Design Guidelines for New Residential and Commercial Buildings", ESTIDAMA, which means 'sustainability' in Arabic.
- A listing of important players on the international level can be found on the webpage of the United Nations Environment Programme (UNEP): http://www.unep.or.jp/ietc/sbc/resource_link.asp

In addition to those local schemes, international effort are being done to join hands and to expand the understanding and methods used in the green building design and construction. An example of this association of efforts is the World Green Building Council (WGBC). (http://www.worldgbc.org). The United Nations Environment Programme is as well trying to gather efforts from around the world to develop the concept in a more collective form through their sustainable building council (SBC) (http://www.unep.or.jp/ietc/sbc/)

It can be easily noticed from the descriptions above and from extended consultations and reading about the topic that a Sustainable Building (or Green Building) is much more than an energy efficient home. In fact they include terms like occupant comfort, indoor environment quality, minimizing energy consumption, living healthy, reducing water consumption. The inclusion of a description of a green building in this paper is impossible due the breadth of the topic. Instead, a list of key terms will be listed without explicit details. For any further information, the reader can refer to the authorities, agencies, councils and authors mentioned in this research.

2.4. Sustainable Buildings Illustrated

The green buildier magazine have published in 2008 and updated in 2011 the green building pyramid. This pyramid shown in Figure 10: The Green Building Pyramid. describes in an easy way what can be done to make a sustainable building and shows the increase in cost against the increase of sophistication of the technical side of the design and the benefits from the whole operation. The pyramid is an excellent tool that can be used to introduce the green buildings concept to non technical individuals in a very simple way. Such presentations are extremely important especially that a typical home owner is not expected to understand complicated engineering tasks and is not probably willing to pay for an engineering to achieve sustainability at his own house. Another interesting model for energy efficiency of a green building has been published in 2010 by Martin Halladay. See Figure 11: Energy Efficiency Pyramid . In its turn, this pyramid is a very helpful too to inform the non technical users about how to reduce their energy bills in a very simple way. The final illustration Figure 12: Illustration for a green building , is a typical sustainable house where basic issues have been addressed in a sustainable way. The importance of this illustration is in its simplicity, so that it can be understood by any person without the need to be aware of complicated technical issues. It is very important to mention here that these illustration are guidelines and that every case is specific. The get the best results, a consultation of an expert is indispensable.


SPECIFY SUSTAINABLY HARVESTED/MINED MATERIALS
SPECIFY HIGHEST RECYCLED CONTENT MATERIALS
OPT FOR DURABILITY
DITCH THE LAWN
UPGRADE SHELL INSULATION
CALK OPENINGS
TAPE HOUSEWRAP
SPECIFY RE-USED/SALVAGED MATERIALS
SITING
LOCATION
EDUCATION
HOUSE SIZE
14

REVISED FOR 2011

GreenBuilder®

Green Building Pyramid®

Several time-tested alternative structural systems offer higher R-values and other advantages over conventional stick framing. They include structural insulated panels (SIPs) and insulating concrete forms (ICFs), along with straw bale, cordwood and other systems.

Various organizations will "certify" your project's green features, including the NAHB, USGBC and EarthCraft House. Some may argue that certification belongs lower on the pyramid, but earning that green stamp of approval will come easily if you have given attention to the bottom two thirds of the pyramid.

At a minimum, windows in a new home should include insulated low-E glazings. Look for durable window frames made with materials that are renewable or recyclable, and seal and flash them meticulously.

Uninsulated concrete foundations can reduce HVAC efficiency by 30%-50%. Specify rigid or spray-on foam insulation or insulating concrete forms (ICFs) for best results. Consider a frost-protected shallow foundation or slab-on-grade construction.

For stick-framed walls and ceilings, air infiltration is a major concern. Consider an insulation package that seals walls tightly, whether with spray foam housewrap, or a combination of insulating materials. Specify 2x6 framing with 24" stud cavities.

Well-designed site plans take advantage of free solar light and energy and minimize damage to existing plants and habitats.

Automobile dependency is not a green asset. Build close to transit hubs.

○○●●●●● **KEY:** Difficulty/Knowledge required for implementation.
Note that some of the easiest changes have the greatest green impact.

At the highest level of green building, the finished home recycles water and uses little or no outside energy. It may include geothermal heating/cooling, solar hot water, a wind turbine and/or photovoltaics.

Production and transportation of materials used in building a home account for only 6% of its lifetime energy use. Reducing and recycling waste on the job is an important but relatively small player in a home's long-term ecological footprint.

Durability is a green characteristic. On the roof, opt for metal, clay tile, recycled rubber, or extended life (recyclable) asphalt roofing. Side with fiber cement, cedar, brick veneer or other long-lived products. Build decks and patios with recycled plastic composites or long-lasting wood species. Indoors, specify durable countertops and floors made from renewable or recycled materials.

Lawn irrigation accounts for almost half of all residential water usage. No lawns are good lawns. Specify native plants and use recycled water when possible for landscape watering.

If you don't understand basic green principles, you're likely to make decisions you later regret. Consider a course at Green Builder College (www.greenbuildercollege.com) or hit the books on your own.

Doubling a home's size triples its annual energy use for the life of the home. Think small and clever, not big and boxy.

Figure 10: The Green Building Pyramid. (Power, 2012)

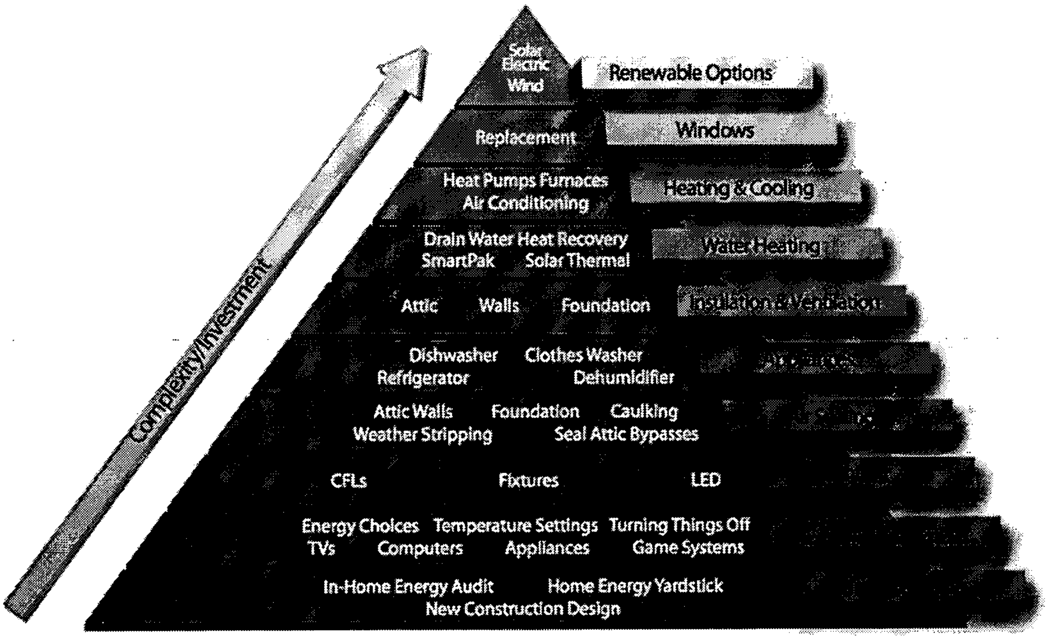

Solar
Electric
Wind
Renewable Options
Replacement
Windows
Heat Pumps Furnaces
Air Conditioning
Heating & Cooling
Drain Water Heat Recovery
SmartPak Solar Thermal
Water Heating
Attic Walls Foundation
Insulation & Ventilation
Dishwasher Clothes Washer
Refrigerator Dehumidifier
Appliances
Attic Walls Foundation Caulking
Weather Stripping Seal Attic Bypasses
CFLs Fixtures LED
Energy Choices Temperature Settings Turning Things Off
TVs Computers Appliances Game Systems
In-Home Energy Audit Home Energy Yardstick
New Construction Design
Complexity/Investment

Figure 11: Energy Efficiency Pyramid (Holladay, 2010)

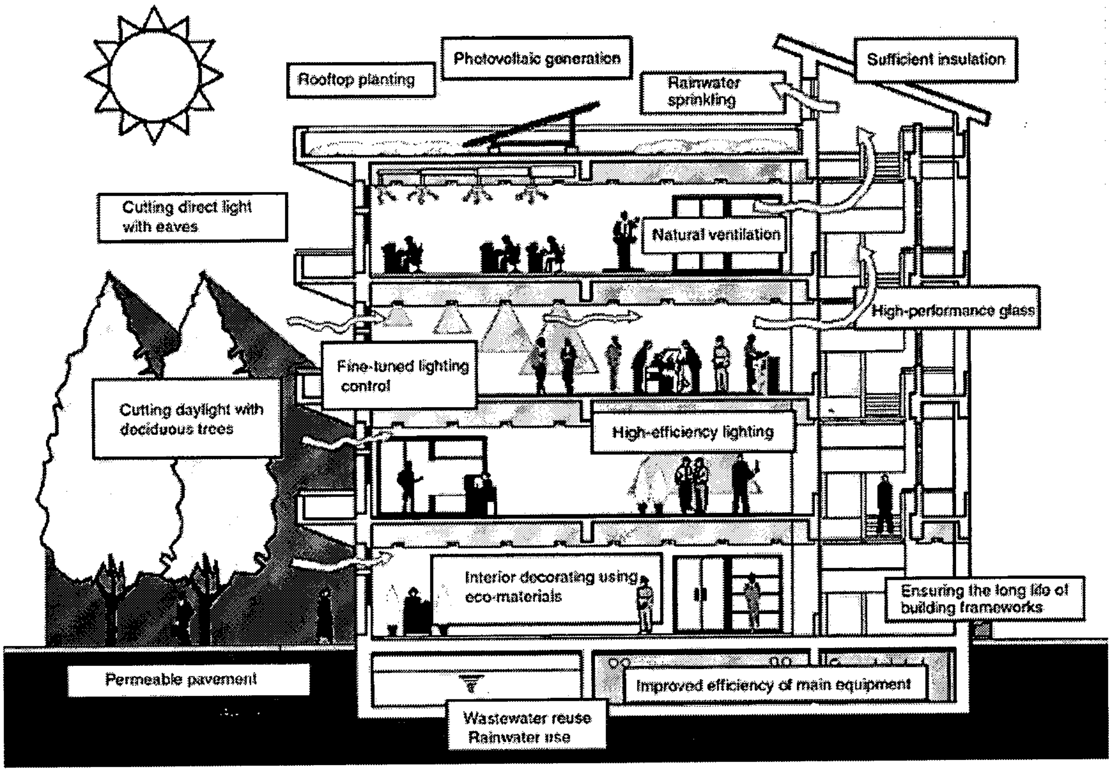
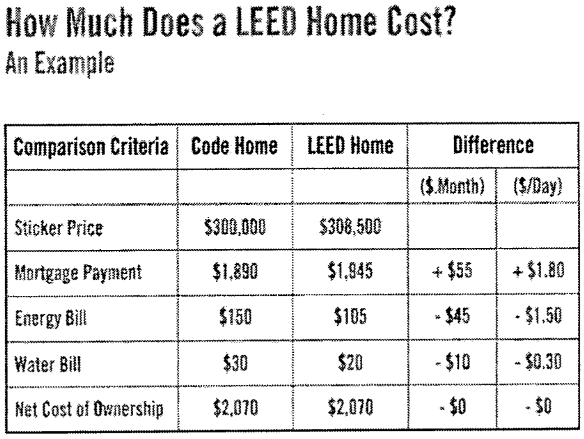

Photovoltaic generation
Rooftop planting
Rainwater sprinkling
Sufficient insulation
Cutting direct light with eaves
Natural ventilation
High-performance glass
Fine-tuned lighting control
Cutting daylight with deciduous trees
High-efficiency lighting
Interior decorating using eco-materials
Ensuring the long life of building frameworks
Permeable pavement
Improved efficiency of main equipment
Wastewater reuse
Rainwater use

Figure 12: Illustration for a green building (Shams, 2010)

2.5.Investment in Sustainable Building

In terms of costs of a sustainable house, researches have demonstrated that the initial cost of a sustainable house is very similar to the cost of a conventional house. According to "The Cost of Green Revisited" by Davis Langdon, many projects are achieving LEED Certification within their budgets and within the same cost range as non-LEED projects. (Langdon, 2007) However, the operational costs are significantly lower. In addition to the direct financial benefit of green buildings, its value increases as well, improving the return on long term investment in green buildings. This result can be confirmed by different parties and in different contexts. For example, the US Department of Energy wrote that: Using today's best practices, builders have demonstrated that it is possible to design and construct new houses that are 30 to 40 percent lower in energy intensity than a typical code house, at little or no additional cost. Still, such high-performance homes hold a very small market share. (Energy Efficiency Trends in Residential and Commercial Buildings, 2008). And Greg Kats: Direct savings of $100 million in annual residential air conditioning costs (A/C needs reduced by 10% to 30% as estimated by various studies). (Greg Kats, 2003). Figure 13 is extracted from the USGBC website and reflects a set of costs vs benefits in a green house.



How Much Does a LEED Home Cost?
An Example

Comparison Criteria	Code Home	LEED Home	Difference	
			($.Month)	($/Day)
Sticker Price	$300,000	$308,500		
Mortgage Payment	$1,890	$1,945	+ $55	+ $1.80
Energy Bill	$150	$105	- $45	- $1.50
Water Bill	$30	$20	- $10	- $0.30
Net Cost of Ownership	$2,070	$2,070	- $0	- $0

Figure 13: How much Does a LEED Home Cost? (USGBC, 2012)

The British Building Research Establishment in his BREEAM rating system website publishes the following:

- There is a positive gentrification effect for neighbourhoods with BREEAM certified buildings in them, around 1.5 to 6 percent, for rents and transactions, respectively.

- There are positive premiums for rents and transactions prices for BREEAM certified buildings. Rents are 21% higher and transactions are 18% higher. This reflects what happens when BREEAM buildings start to cluster. (BREEAM, 2012)

Other authors are more conservative and suggest that there is a slight increase in the cost of a sustainable building. Greg Kats, in his Report to California's Sustainable Building Task Force wrote: Sustainable buildings generally incur a "green premium" above the costs of standard construction. (...) The average premium for these green buildings is slightly less than 2%, substantially lower than is commonly perceived. The majority of this cost is due to the increased architectural and engineering (A&E) design time necessary to integrate sustainable building practices into projects. Generally, the earlier green building gets incorporated into the design process, the lower the cost. (Greg Kats, 2003) Kats reaffirms his results in 2010 in his book "Greening Our Built World, Costs, Benefits, and Strategies". Based on a study involving 170 green buildings, he reports that building in the data set reported green premiums ranging from 0% to 18%, with a median of 1.5%; The large majority reported premiums between 0% and 4% (Figure 14) and that different approaches to researching the cost of going green yield similar results.

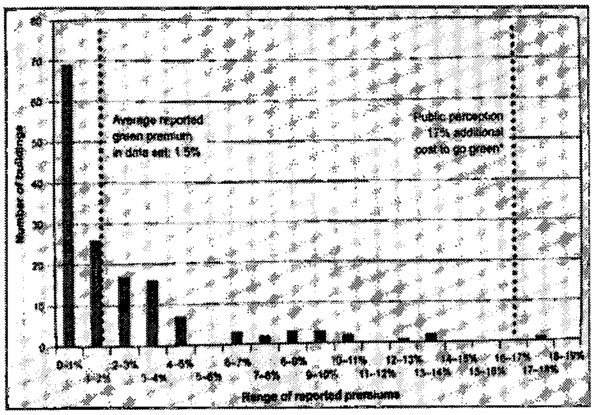


Figure 14: Range of Green Premium (Kats, 2010)

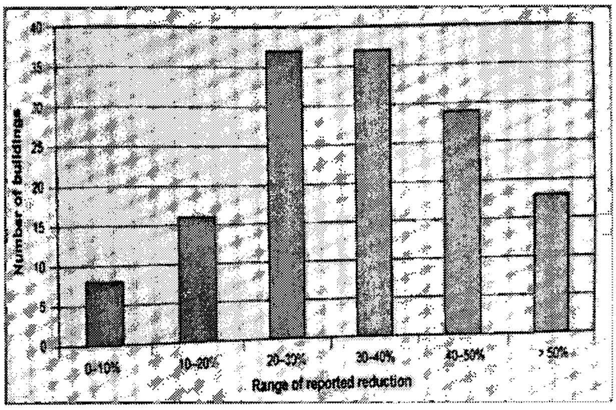


Figure 15: Range of Reduction in Energy Consumption (Kats, 2010)

The same study and for the same sample, he reports energy use reductions ranging from 10% to more than 100%. (building produce more energy than what they use) with a median of 34% (Figure 15). 18 building projected to save 50% or more in energy can be cost-effectively achieved with today's technology. For these buildings, the median green premium is 4%. Water saving were reported between 0% and 80% at a median of 39%. For the affordable housing case, the average is at 2.4% and the median was at 2.9% (Kats, 2010)

All of these facts make it certain that the investment in a green home is financially beneficial. The benefits of a green home are not restricted to the financials. Studies have showed improvement of both physical and mental health. Comfort level and productivity are increased. For instance, Studies substantiate that daylighting creates healthier and more stimulating work environments than artificial lighting systems and can increase productivity up to 15 percent. (Sustainable Building Technical Manual, 1996). One study performed by the Heschong-Mahone group looked at students in three cities and found that students in classrooms with the greatest amount of daylighting performed up to 20% better than those in classrooms that had little daylight. (Greg Kats, 2003). Choice of low or no volatile organic compounds (VOCs) helps in reducing the respiratory and allergy problems. Selection of convenient air handling units reduces the acoustic pollution. Site selection reduces transportation needs. It is not convenient to go into a lot of details in this document because of the breadth of the topic. For additional information the reader can refer to any of the references cited previously.

2.6.Role of the Authorities-Role of the Private Sector

All of the plans, guidelines and rating systems that were mentioned above and despite their excellent and growing reputation, stayed at the level of guidelines. In fact, governments do not force the application of any of the abovementioned guidelines. The decision to implement or not these plans remain the choice of the investor or the owner and the designers of the buildings. For example, The Abu Dhabi Government through their ESTIDAMA program mentioned earlier.

In contrast with, for example, the CO2 emissions in cars, the building industry do not have any obligations towards reducing emissions. Neither has it any obligations regarding the CFC emissions, the case of many industries. And even when policies are applied, there is an issue about its efficacy. Examples from other environmental cases can be analyzed. Jessica Pape explains in her paper about the Irish case, the reason behind the limited effectiveness of the sustainable consumption policies: “The limited effectiveness of many of the sustainable consumption policies and instruments discussed in this paper can be partly attributed to their top–down, government-led nature that allows for little active participation by consumers, householders and other interested parties”. (Jessica Pape, 2010) On the contrary, Palmujoki gives an important role to the authorities. He suggests the power should be kept in the hand of the government while the private sector should stay at the advocacy side. the oldest public–private type of environmental governance, in which the environmental organisations are in advocacy roles, reform environmental management in a more concrete and sustainable way than the more recently emerging patterns. (Palmujoki, 2006). Both authors end to a conclusion that the private sector and the governments should be working in a complementary way in order to achieve the best result. This has been proven through assessment of real scenarios; Palmujoki suggests four patterns for the governance of the role of NGOs in sustainable development:

> In environmental issues, the paper identifies four patterns of wherein the governance between International Organizations, governments and private actors is constructed:
> The first case is the role of an advocacy NGO in which an international organization and the NGO have a more or less direct relationship reflected in the policy of the international organization towards governments.
> The second is a typical international organization–national government–operational NGO cooperation pattern, in which the international organization realizes its projects, partly or entirely, through governments and NGOs or directly through NGOs. Policy implementation here is more or less in the hands of an operational NGO.
> In the third case the NGO or other private actor has been accepted as an integral part of governance together with states and international organizations.
> In the fourth case, the state is also active, or even manipulates the international organizations and the NGOs. (Palmujoki, 2006, p. 4)

Pape from her side suggests targeting the consumer in a participatory and interactive rather than governmental approach. It is argued here that participatory and interactive approaches to policy have advantages over top–down awareness campaigns based on an information deficit model, simplistic fiscal measures or command and control regulatory frameworks because they directly confront all policy actors with sustainability challenges. These policies need to be complemented with transdisciplinary research which involves participants from governmental and non-governmental organizations, business and industry, designers and environmentalists as well as householders in the development of innovative methodologies, action plans and programmes for more sustainable consumption. (Jessica Pape, 2010)

2.7.Role and capacity of the individual

The role of the individual in making a change towards sustainability depends on a matrix of factors, varying from culture to knowledge, financial capabilities, beliefs, understanding, and priorities. Results show that general environmental beliefs do influence norms on environmental actions and prices, but only norms on price are correlated with environmental attitudes; both intrinsic and extrinsic environmental drivers together with social norms and community influence are associated with environmental attitudes, but cost barriers may have a negative influence. It was also found that there was a strong association between environmental attitudes and energy saving behaviours but the latter was not in any way influenced by government policies or subsidies (David Gadenne, 2011). The degree of knowledge of the topic among public is itself low even in the industrialized countries and even when it comes

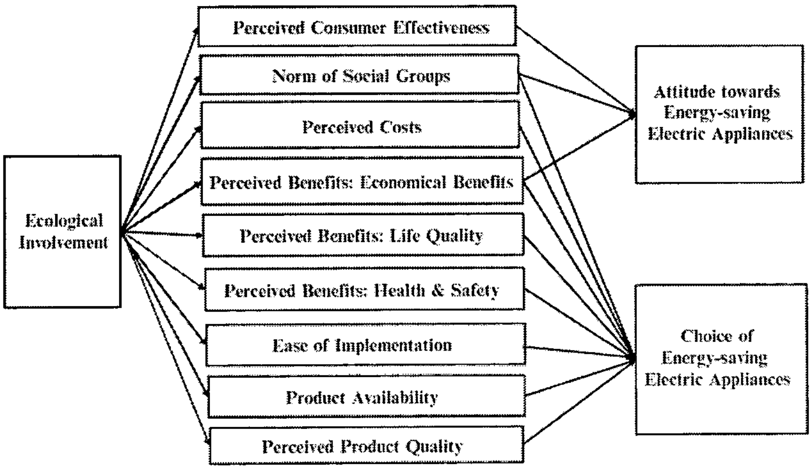

Ecological Involvement
Perceived Consumer Effectiveness
Norm of Social Groups
Perceived Costs
Perceived Benefits: Economical Benefits
Perceived Benefits: Life Quality
Perceived Benefits: Health & Safety
Ease of Implementation
Product Availability
Perceived Product Quality
Attitude towards Energy-saving Electric Appliances
Choice of Energy-saving Electric Appliances

Figure 16: Factors Affecting the Consumer's Choice of Energy-Saving Appliances (Nishio, 2010)

to educated and high professionals. “amongst the 5.5 million people in the UK who call themselves professionals there is already a growing realization that they need help in understanding how to put the principles of sustainability into practice” (Martin, 2005, p. 163). Research in the field of housing and urban sustainability also encompasses studies of cultural diversity. Inheritance, habits and tradition, along with different ways of living, provide the social framework in which sustainability should be analyzed. The universal and commonly accepted standards proposed for improving sustainability should be grounded in cultural perspectives to ensure a holistic approach. (Dimensions of Housing and Urban Sustainability, 2004). While the concept of the long term investment in sustainable building might be easy to explain to educated people, the whole idea might not be very simple and acceptable for less educated people. The diagram developed by Nishio (Figure 16: Factors Affecting the Consumer's Choice of Energy-Saving Appliances (Nishio, 2010)) shows a set of variables that affect the consumer’s decision to buy or not an energy saving appliance. Nishio classifies the consumer’s action being either an attitude or a choice (decision). So we should be looking for factors that would induce a decision to implement sustainability. However, consumer’s attitude or decision might change with time. BRANZ describes the change in the consumers’ attitude in New Zealand towards their Eco Build Guide. ‘It’s gone from people not being aware, to being aware but not knowing what to do, to the point where people are now taking action. BRANZ’s Eco Building Guide was first published 10 years ago. Now it is one of our most requested and distributed free products.’ (BRANZ Group, 2008). The concept is very important especially that the occupant’s attitude is one of the major determinants of the sustainability of a construction. So even if the building was initially built green, the occupant’s attitude is what makes it sustainable. The use of housing entails the consumption of energy and water as well as the production of waste, all of which can be reduced depending on the design of housing and its facilities (Winston, 2007). Consicent with the above literature we can hypothesize that if well informed about the principles of sustainable buildings, he will be more interested to implement such design and construction processes. In addition, the individual will be interested in modifying his attitude in a way that helps to reduce the energy consumption, waste and the environmental footprint.

Hypothesis 1: The population is not aware that the built environment is among the major causes of environmental damage.

Hypothesis 2: Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).

Hypothesis 3: The population, if well informed is more willing to invest in green building

2.8.Role of the financial institutions

Just as any other institution, financial institutions are concerned in sustainable development in terms their own investments but their role is leading in terms of subsidizing or encouraging investments in the green field. They are particularly expected to play an important role in helping to induce the sustainable development due their access to an infinite range of applications through financing. Banks may confront environmental issues as potential risks or as opportunities to develop new financial products. Environmental risks found for example in polluting firms (e.g. the chemical industry) might generate financial liabilities to banks, if they had lent money to those firms. (Thompson, 1998). Most banks perceive environmental issues not only as threats, but also as an opportunity to gain financial benefits or to foresee potential future financial risks that should be avoided. Taking this into account, banks' environmental strategies could be classified in two general approaches: those aiming at developing new financial products and those related to environmental management strategies for improving their environmental performance and reputation. According to the former approach, banks have designed new financial tools and loans to finance cleaner technology (Thompson, 1998). Green lending and/or green bonds are other terms used in the financial institutions to describe the services supporting investment in green development. Such tools are often called 'green' lending, 'green' funds, 'green' bond and other 'green' financial products. The overall purpose of these strategies is that they support banks not only by gaining benefits or avoiding risks, but also by playing the role of motivator for firms and other organizations to implement environmental and corporate social strategies and to achieve the ultimate goal: sustainable development. (Banking CSR)

Hypothesis 4: Financial incentives are amongst the most important for the Lebanese consumer to invest in sustainable buildings.

2.9.Previous research-Sustainable Building in Lebanon

The first executive order that dealt with the local environment was issued in 1925 (Executive Order 144) and declared the sea including the deep sea, the sea side, and the shore a public property. The second initiative followed in 1970 almost 45 years later with an executive order to specify the general rules to establish and invest in touristic enterprises (Executive Order 15598) (Djoundourian, 2007). Despite the early involvement of Lebanon in environmental issues, these issues are currently being marginally approached. In fact it was until April 2012 that the ministry of environment released new executive orders related to the environmental footprint, the strategic environmental assessment, the greening of the public assets and finally the environmental assessment of constructions. The ministry launched as well in December 2011 the communication campaign on saving energy-an initiative funded by the Italian Ministry of Foreign Affairs – Development Cooperation in the framework of the project "Climate Change Mitigation – Renewable Energy" (the communication campaign on saving energy, 2011). Besides, the sustainable buildings concept which is relatively a new concept has been addressed very faintly by the government and by the private sector. Most of the actions in the field were restricted to some small initiatives of small energy business firms. These firms are relying on the individual initiative and on marketing tools to encourage the consumer to invest in sustainability. Most of the investment in sustainability is in solar water heaters and in energy saving light bulbs. The Ministry of Energy and Water has subsidized the installation of solar heater through long term loans from the central bank and through participation in a small amount of money (200 000 Lebanese Lira) for every thermal solar water heater. In addition to that, the ministry has distributed 1 000 000 energy saving light bulbs. Besides this, no significant action has been done by the government. In contrast, the Lebanese Green Building Council is in the process of preparing a rating system under the name "ARZ". ARZ is the Arabic name of The Cedar which is the national tree of Lebanon. However the rating system is not yet complete. Possibly, the UNDP is the only organization to have complete significant works in terms of sustainable development. In their 2010 results they report:

UNDP assisted legislators in drafting two laws on energy efficiency and conservation in Lebanon, and also helped to create the Lebanese Center for Energy Conservation. Our experts also worked alongside Lebanese officials to establish a specialized jurisdiction to address and penalize environmental crimes.

☐ Major governmental and commercial organizations joined the UNDP-assisted Energy Audit Program which generated an average annual savings of 45,000 USD per building (for a total 110 buildings) with an average payback period of 2.67 years.

☐ UNDP's pilot installation of solar water heaters in 1100 households in poor villages in South Lebanon demonstrated over 30% reduction in household energy costs. Scaling up to the national level has commenced and is expected to achieve a significant lowering in the cost of energy.

☐ Energy efficiency and renewable energy equipment have been installed in 28 public buildings and facilities across the country including: 5 hospitals, 3 schools, 17 municipalities, and 3 social centers. (total of : 28)

☐ Photovoltaic (PV) system project has to date installed over 25PV system (of 40 Kilowatts) mostly in public schools to provide schools with energy independence.

As mentioned by the UNDP, draft laws on energy efficiency and conservation are ready, but no law has been enacted yet.

On the other hand, some academic research has been done on the topic of environmental protection in the country. Most of them are also individual initiatives by environmental enthusiasts working on their degrees. Among many, we will be nothing those who's results are relevant for the subject of this paper.

Salpie Djoundourian concluded in her paper "Enviromental Movement in Lebanon" that: The establishment of the many new ENGOs (Environmental Non Govenrmental

Organization) has sent a clear message to the government that people have environmental concerns, ranging from availability of clean water to proper management of residential and medical waste to protection of the green areas, and that one of the responsibilities of the ministry would be to help resolve the many issues that they had. (Djoundourian, 2007). This result is of high significance for the purpose of this study as it proves that the Lebanese population is environmentally responsible and it's even initiating environmental actions leading the government in many aspects. In fact, one of the latest achievement of the Lebanese citizens at this level was at the Sixth International Conference on Environmental Science and Technology in Texas reaping the first prize through its representative Dr. in Environmental Engineering Mervat el-Hoz for her research project titled Site Evaluation for Olive Mills Waste Composting Facility (Naharnet, 2012). This involvement of the Lebanese people in the environmental responsivility will be reflected in this research.

Dr Abbas El-Zein studied the willingness to participate in an environmental intervention in the neighborhood of Beirut. The correlations between different variables are shown in **Error! Not a valid bookmark self-reference.**. In this study, respiratory health patients, males, the less educated, and tenants have been found to be more likely to express a stronger willingness to participate than others. No association has been found between willingness-to-participate, on the one hand, and age, access to a private health insurance, or crowding. Nor does the belief in the effectiveness of local action appear to be a predictor of participation intentions. (Abbas EL-Zein, 2006)

Table 1: Correlations Between Different Variables

	Sex (male vs. female)	Age	Education (elementary or less vs. more than elementary)	Working status (income-generating vs. non-income-generating)	Private health insurance (yes vs. no)	Crowding index	House ownership (owned vs. rented)	Respiratory disease (yes vs. no)	Belief in local action (yes vs. no)
Sex (male vs. female)	1.000 (0.000)	−0.008 (0.935)	0.092 (0.340)	**0.694** **(0.000)**	0.143 (0.137)	0.012 (0.903)	0.044 (0.650)	−0.022 (0.816)	**−0.200** **(0.036)**
Age		1.000 (0.000)	**−0.428** **(0.000)**	0.147 (0.125)	**−0.247** **(0.009)**	−0.090 (0.349)	0.035 (0.714)	−0.127 (0.188)	0.134 (0.164)
Education (elementary or less vs. more than elementary)			1.000 (0.000)	0.182 (0.057)	0.145 (0.130)	−0.138 (0.150)	0.016 (0.872)	−0.088 (0.361)	**−0.212** **(0.026)**
Working status (income-generating versus non-income-generating)				1.000 (0.000)	0.133 (0.167)	0.073 (0.448)	0.048 (0.622)	−0.095 (0.322)	−0.144 (0.132)
Private health insurance (yes vs. no)					1.000 (0.000)	−0.114 (0.235)	0.027 (0.779)	0.011 (0.909)	−0.026 (0.789)
Crowding index						1.000 (0.000)	0.017 (0.856)	0.171 (0.074)	−0.026 (0.789)
House ownership (owned vs. rented)							1.000 (0.000)	0.120 (0.212)	0.080 (0.406)
Respiratory disease (yes vs. no)								1.000 (0.000)	0.132 (0.170)
Belief in local action (yes vs. no)									1.000 (0.000)

Note: *P* for a two-tailed significance test is shown in parentheses; $p<0.05$ is shown in bold type.

One interesting factor is the correlation that he found between the willingness and the respiratory health problem. This direct relationship between the individual's health and his willingness to take an environmentally responsible action has not been considered sufficiently in the literature that was reviewed for the purpose of this paper. However the factor is quiet interesting and will be included in our study along with any allergy problems which we believe do affect the attitude of the individual.

2.10. Conclusion

The problematique of climate change is now possibly the hottest research topic around the world. Sustainability science is now present in almost every aspect of human life. It is getting so popular to the point where it is becoming a cliché. Yet, it remains important! In fact we have damaged the environment enough to start seeing abnormal climatic conditions. Everyone should bear his responsibility to dampen the change, and this does not have to be at all at the expense of quality or comfort. An excellent example of application of environmentally friendly development is Sustainable Building or Green Building which in fact improve the health and increase economic benefits for mankind. Such a building is capable of minimizing harm to the environment and natural resources and at the same time providing a healthier built environment. The implementation of the concept is affected by many factors including but not restricted to: site considerations, economic situation, governance, beliefs, awareness, education, availability of information, willingness of the individuals. The problem is global and Lebanon makes part of the nations concerned with the change. The country's green image is being weakened due to irresponsible urban development and due to the unstable political and difficult social conditions. The purpose of the study is to assess the individual's position regarding the sustainable buildings.

The results will validate the hypothesis related to the lack of awareness and to show to which extent it might affect the decision of the Lebanese population. It will identify the incentives that might affect the consumer's decision and will open the way for future market options including the integration of the sustainability into the real estate sector in Lebanon using the power of financial institutions, which in their turn will be beneficiaries.

Chapter 3

3. PROCEDURES AND METHODOLOGY

3.1. Introduction

Previous researches have proven many determinants of the attitude of an individual towards environmental issues. These determinants include the recognition of the problem, the awareness concerning the related damages, the beliefs of the individual, health factors, social factors, financial constraints and benefits, the available information, the availability of solution and many other factors. The purpose of this study is to analyze the current situation of the Lebanese consumer's position when it comes to implementing a green or sustainable design to his own house. It will reconfirm the fact that the Lebanese consumer has a good awareness and a concern about environmental issues. However, he/she do not have correct figures about the position of buildings in the global environmental harm and they are not aware about the green buildings. On the other hand, the study will prove that if good information is available, the consumer is more willing to invest in his house to make it green especially if he has financial incentives from the financier. Understanding this position will open the door to future research in terms of how to target the needs of the Lebanese consumer in order to encourage him to implement sustainability.

As it has been mentioned previously, half of the respondents will be given information about green buildings in an attempt to measure the impact of information on the decision of the individual. For the purpose of this paper, and given the fact that there isn't any model/rating system or regulation regarding the green buildings in Lebanon, we have used models from other international institution.

The survey has been tested thouroughly on many levels to make sure that it represents the population and that it reflected their opinion without any bias or leading questions.

The final form of the survey was electronic and administered online while more than 60 000 electronic invitations have been sent through social media and emails.

3.2. Hypothesis

Consistent with the literature when data is available about Lebanon and by analogy with other researches around the world when data is not available, the hypothesis of this study are taken as follows:

Hypothesis 1: The population is not aware that the built environment is among the major causes of environmental damage.

Hypothesis 2: Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).

In analogy to what is going on around the world, the concept is new and people are not very aware of it. And even if they were aware, they are still not sure about what to do. Specificly in Lebanon it has not been seriously presented to the public by any Lebanese governmental or non governmental organization

Hypothesis 3: The population, if well informed is more willing to invest in green building.

Hypothesis 4: Financial incentives are amongst the most important for the Lebanese consumer to invest in sustainable buildings.

In analogy with the New Zealand 's experience. More knowledge about the topic lead the population to be more keen to implement sustainability and to look for resources and support in this direction.

3.3. Selected Variables.

The following table represents the design of the questionnaire and the measured variables.

Table 2: Table of Selected Variables

Part One: Demographics	
Question subject	Answer Type
1- Nationality	Choose one
2- Gender	Choose one
3- Educational Level	Choose one
4- Marital Status	Choose one
5- House Ownership	Choose one
6- Income (Monthly)	Choose one
7- Age	Choose one
8- Occupation	Choose one
9- Work Industry	Choose one
10- Place of Living – Place of Birth	Choose one
Part Two: Testing hypothesis1 - The population is not aware that the built environment is among the major causes of environmental damage.	
Question subject	Answer Type
11- Testing the general concern of the Lebanese population about global environmental issues. If they believe or not in the danger related to the following topics:	
Climate Change Fresh Water Shortage Depletion of Resources Deforestation Indoor Environment Global Warming Rise of the Sea Level	5 points likert scale matrix
Testing the knowledge of the population regarding effect of the buildings on the environment.	
12- Self Assessment in terms of knowledge about green buildings	5 points likert scale
13- Global share of buildings in Emissions of Green House Gases (GHG) and Ozone Depleting Gases (ODG)	Choose the correct answer
14- Energy Consumption in Lebanon	Choose the correct answer
15- Water Consumption in Lebanon	Choose the correct answer
Part Three: Testing hypothesis2 - Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).	
Question subject	Answer Type
Testing the knowledge of the population regarding green buildings.	

16- Energy and Water savings in a green buildings	Choose the correct answer
17- Increase of human productivity in a green building	Choose the correct answer
18- Cost breakdown of a building	Choose the correct answer
19- Additional cost for a green house	Choose the correct answer
20- Open Ended question	Write what you think should be consideredin green building design
21- Random selection of the series	Choose randomly one of two buttons
Part Four: Testing Hypotesis 3 - The population, if well informed is more willing to invest in green building.	
Question subject	Answer Type
22- Presenting information about green buildings randomly to 50% of the respondents.	RANDOMLY FOR 50% OF RESPONDANTS. Figure 11: Energy Efficiency Pyramid Figure 12: Illustration for a green building
23- Measuring the interest of the respondents to make their house a green building.	7 point likert scale
Part Five: Testing Hypothesis 4 - Financial incentives are amongst the most important for the Lebanese consumer to invest in sustainable buildings	
Question subject	Answer Type
24- Ranking of influencing factors: The opinion of someone who did it Sustainable buildings are required by law The availability of a specialist to tell me what i should do A bank loan to cover the cost of the project If i can include the cost in my housing loan The trend in the country My own knowledge of the benefits of such an investment	Rank from 1 for the most important to 7 for the least important
25- Ranking of reasons to invest in green building: For health reasons For environmental reasons For financial reasons (money saving)	Rank from 1 for the most important to 3 for the least important
26- Contact Details	OPTIONAL

3.4. Methodology

3.4.1. Test the above hypothesis

Due to the lack of available data, raw data was be collected using the survey technique. The survey was online using one of the best known online surveys providers, www.questinpro.com. The website provides a very helpful set of functions and a good design. For further analysis, the results will be exported to the statistical package SPSS. An arbitrary representative sample was surveyed. To make sure that the sample was as randomized as possible, and to reach individuals from every geographical area every social, professional, and other backgrounds in Lebanon, invitations were sent to more than 60 000 respondants via emails in addition to invitations on social media (facebook). Questions will reflect the variables mentioned in the previous table. The respondants will be split randomly into two series. All questions in the two series are identical. The difference is that one of the two series will provide some information about green buildings after question 23. Then everyone will be asked about his interest to invest in green buildings.

Part one, Demographics, will be a descriptive part and will describe the respondants profiles in to validate the sample.

In part two: Testing hypothesis1, the respondants will give their opiniong regarding six of the most important climate and environmental problems on a 5 point likert scale. Then they will choose what they think is the correct answer in questions related to the environmental footprint of buildings in general. Results will be analysed in terms of frequencies of correct answers.

In part three, testing hypothesis 2, the respondants will be asked to select what they think is the right answer for questions about the green buildings. Results will be analysed in terms of frequencies of correct answers. Then they will be asked to write in an open ended box what they think should be considered in a green building.

Part four, testing hypothesis three, The respondants will be divided in two groups. Only the first half will be shown two illustrations, Figure 11: Energy Efficiency

Pyramid and Figure 12: Illustration for a green building . Then all respondants will be asked about how interested they are to invest in making their house sustainable. The answer is on a 7 point likert scale. At a first stage, the analysis of the data will be in a descriptive. In fact, in part two and part three, with the exception of question 13, I analysed the tendency of the respondants towards or away from the correct answer in order to understand the understanding of the population for the subject of this research. The descriptive analysis was used as well in part five to describe the tendency of the population and understand what would be the best incentive for them to invest in green building. The second phase of the analysis was correlational in order to understand the relationship between different variables. And the final analysis was experimental to assess the importance of the information factor on the sample. For this comparison, a t-test will be done for the experiment to show the difference in responses. The results of this part was then analysed from a marketing point of view in order to initiate a plan for the Lebanese maket.

3.5.Pilot Test

The first draft of the questionnaire can be found in appendix B and appendix C. The pilot test has been administered on paper for 30 persons and studied thouroughly. The results of the questionnaire couldn't be analysed in a proper way. In fact the structure of the questionnaire was leading to the correct answers, especially in testing the knowledge of the participants. The answers were shown in the question itself so the respondants had a tendency to accept the numbers rather than evaluating them. The structure was rectified and instead of using a 5 point likert scale questions in part two, a "choose the correct answer" structure was used with symetric answers in order to avoid any induction of the answer. The given options were general percentages, of which, one is close to the true answer.

Another problem with the pilot test was that the information given for the experimental part of the study, (questionnaire series B, Part Five) was presented in a full page document, and the respondants were not all ready to read the whole page. So the information was reduced to the minimum in the second pilot questionnaire. Few lines in bullet point structure insead of a full page.

The second pilot questionnaire was designed in an electronic version using an online tool and tested with 52 respondants. In general there were no serious problems. Some final arrangements were made and the questionnaire was ready to be published. The most important remarks on this questionnaire were about the concentration in the sense that the presentation of the survey was condensed. This was changed in the final survey. And the last important issue was about how to present information about green buildings. Finally, the information part was changed from a bullet point information presentation to a graphic presentation. This was done to include much more information in a simple way. The second pilot of the questionnaire is in appendix C.

The final questionnaire was designed taking into consideration all of the problems encountered in the three tests. Even though, three final modifications were made:

1- The open ended question about green buildings was asked to all respondents to make sure that the only variable between the two series was the information question. (question 23 in the variables table)
2- The last modification was made during the collection of the responses to minimize the dropouts. In fact the questionnaire was presented in three pages. The respondant had to press a continue button twice and the drop out analysis provided by the online engine showed that about 70% of the drop outs were at the page break. to resolve it, only one page break was left, just before question 23 (the informative question) and a "You are almost done, Thank you for your patience" message was induced. The results of this trick were positive as it almost eliminated the drops before question 23.
3- The scale of question 24 was changed from 5 to seven. In fact, more then 85% responses were at the positive side, hense on 2 points. Therefore was the need to spread the scale to 7 points to get a better feedback.

The final questionnaire can be found in appendix D.

3.6. Instrumentation

3.6.1. Administration / Statistical Package / Framework.

In the spirit of the green attitude, the questionnaire was designed using an online survey website. This decision was beneficial at many level, including the ability to reach geographically a very large portion of the Lebanese territory. As the question concerns the whole Lebanese population and as there is a significant cultural difference between different areas in Lebanon, it was important to reach respndants from every area. The other reason for this choice was the ease data handling. This method have saved a lot of time for data entry and eliminated the data entry errors. The results from this website/tool were analysed at two levels. The first was using the same online tool, www.questionpro.com which has very nice basic statistical features. The second tool was the well known SPSS professional software. The questionnaire link was sent via bulk email providers to more than 60 000 email addresses in Lebanon. The survey link was accessed by more than 1400 persons of which 467 people started the survey and 316 people completed it. Such a volume couldn't have been achieved using the paper administered method. The green success of such a choice is in saving not less than 1500 A4 papers, equivalent to eight kilograms. And the value of this choice is in proving that sometimes, the green option is even better than the traditional option.

The analysis of the data was in its greatest part a descriptive analysis in which the respndants were tested in terms of correct answers and frequencies of correct answers. Cross tabulation and correlations between different variables were identified in order to understand the population and to deduct the results show in the findings chapter However, hypothesis three was studied in an experimental way using a t-test to show the difference in the responses two groups, one of which was (controlled) given information and another was left with its own knowledge and the last part was analysed in terms of frequencies and assessed in the wake of the previous findings.

3.7. Conclusion

The methodology of this research was chosen to make the best benefits of the available technologies to expand the reach and to make the sample as representative as possible to maximize the margin of confidence of the research. The pilot test was very important, in fact essential corrections were done for the first draft and the second draft to reach the final format. The statistical analysis was descriptive at one level and experimental at another level. The use of the online tool www.questionpro.com and of the SPSS professional software was an excellent combination to draw the best result from the two in a synergic formula.

Chapter 4

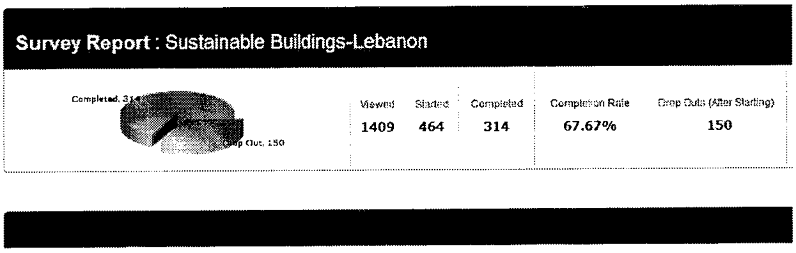
4. FINDINGS

4.1.1. Introduction

The collected data has been analysed in different dimensions in order to depict as many useful information as possible about the attitude of the Lebanese population with regards to the green buildings. In general, the demographic properties of the sample were pretty diverse which increases the representativeness of the sample. The majority of the respondants were university graduates with a bachelor's or a master's degree. And between 18 and 34 years old. About 50% of the respondants did not have a house at the moment they filled the survey which gives a special importance to the study as it reflects the point of view of those who do not have an apartment and the point of view of those who have one. As for the remaining parts of the survey, the results were very close to the expected results. In terms of knowledge, the population was not very well informed about green buildings even though the affinity towards environmental issues was very high. The experimental part proved that the population would be more interested to invest in green buildings if they were well informed. In this chapter and finally the financial incentives were proven to be amongst the top incentives for the Lebanese individuals to invest in making their house a green house.

Detailed analysis of the results will describe and analyse thoroughly the data set and extract useful results. Descriptive statistics including correlational and experimental analysis were used at different stages of the analysis depending on the type of variables assessed and the structure and flow of the survey.

The survey was accessed by 1409 persons. 464 persons started the survey and 316 completed all the



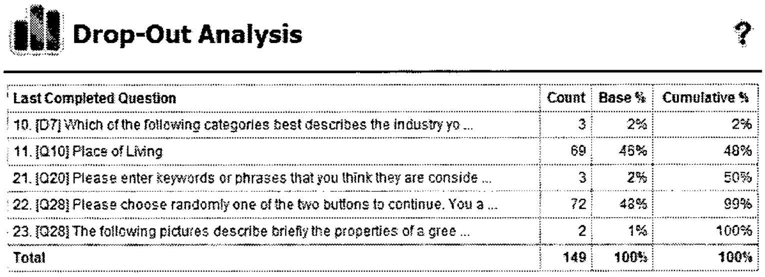
Survey Report : Sustainable Buildings-Lebanon

Viewed	Started	Completed	Completion Rate	Drop Outs (After Starting)
1409	464	314	67.67%	150

Figure 17: Survey Report

question of the survey. With a an average time of completion of 14 minutes (Figure 17: Survey Report).

The drop outs were mostly at the first page break. When this page break was removed, the drop outs shifted to the second page break that could not be removed due to the experimental section of the survey. In Figure 18: Drop Out Analysis,46% drop outs were at question 11 (code Q10 in the program) when this question was just before the page break. When this page break was deleted, the majority of the drop outs were shifted to question 22 (code Q28 in the program). So in total, the drop outs at page breaks were 94%. Which proves a friendly design of the survey. In fact only 5% dropped it out at a point other than the page breaks.



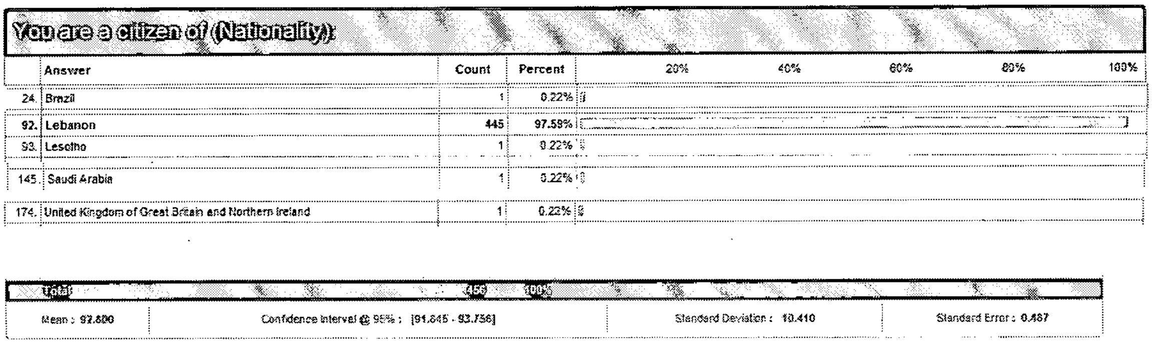
Drop-Out Analysis

Last Completed Question	Count	Base %	Cumulative %
10. [D7] Which of the following categories best describes the industry yo ...	3	2%	2%
11. [Q10] Place of Living	69	46%	48%
21. [Q20] Please enter keywords or phrases that you think they are conside ...	3	2%	50%
22. [Q28] Please choose randomly one of the two buttons to continue. You a ...	72	48%	99%
23. [Q28] The following pictures describe briefly the properties of a gree ...	2	1%	100%
Total	149	100%	100%

Figure 18: Drop Out Analysis

4.1.2. Survey Results

Part One

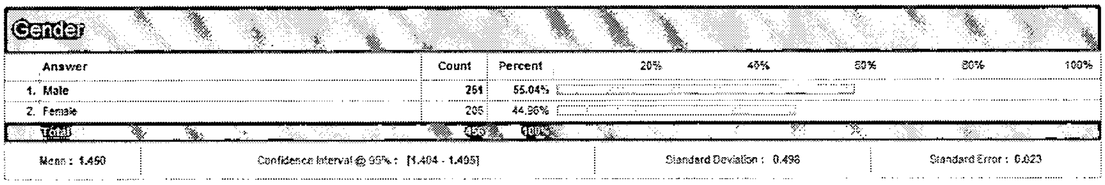


You are a citizen of (Nationality):

	Answer	Count	Percent
24.	Brazil	1	0.22%
92.	**Lebanon**	**445**	**97.59%**
93.	Lesotho	1	0.22%
145.	Saudi Arabia	1	0.22%
174.	United Kingdom of Great Britain and Northern Ireland	1	0.22%
	Total	**456**	**100%**

Mean : 92.800 | Confidence Interval @ 95% : [91.845 - 93.756] | Standard Deviation : 10.410 | Standard Error : 0.487

20%
40%
60%
80%
100%

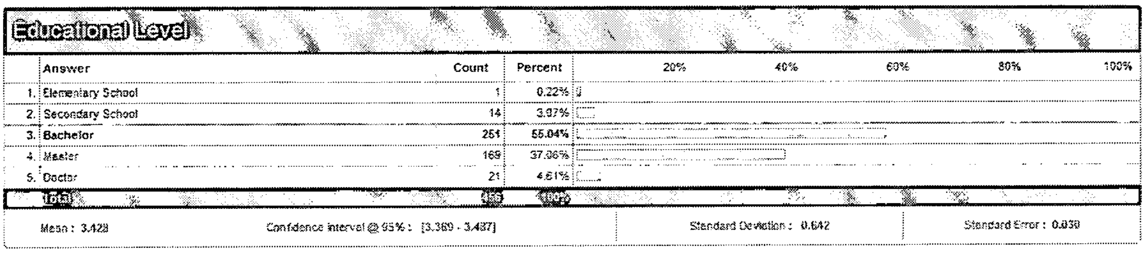


Gender

	Answer	Count	Percent
1.	**Male**	**251**	**55.04%**
2.	Female	205	44.96%
	Total	**456**	**100%**

Mean : 1.450 | Confidence Interval @ 95% : [1.404 - 1.495] | Standard Deviation : 0.498 | Standard Error : 0.023

20%
40%
60%
80%
100%

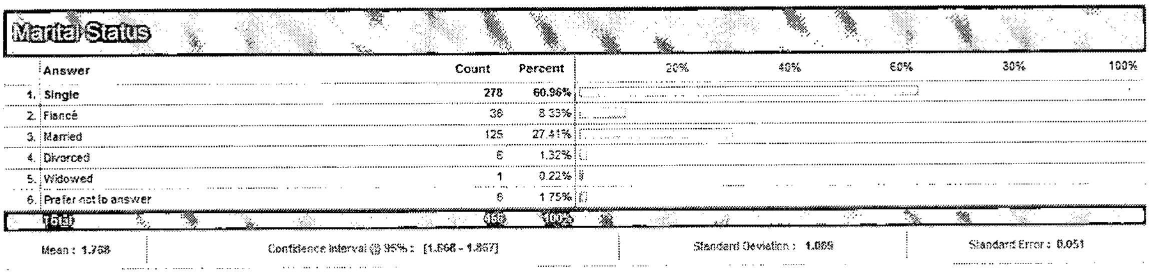


Educational Level

	Answer	Count	Percent
1.	Elementary School	1	0.22%
2.	Secondary School	14	3.07%
3.	**Bachelor**	**251**	**55.04%**
4.	Master	169	37.06%
5.	Doctor	21	4.61%
	Total	**456**	**100%**

Mean : 3.428 | Confidence Interval @ 95% : [3.369 - 3.487] | Standard Deviation : 0.642 | Standard Error : 0.030

20%
40%
60%
80%
100%

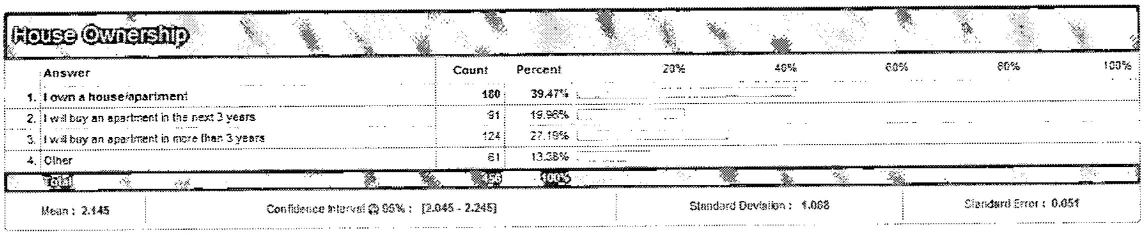


Marital Status

	Answer	Count	Percent
1.	**Single**	**278**	**60.96%**
2.	Fiancé	38	8.33%
3.	Married	125	27.41%
4.	Divorced	6	1.32%
5.	Widowed	1	0.22%
6.	Prefer not to answer	8	1.75%
	Total	**456**	**100%**

Mean : 1.758 | Confidence Interval @ 95% : [1.658 - 1.857] | Standard Deviation : 1.089 | Standard Error : 0.051

20%
40%
60%
80%
100%

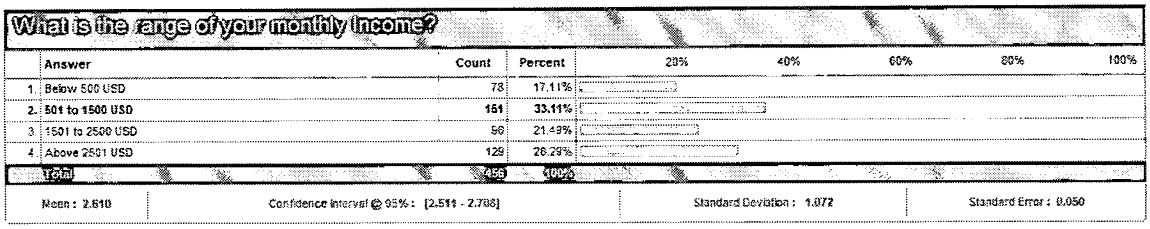


House Ownership

	Answer	Count	Percent
1.	**I own a house/apartment**	**180**	**39.47%**
2.	I will buy an apartment in the next 3 years	91	19.96%
3.	I will buy an apartment in more than 3 years	124	27.19%
4.	Other	61	13.38%
	Total	**456**	**100%**

Mean : 2.145 | Confidence Interval @ 95% : [2.045 - 2.245] | Standard Deviation : 1.088 | Standard Error : 0.051

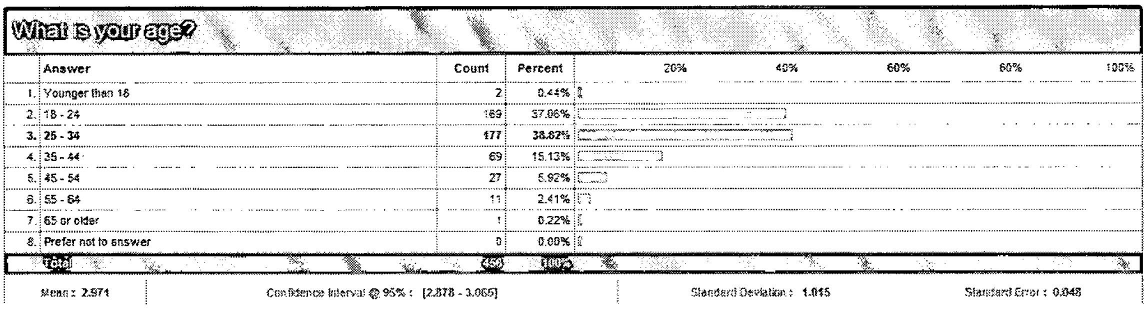
20%
40%
60%
80%
100%



What is the range of your monthly income?

	Answer	Count	Percent
1.	Below 500 USD	78	17.11%
2.	**501 to 1500 USD**	**151**	**33.11%**
3.	1501 to 2500 USD	98	21.49%
4.	Above 2501 USD	129	28.29%
	Total	456	100%

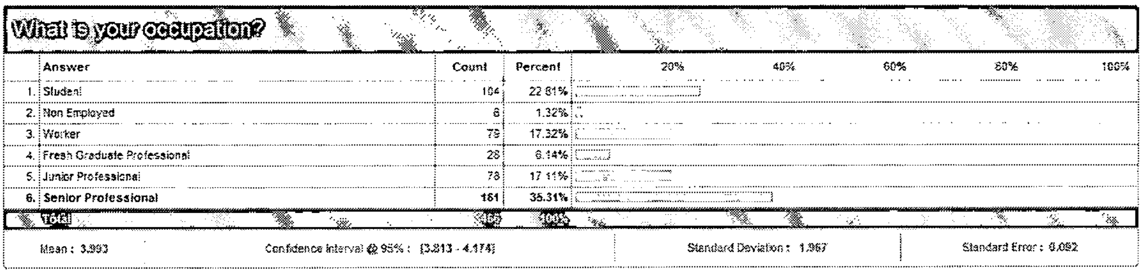
Mean : 2.610 | Confidence Interval @ 95% : [2.511 - 2.708] | Standard Deviation : 1.072 | Standard Error : 0.050



What is your age?

	Answer	Count	Percent
1.	Younger than 18	2	0.44%
2.	18 - 24	169	37.06%
3.	**25 - 34**	**177**	**38.82%**
4.	35 - 44	69	15.13%
5.	45 - 54	27	5.92%
6.	55 - 64	11	2.41%
7.	65 or older	1	0.22%
8.	Prefer not to answer	0	0.00%
	Total	456	100%

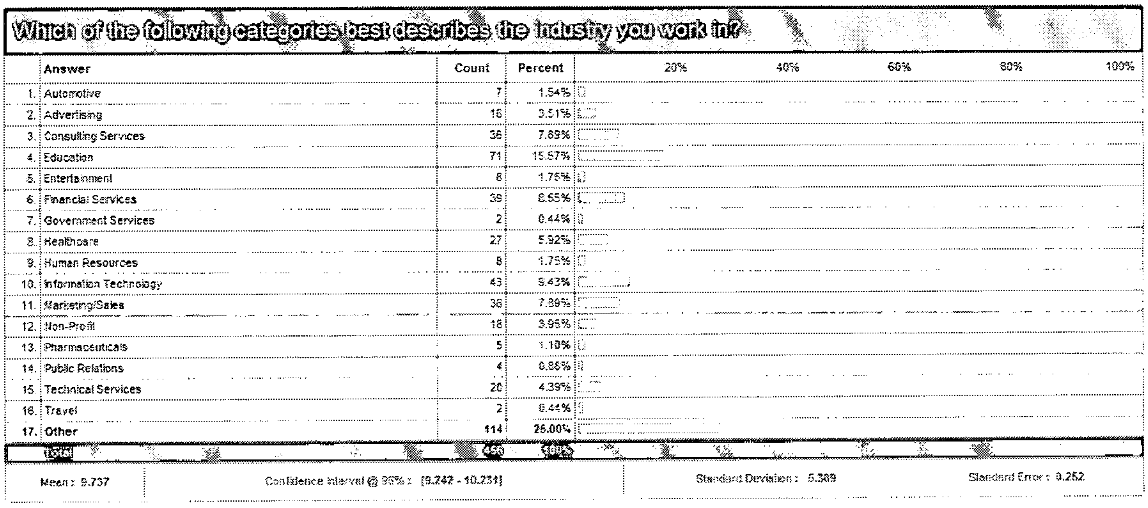
Mean : 2.971 | Confidence Interval @ 95% : [2.878 - 3.065] | Standard Deviation : 1.015 | Standard Error : 0.048



What is your occupation?

	Answer	Count	Percent
1.	Student	104	22.81%
2.	Non Employed	6	1.32%
3.	Worker	79	17.32%
4.	Fresh Graduate Professional	28	6.14%
5.	Junior Professional	78	17.11%
6.	**Senior Professional**	**161**	**35.31%**
	Total	456	100%

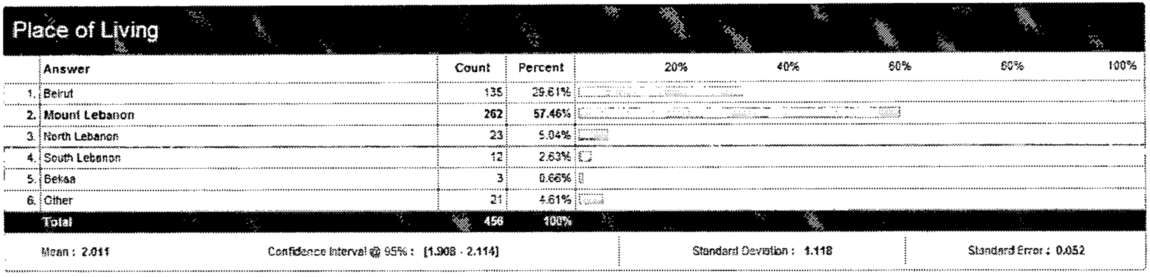
Mean : 3.993 | Confidence Interval @ 95% : [3.813 - 4.174] | Standard Deviation : 1.967 | Standard Error : 0.092



Which of the following categories best describes the industry you work in?

	Answer	Count	Percent
1.	Automotive	7	1.54%
2.	Advertising	16	3.51%
3.	Consulting Services	36	7.89%
4.	Education	71	15.57%
5.	Entertainment	8	1.75%
6.	Financial Services	39	8.55%
7.	Government Services	2	0.44%
8.	Healthcare	27	5.92%
9.	Human Resources	8	1.75%
10.	Information Technology	43	9.43%
11.	Marketing/Sales	36	7.89%
12.	Non-Profit	18	3.95%
13.	Pharmaceuticals	5	1.10%
14.	Public Relations	4	0.88%
15.	Technical Services	20	4.39%
16.	Travel	2	0.44%
17.	**Other**	**114**	**25.00%**
	Total	456	100%

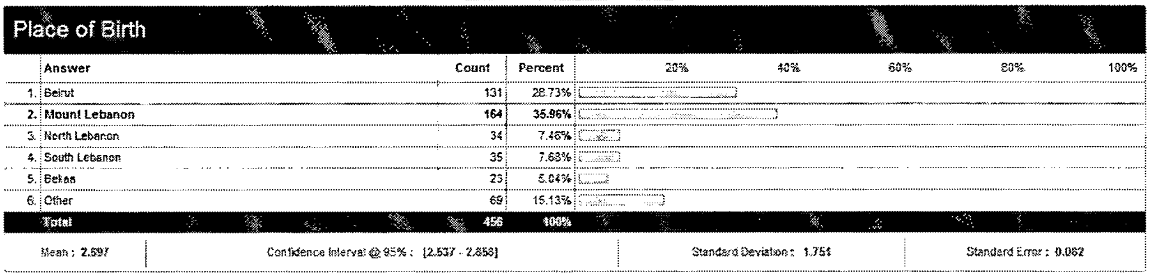
Mean : 9.737 | Confidence Interval @ 95% : [9.242 - 10.231] | Standard Deviation : 5.389 | Standard Error : 0.252



Place of Living

	Answer	Count	Percent	20%	40%	60%	80%	100%
1.	Beirut	135	29.61%					
2.	**Mount Lebanon**	**262**	**57.46%**					
3.	North Lebanon	23	5.04%					
4.	South Lebanon	12	2.63%					
5.	Bekaa	3	0.66%					
6.	Other	21	4.61%					
	Total	**456**	**100%**					

Mean : **2.011** Confidence Interval @ 95% : **[1.908 - 2.114]** Standard Deviation : **1.118** Standard Error : **0.052**

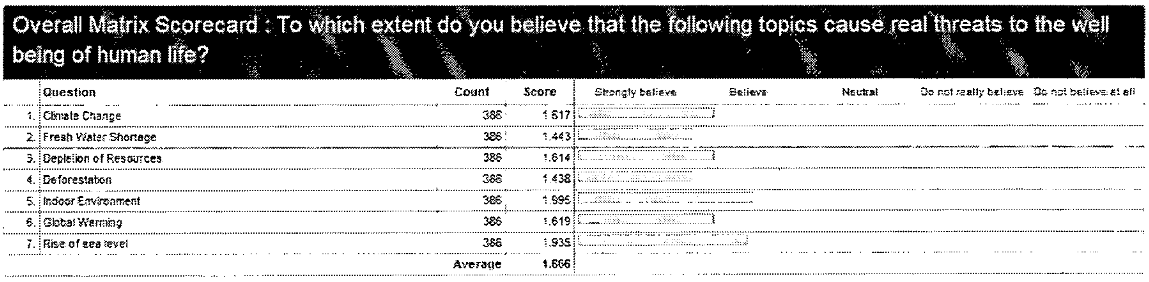


Place of Birth

	Answer	Count	Percent	20%	40%	60%	80%	100%
1.	Beirut	131	28.73%					
2.	**Mount Lebanon**	**164**	**35.96%**					
3.	North Lebanon	34	7.46%					
4.	South Lebanon	35	7.68%					
5.	Bekaa	23	5.04%					
6.	Other	69	15.13%					
	Total	**456**	**100%**					

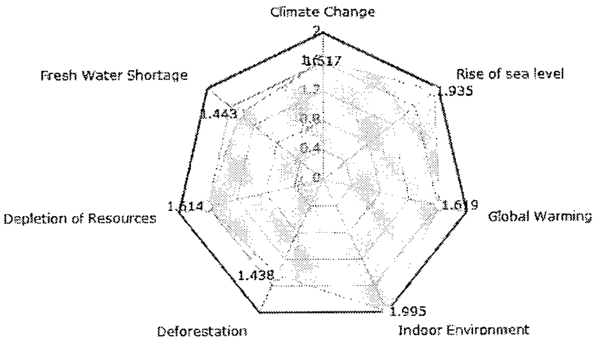
Mean : **2.597** Confidence Interval @ 95% : **[2.537 - 2.858]** Standard Deviation : **1.751** Standard Error : **0.082**

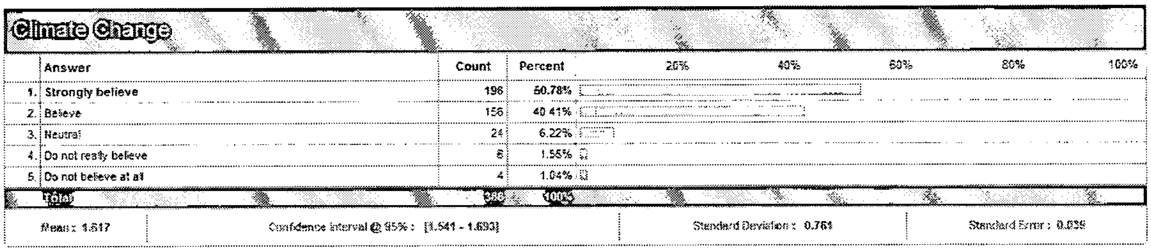
Part Two



Overall Matrix Scorecard : To which extent do you believe that the following topics cause real threats to the well being of human life?

	Question	Count	Score	Strongly believe	Believe	Neutral	Do not really believe	Do not believe at all
1.	Climate Change	386	1.617					
2.	Fresh Water Shortage	386	1.443					
3.	Depletion of Resources	386	1.614					
4.	Deforestation	386	1.438					
5.	Indoor Environment	386	1.995					
6.	Global Warming	386	1.619					
7.	Rise of sea level	386	1.935					
		Average	**1.666**					



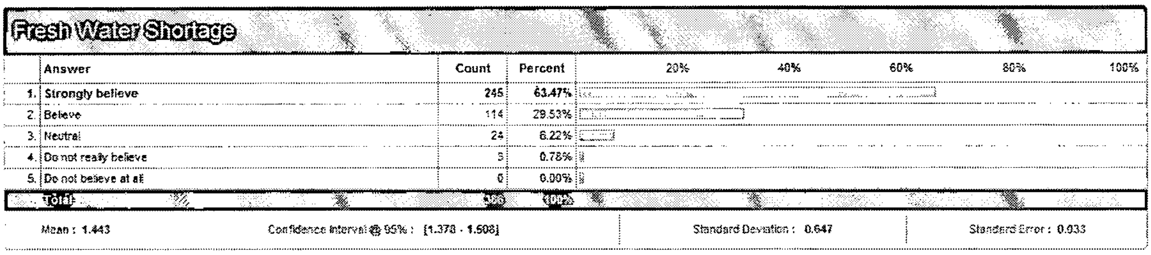


Climate Change

	Answer	Count	Percent
1.	Strongly believe	196	50.78%
2.	Believe	156	40.41%
3.	Neutral	24	6.22%
4.	Do not really believe	6	1.55%
5.	Do not believe at all	4	1.04%
	Total	386	100%

20%
40%
60%
80%
100%

Mean : 1.617 | Confidence Interval @ 95% : [1.541 - 1.693] | Standard Deviation : 0.764 | Standard Error : 0.039

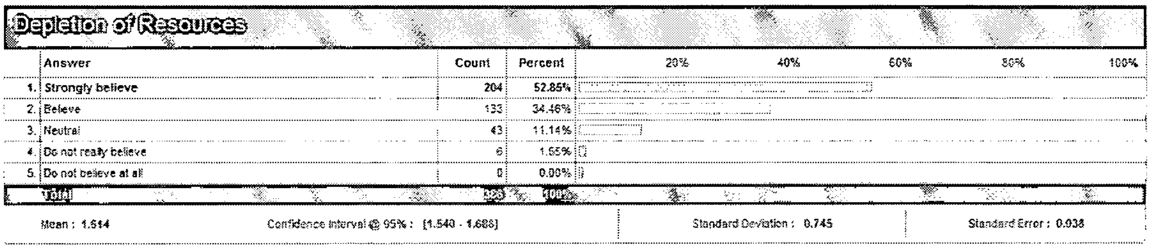


Fresh Water Shortage

	Answer	Count	Percent
1.	Strongly believe	245	63.47%
2.	Believe	114	29.53%
3.	Neutral	24	6.22%
4.	Do not really believe	3	0.78%
5.	Do not believe at all	0	0.00%
	Total	386	100%

20%
40%
60%
80%
100%

Mean : 1.443 | Confidence Interval @ 95% : [1.378 - 1.508] | Standard Deviation : 0.647 | Standard Error : 0.033

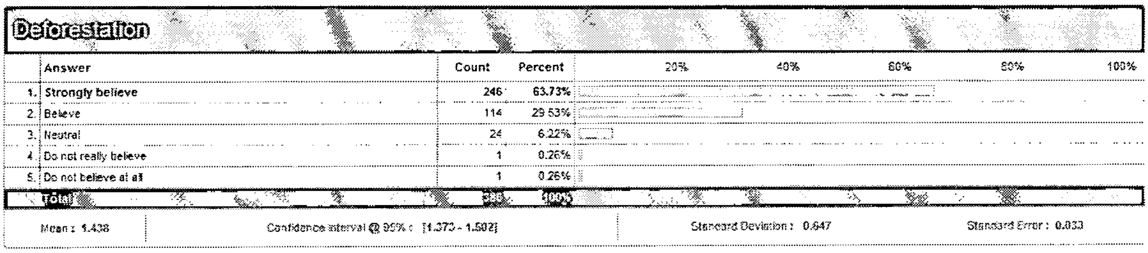


Depletion of Resources

	Answer	Count	Percent
1.	Strongly believe	204	52.85%
2.	Believe	133	34.46%
3.	Neutral	43	11.14%
4.	Do not really believe	6	1.55%
5.	Do not believe at all	0	0.00%
	Total	386	100%

20%
40%
60%
80%
100%

Mean : 1.614 | Confidence Interval @ 95% : [1.540 - 1.688] | Standard Deviation : 0.745 | Standard Error : 0.038

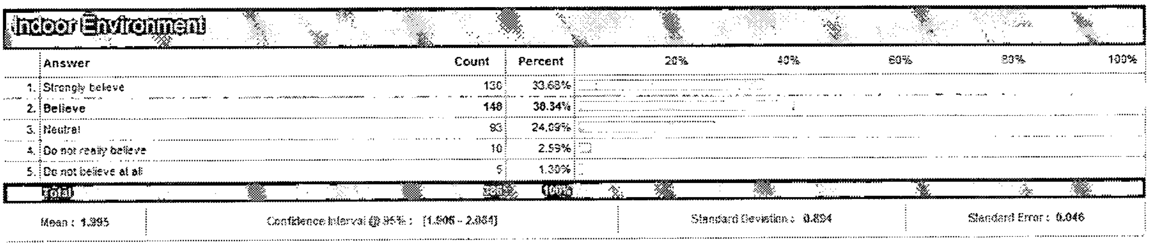


Deforestation

	Answer	Count	Percent
1.	Strongly believe	246	63.73%
2.	Believe	114	29.53%
3.	Neutral	24	6.22%
4.	Do not really believe	1	0.26%
5.	Do not believe at all	1	0.26%
	Total	386	100%

20%
40%
60%
80%
100%

Mean : 1.438 | Confidence Interval @ 95% : [1.373 - 1.502] | Standard Deviation : 0.647 | Standard Error : 0.033

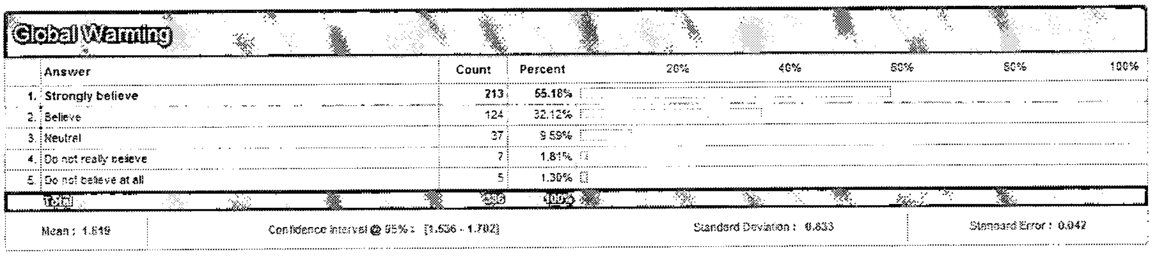


Indoor Environment

	Answer	Count	Percent
1.	Strongly believe	130	33.68%
2.	Believe	148	38.34%
3.	Neutral	93	24.09%
4.	Do not really believe	10	2.59%
5.	Do not believe at all	5	1.30%
	Total	386	100%

20%
40%
60%
80%
100%

Mean : 1.995 | Confidence Interval @ 95% : [1.906 - 2.084] | Standard Deviation : 0.894 | Standard Error : 0.046

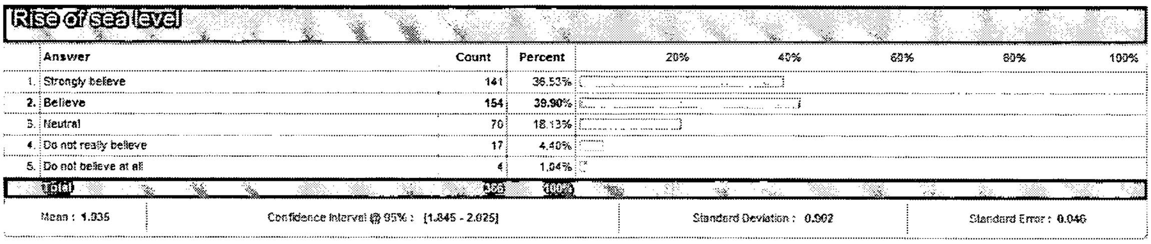


Global Warming

	Answer	Count	Percent
1.	Strongly believe	213	55.18%
2.	Believe	124	32.12%
3.	Neutral	37	9.59%
4.	Do not really believe	7	1.81%
5.	Do not believe at all	5	1.30%
	Total	386	100%

20%
40%
60%
80%
100%

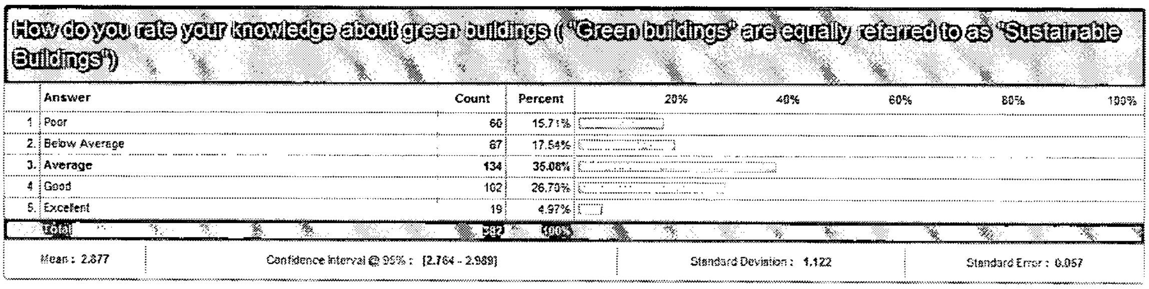
Mean : 1.619 | Confidence Interval @ 95% : [1.536 - 1.702] | Standard Deviation : 0.833 | Standard Error : 0.042



Rise of sea level

	Answer	Count	Percent	20%	40%	60%	80%	100%
1.	Strongly believe	141	36.53%					
2.	**Believe**	**154**	**39.90%**					
3.	Neutral	70	18.13%					
4.	Do not really believe	17	4.40%					
5.	Do not believe at all	4	1.04%					
	Total	386	100%					

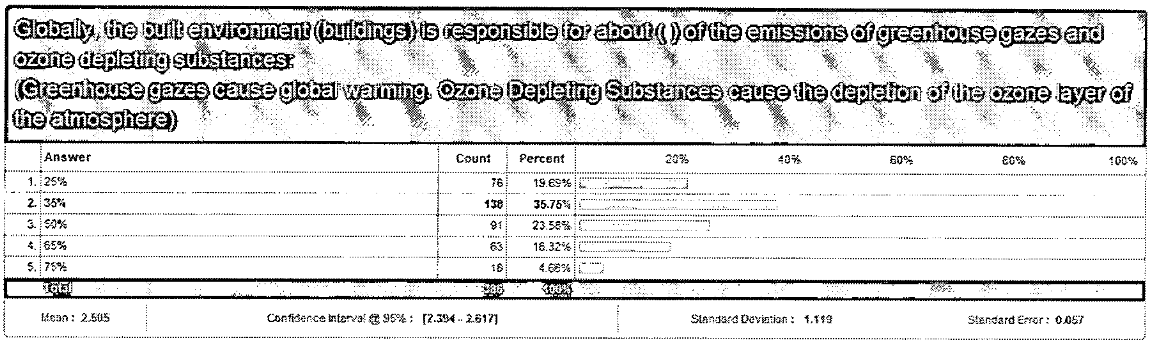
Mean : 1.935 | Confidence Interval @ 95% : [1.845 - 2.025] | Standard Deviation : 0.902 | Standard Error : 0.046



How do you rate your knowledge about green buildings ("Green buildings" are equally referred to as "Sustainable Buildings")

	Answer	Count	Percent	20%	40%	60%	80%	100%
1	Poor	60	15.71%					
2.	Below Average	67	17.54%					
3.	**Average**	**134**	**35.08%**					
4	Good	102	26.70%					
5.	Excellent	19	4.97%					
	Total	382	100%					

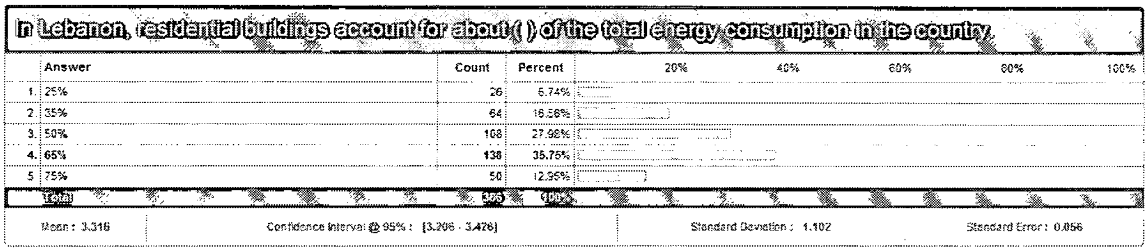
Mean : 2.877 | Confidence Interval @ 95% : [2.764 - 2.989] | Standard Deviation : 1.122 | Standard Error : 0.057



Globally, the built environment (buildings) is responsible for about ( ) of the emissions of greenhouse gazes and ozone depleting substances:
(Greenhouse gazes cause global warming. Ozone Depleting Substances cause the depletion of the ozone layer of the atmosphere)

	Answer	Count	Percent	20%	40%	60%	80%	100%
1.	25%	76	19.69%					
2.	**35%**	**138**	**35.75%**					
3.	50%	91	23.58%					
4.	65%	63	16.32%					
5.	75%	18	4.66%					
	Total	386	100%					

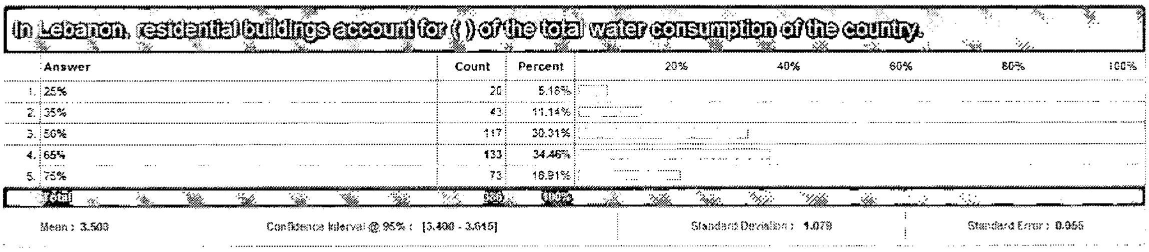
Mean : 2.505 | Confidence Interval @ 95% : [2.394 - 2.617] | Standard Deviation : 1.119 | Standard Error : 0.057



In Lebanon, residential buildings account for about ( ) of the total energy consumption in the country.

	Answer	Count	Percent	20%	40%	60%	80%	100%
1.	25%	26	6.74%					
2.	35%	64	16.58%					
3.	50%	108	27.98%					
4.	**65%**	**138**	**35.75%**					
5	75%	50	12.95%					
	Total	386	100%					

Mean : 3.316 | Confidence Interval @ 95% : [3.206 - 3.426] | Standard Deviation : 1.102 | Standard Error : 0.056

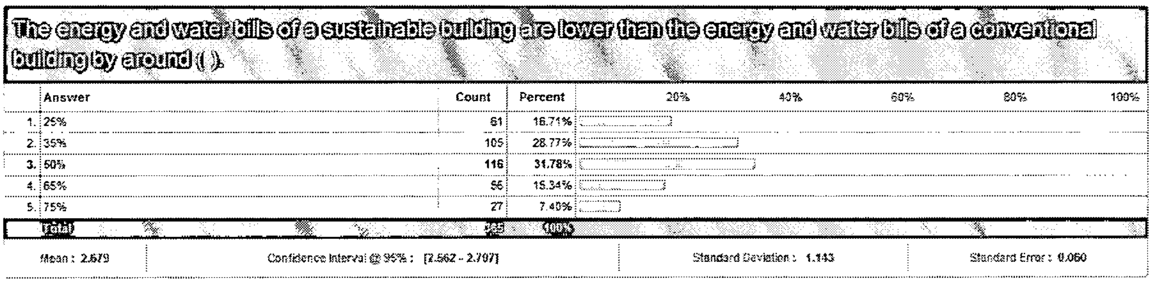


In Lebanon, residential buildings account for ( ) of the total water consumption of the country.

	Answer	Count	Percent	20%	40%	60%	80%	100%
1.	25%	20	5.18%					
2.	35%	43	11.14%					
3.	50%	117	30.31%					
4.	**65%**	**133**	**34.46%**					
5.	75%	73	18.91%					
	Total	386	100%					

Mean : 3.508 | Confidence Interval @ 95% : [3.400 - 3.615] | Standard Deviation : 1.079 | Standard Error : 0.055

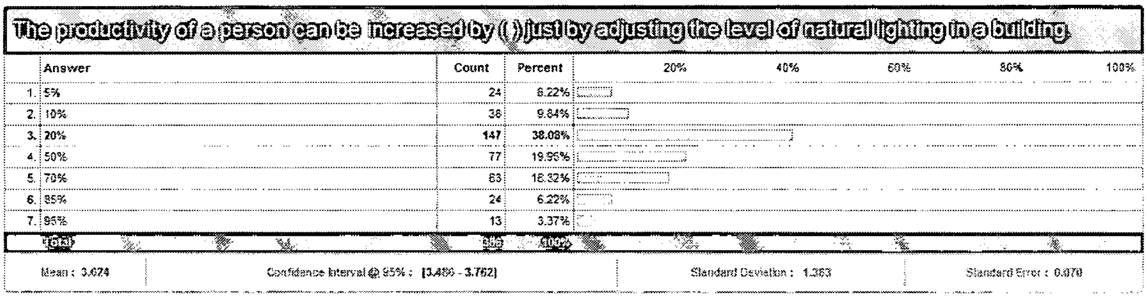
Part Three



The energy and water bills of a sustainable building are lower than the energy and water bills of a conventional building by around ( ).

	Answer	Count	Percent
1.	25%	61	16.71%
2.	35%	105	28.77%
3.	**50%**	**116**	**31.78%**
4.	65%	56	15.34%
5.	75%	27	7.40%
	Total	**365**	**100%**

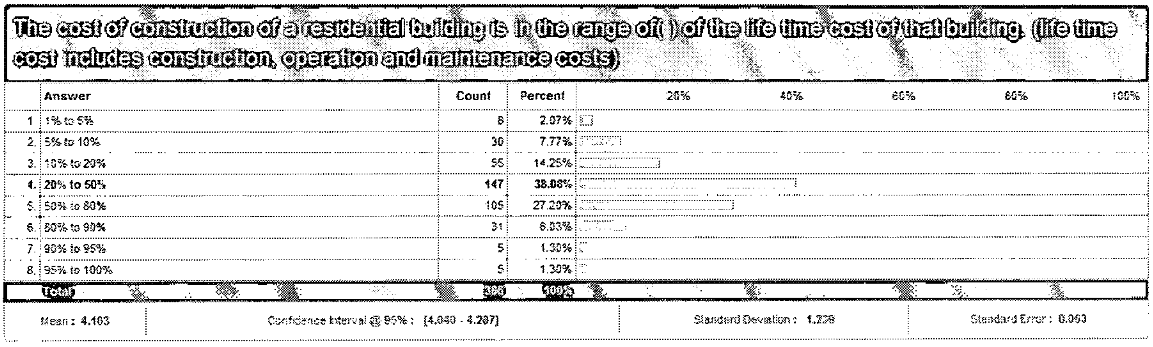
Mean : 2.679 | Confidence Interval @ 95% : [2.562 - 2.797] | Standard Deviation : 1.143 | Standard Error : 0.060



The productivity of a person can be increased by ( ) just by adjusting the level of natural lighting in a building.

	Answer	Count	Percent
1.	5%	24	6.22%
2.	10%	38	9.84%
3.	**20%**	**147**	**38.08%**
4.	50%	77	19.95%
5.	70%	63	16.32%
6.	85%	24	6.22%
7.	95%	13	3.37%
	Total	**386**	**100%**

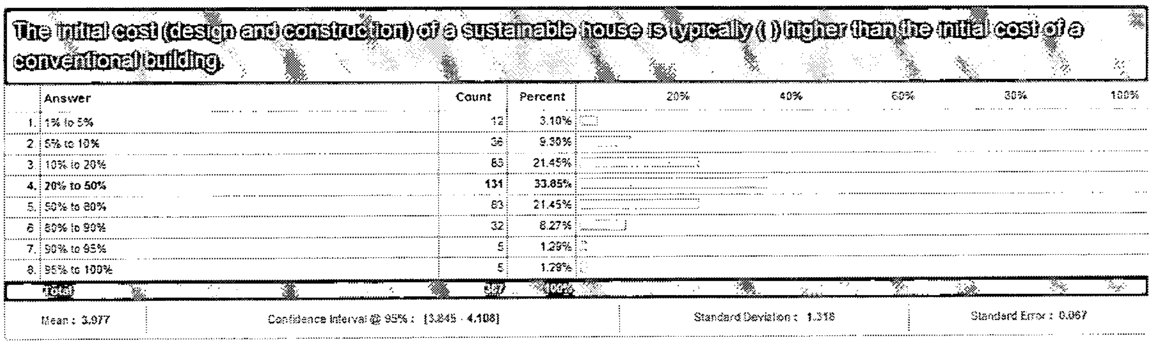
Mean : 3.624 | Confidence Interval @ 95% : [3.486 - 3.762] | Standard Deviation : 1.363 | Standard Error : 0.070



The cost of construction of a residential building is in the range of( ) of the life time cost of that building. (life time cost includes construction, operation and maintenance costs)

	Answer	Count	Percent
1	1% to 5%	8	2.07%
2.	5% to 10%	30	7.77%
3.	10% to 20%	55	14.25%
4.	**20% to 50%**	**147**	**38.08%**
5.	50% to 80%	105	27.20%
6.	80% to 90%	31	8.03%
7.	90% to 95%	5	1.30%
8.	95% to 100%	5	1.30%
	Total	**386**	**100%**

Mean : 4.163 | Confidence Interval @ 95% : [4.040 - 4.287] | Standard Deviation : 1.229 | Standard Error : 0.063

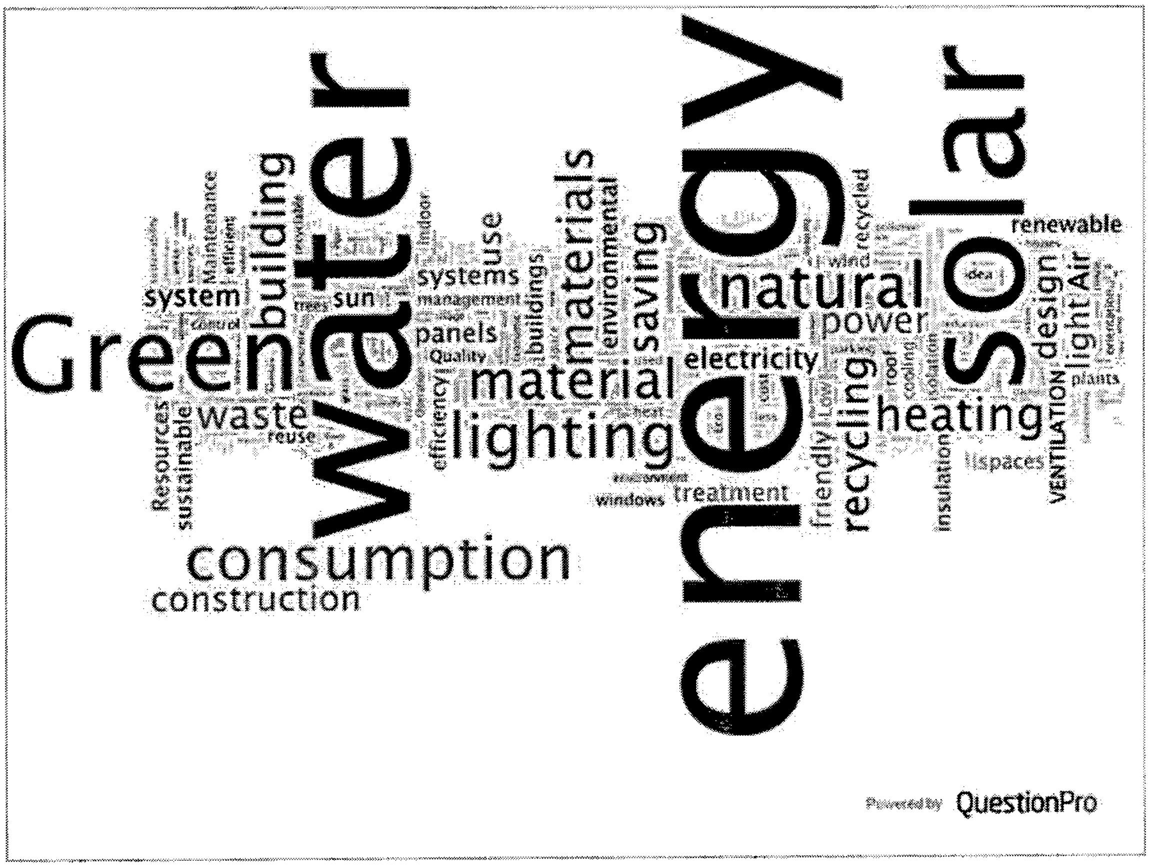


The initial cost (design and construction) of a sustainable house is typically ( ) higher than the initial cost of a conventional building.

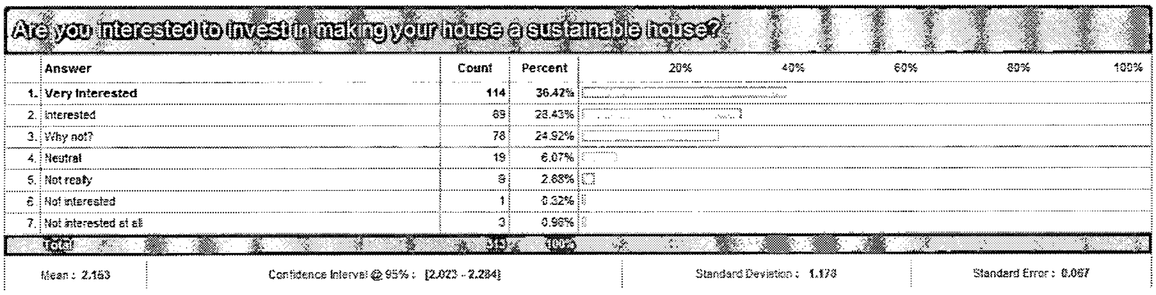
	Answer	Count	Percent
1.	1% to 5%	12	3.10%
2	5% to 10%	36	9.30%
3	10% to 20%	83	21.45%
4.	**20% to 50%**	**131**	**33.85%**
5.	50% to 80%	83	21.45%
6	80% to 90%	32	8.27%
7.	90% to 95%	5	1.29%
8.	95% to 100%	5	1.29%
	Total	**387**	**100%**

Mean : 3.977 | Confidence Interval @ 95% : [3.845 - 4.108] | Standard Deviation : 1.318 | Standard Error : 0.067

Please enter keywords or phrases that you think they are considered in the design, construction and operation of a sustainable building. (write every topic on a new line)


energy
water
solar
Green
consumption
construction
building
material
lighting
materials
natural
heating
recycling
power
electricity
saving
waste
system
systems
sun
panels
use
buildings
environmental
renewable
design
light
Air
treatment
windows
friendly
insulation
VENTILATION
spaces
plants
recycled
wind
Resources
sustainable
Maintenance
efficient
efficiency
management
Quality
reuse
trees
control
Indoor
roof
cooling
isolation
Low
idea
environment
used
heat
cost
Powered by QuestionPro

Part Four

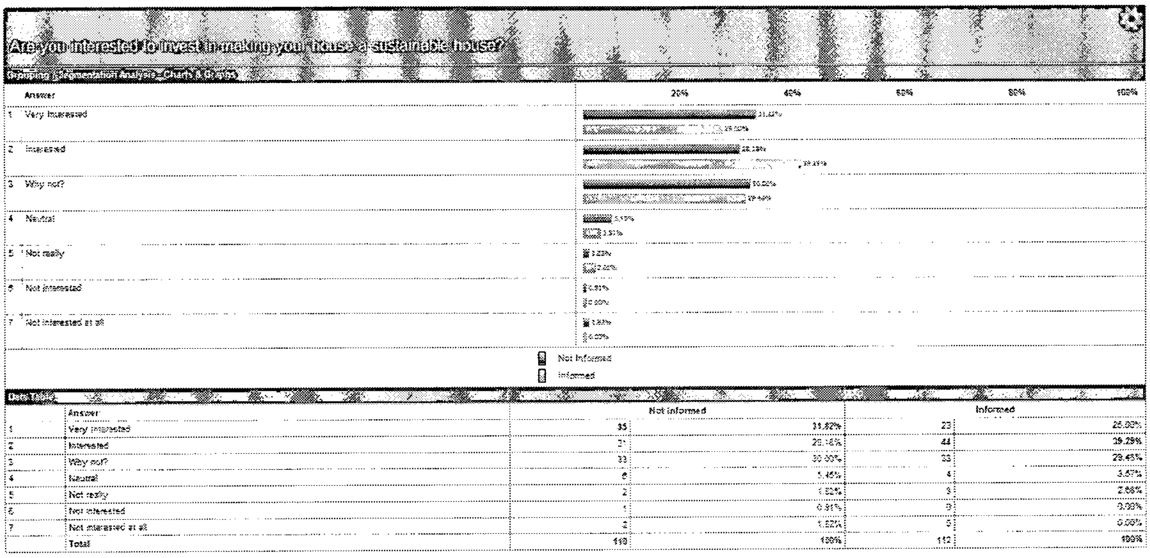


Are you interested to invest in making your house a sustainable house?

	Answer	Count	Percent
1.	**Very Interested**	**114**	**36.42%**
2.	Interested	89	28.43%
3.	Why not?	78	24.92%
4.	Neutral	19	6.07%
5.	Not really	9	2.88%
6.	Not interested	1	0.32%
7.	Not interested at all	3	0.96%
	Total	313	100%

Mean : 2.153 | Confidence Interval @ 95% : [2.023 - 2.284] | Standard Deviation : 1.173 | Standard Error : 0.067

20%
40%
60%
80%
100%



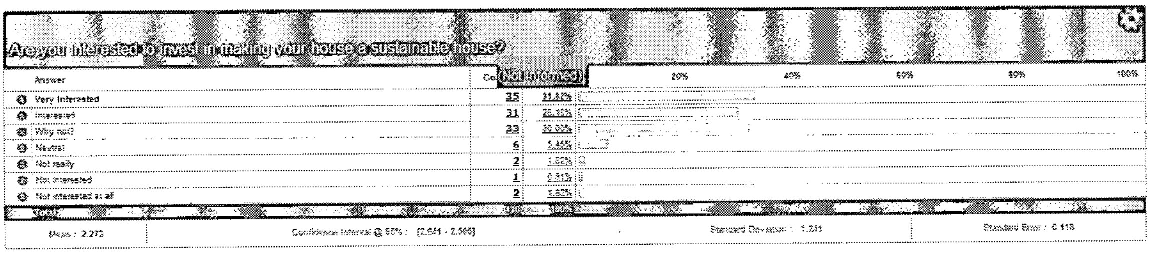
Are you interested to invest in making your house a sustainable house?

Grouping (Segmentation Analysis - Charts & Graphs)

Answer
20%
40%
60%
80%
100%
1 Very Interested
31.82%
25.00%
2 Interested
28.18%
39.29%
3 Why not?
30.00%
29.46%
4 Neutral
5.45%
3.57%
5 Not really
1.82%
2.68%
6 Not interested
0.91%
0.00%
7 Not interested at all
1.82%
0.00%
Not Informed
Informed

Data Table

	Answer	Not informed		Informed	
1	Very interested	35	31.82%	28	25.00%
2	Interested	31	28.18%	44	39.29%
3	Why not?	33	30.00%	33	29.46%
4	Neutral	6	5.45%	4	3.57%
5	Not really	2	1.82%	3	2.68%
6	Not interested	1	0.91%	0	0.00%
7	Not interested at all	2	1.82%	0	0.00%
	Total	110	100%	112	100%

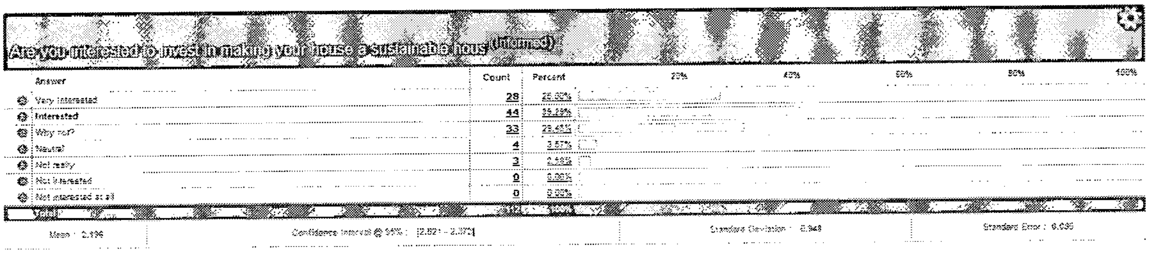


Are you interested to invest in making your house a sustainable house? (Not Informed)

Answer	Count	Percent
Very Interested	35	31.82%
Interested	31	28.18%
Why not?	33	30.00%
Neutral	6	5.45%
Not really	2	1.82%
Not interested	1	0.91%
Not interested at all	2	1.82%
Total	110	100%

Mean : 2.273 | Confidence Interval @ 95% : [2.041 - 2.505] | Standard Deviation : 1.241 | Standard Error : 0.118

20%
40%
60%
80%
100%



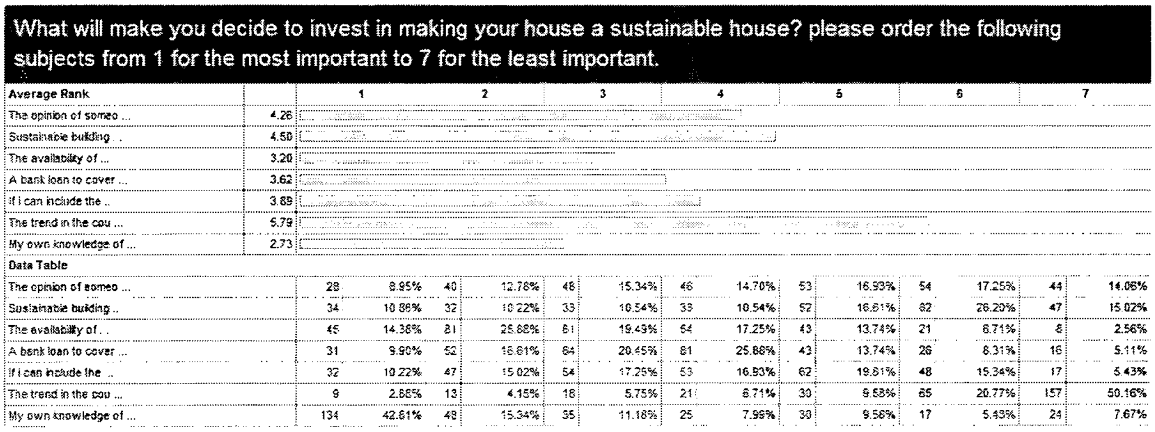
Are you interested to invest in making your house a sustainable hous (Informed)

Answer	Count	Percent
Very interested	28	25.00%
Interested	44	39.29%
Why not?	33	29.46%
Neutral	4	3.57%
Not really	3	2.68%
Not interested	0	0.00%
Not interested at all	0	0.00%
Total	112	100%

Mean : 2.196 | Confidence Interval @ 95% : [2.021 - 2.372] | Standard Deviation : 0.948 | Standard Error : 0.090

20%
40%
60%
80%
100%

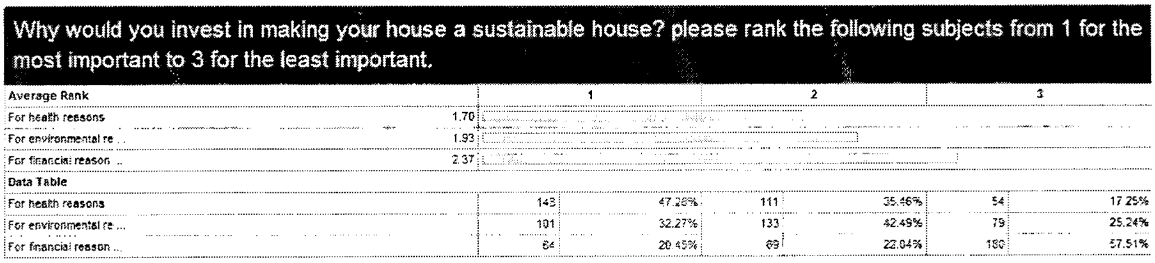
Part Five



What will make you decide to invest in making your house a sustainable house? please order the following subjects from 1 for the most important to 7 for the least important.

Average Rank	
The opinion of someo ...	4.26
Sustainable building ..	4.50
The availability of ...	3.20
A bank loan to cover ...	3.62
If i can include the ..	3.89
The trend in the cou ...	5.79
My own knowledge of ...	2.73

Data Table	1		2		3		4		5		6		7	
The opinion of someo ...	28	8.95%	40	12.78%	48	15.34%	46	14.70%	53	16.93%	54	17.25%	44	14.06%
Sustainable building ..	34	10.86%	32	10.22%	33	10.54%	33	10.54%	52	16.61%	82	26.20%	47	15.02%
The availability of . .	45	14.38%	81	25.88%	61	19.49%	54	17.25%	43	13.74%	21	6.71%	8	2.56%
A bank loan to cover ...	31	9.90%	52	16.61%	64	20.45%	81	25.88%	43	13.74%	26	8.31%	16	5.11%
If i can include the ..	32	10.22%	47	15.02%	54	17.25%	53	16.93%	62	19.81%	48	15.34%	17	5.43%
The trend in the cou ...	9	2.88%	13	4.15%	18	5.75%	21	6.71%	30	9.58%	65	20.77%	157	50.16%
My own knowledge of ...	134	42.81%	48	15.34%	35	11.18%	25	7.99%	30	9.58%	17	5.43%	24	7.67%



Why would you invest in making your house a sustainable house? please rank the following subjects from 1 for the most important to 3 for the least important.

Average Rank	
For health reasons	1.70
For environmental re ..	1.93
For financial reason ..	2.37

Data Table	1		2		3	
For health reasons	148	47.28%	111	35.46%	54	17.25%
For environmental re ...	101	32.27%	133	42.49%	79	25.24%
For financial reason ...	64	20.45%	69	22.04%	180	57.51%

4.1.3. Discussions:

Table of Analysis Approach

The questionnaire was analyzed using many statistical methods depending on the type of question and depending on the required output. Descriptive statistics, frequencies analysis and cross tabulation were the most significant in addition to the open ended text "word cloud" and comparison of means test (t-test). Table 3: Table of Statistical Test, summarizes all of the questions and the tools used to analyze the results.

Table 3: Table of Statistical Tests

Part One: Demographics	
Question subject	Approach
1- Nationality	Descriptive statistics – Frequencies analysis
2- Gender	Descriptive statistics – Frequencies analysis
3- Educational Level	Descriptive statistics – Frequencies analysis
4- Marital Status	Descriptive statistics – Frequencies analysis
5- House Ownership	Descriptive statistics – Frequencies analysis
6- Income (Monthly)	Descriptive statistics – Frequencies analysis
7- Age	Descriptive statistics – Frequencies analysis

8- Occupation	Descriptive statistics – Frequencies analysis
9- Work Industry	Descriptive statistics – Frequencies analysis
10- Place of Living – Place of Birth	Descriptive statistics – Frequencies analysis
Part Two: Testing hypothesis1 - The population is not aware that the built environment is among the major causes of environmental damage.	
Question subject	Approach
11- Testing the general concern of the Lebanese population about global environmental issues. If they believe or not in the danger related to the following topics:	
Climate Change Fresh Water Shortage Depletion of Resources Deforestation Indoor Environment Global Warming Rise of the Sea Level	Descriptive statistics – Frequencies analysis
Testing the knowledge of the population regarding effect of the buildings on the environment.	
12- Self Assessment in terms of knowledge about green buildings	Descriptive statistics – Frequencies analysis
13- Global share of buildings in Emissions of Green House Gases (GHG) and Ozone Depleting Gases (ODG)	Descriptive statistics – Frequencies analysis
14- Energy Consumption in Lebanon	Descriptive statistics – Frequencies analysis
15- Water Consumption in Lebanon	Descriptive statistics – Frequencies analysis
Part Three: Testing hypothesis2 - Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).	
Question subject	Approach
Testing the knowledge of the population regarding green buildings.	
16- Energy and Water savings in a green buildings	Descriptive statistics – Frequencies analysis
17- Increase of human productivity in a green building	Descriptive statistics – Frequencies analysis
18- Cost breakdown of a building	Descriptive statistics – Frequencies analysis
19- Additional cost for a green house	Descriptive statistics – Frequencies analysis
20- Open Ended question	Descriptive statistics – Frequencies analysis
21- Random selection of the series	Not Applicable
Part Four: Testing Hypotesis 3 - The population, if well informed is more willing to invest in green building.	
Question subject	Approach
22- Presenting information about green buildings randomly to 50% of the respondents.	Not Applicable
23- Measuring the interest of the respondents to make their house a green building.	Comparison of means, t-Test
Part Five: Testing Hypothesis 4 - Financial incentives are amongst the most important	

for the Lebanese consumer to invest in sustainable buildings	
Question subject	Approach
24- Ranking of influencing factors: The opinion of someone who did it Sustainable buildings are required by law The availability of a specialist to tell me what i should do A bank loan to cover the cost of the project If i can include the cost in my housing loan The trend in the country My own knowledge of the benefits of such an investment	Rank from 1 for the most important to 7 for the least important
25- Ranking of reasons to invest in green building: For health reasons For environmental reasons For financial reasons (money saving)	Rank from 1 for the most important to 3 for the least important
26- Contact Details	Not Applicable

Part One

The demographic distribution of the sample very well diversified. All of the questions and each category had a significant proportion of respondents which validates the represent ability of the sample. In fact, few options were not selected by a significant number of respondents.

Age: Respondents' age ranged between 18 and 54 years. This is due to the mailing list which, as per the provider includes adults. Older individuals probably didn't access the questionnaire due to limited online activity.

Marital Status: Divorced, Widowed and prefer not to answer were not practically present and this is pure coincidence/random choice.

Occupation: Non employed represent a small fraction. Again this reflects the situation of the Lebanese population between 18 and 54 years old.

Place of living: the greatest concentration was in Beirut and Mount Lebanon. This reflects the current concentration in Lebanon.

Place of birth: Although the sample is generally acceptable, it was not equally distributed as we would have wished. Reasons might include limited access to internet in remote areas of the country.

Part Two and Part Three

In the first questions the respondents were given 7 topics and were asked to answer on a 5-point likert scale whether they believe or not that these topics present a real threat to human well being. That grand majority of the respondents tended to believe that the 7 points were a real threat. (See results on pages 48 and 49). Remarkably, the term that was the least believed to affect the well being of human life was the indoor environment, followed by the rise of the sea level then the global warming. Fresh water shortage was believed to be the factor the affects human life the most. In general, the answers to this matrix have a mean very close to "one" which reflects a strong tendency of the Lebanese citizens to believe in major global environmental problems. Even though this question was not intended to give any result directly related to green buildings, the fact that indoor environment was considered the least important gives a strong clue to how far is the Lebanese population from understanding green buildings. In the following question, the respondents had to choose the correct answer. Actually, as the answers of the questions are not common knowledge, the respondents were not expected to find the correct answer. In fact the test was to see how close the Lebanese to the correct figures are. It was an exercise to try to depict whether they were close of far from knowing the real figures. As a result we could figure out what the Lebanese think about each question and to assess to which extent they believe that the built environment has an impact on the environment. Only 36%, 17%, 11% 29% of the respondents had the correct figures for variables 13, 14, 15 and 16 respectively. The most acceptable answer for all four questions is 35%. 35% of the respondents rate their knowledge about green buildings as "AVERAGE", 27% rate it as "GOOD" and less than 5% rate it as "EXCELLENT". However, the bar charts show that the answers were most of the time normally distributed, slightly skewed off the center. The only question that had some clear "Mode" was the question about the increase in productivity and the question about the share of buildings in the emissions. And it's only here that the mode is at the correct answer. For all of the remaining questions, the normal distribution whether it was centered or skewed away from the right answer suggests that the population has biased information about the topic, and most of their answers were randomly selected with a tendency towards the middle answer. In addition, the open ended text about what should be considered in green buildings show clearly that the understanding of green buildings is mostly relating it to energy, water, consumption, recycling and materials. Very few answers included other points important to sustainable buildings such as: Indoor Air Quality; Health; Site Selection; Indigenous and selective Plantation; Natural Lighting; Passive Solar Design; Natural Cooling... These terms, as they are, would not be expected to be known by the population, that's why a thorough consultation of the open ended data was done to try to depict any concepts that would be related to green buildings even if they were not stated using the correct technical terms. As for the financial side, only 3% estimate the green premium to be between 2% and 5%. And only 2% estimate the construction cost to be between 2% and 5% of the life cycle cost of a building. What does this mean? It means that the Lebanese think that building a sustainable house costs a lot! The mode was at 20% to 50% and the mean was beyond that!

In a frequencies analysis and cross tabulation of the answers, males believe themselves to be more aware about green buildings than females. However, if we look at Table 5: Frequencies of correct answers in part 2 and part 3 vs. gender, there isn't evidence that neither gender is more aware about any of the topics mentioned in part 2 and part 3.

How do you rate your knowledge about green buildings Green buildings are equally referred to as Sustainable Buildings * Gender

Gender	Mean	N	Std. Deviation
Male	3.02	219	1.109
Female	2.69	163	1.114
Total	2.88	382	1.122

Table 4: Comparison of means of Q12 based on gender

		Part 2			Part 3			
		Q13	Q14	Q15	Q16	Q17	Q18	Q19
Gender	Male	54	33	21	59	97	4	7
		24.5%	15.0%	9.5%	28.0%	**44.1%**	1.8%	**3.2%**
	Female	22	31	22	47	50	4	5
		13.3%	**18.7%**	**13.3%**	**29.7%**	30.1%	**2.4%**	3.0%
	Total	76	64	43	105	147	8	12
		19.7%	16.6%	11.1%	28.8%	38.1%	2.1%	3.1

Table 5: Frequencies of correct answers in part 2 and part 3 vs. gender

On the other hand, the educational level seems to be a serious factor in terms of knowledge about buildings in general and green buildings specifically. Table 6: Comparison of means of Q12 based on educational level shows that respondents with higher educational level believe more that they know about green buildings and Table 7: Frequencies of correct answers in part 2 and part 3 vs. educational level proves that the higher the educational level, the more correct answers the respondents have.

How do you rate your knowledge about green buildings Green buildings are equally referred to as Sustainable Buildings * Educational Level

Educational Level	Mean	N	Std. Deviation
Elementary School	2.00	1	.
Secondary School	2.44	9	1.333
Bachelor	2.84	201	1.165
Master	2.95	151	1.057
Doctor	3.00	20	1.076
Total	2.88	382	1.122

Table 6: Comparison of means of Q12 based on educational level

		Part 2			Part 3			
		Q13	Q14	Q15	Q16	Q17	Q18	Q19
Educational Level	Elementary School	1	1	1	1	1	0	0
		100.0%	100.0%	100.0%	100.0%	100.0%	.0%	.0%
	Secondary School	3	3	1	2	2	0	0
		33.3%	33.3%	11.1%	22.2%	22.2%	.0%	.0%
	Bachelor	75	32	18	55	76	4	8
		36.8%	15.7%	8.8%	28.6%	37.3%	2.0%	3.9%
	Master	51	22	20	41	60	3	4
		33.6%	14.5%	13.2%	28.5%	39.5%	2.0%	2.6%
	Doctor	8	6	3	6	8	1	0
		40.0%	30.0%	15.0%	31.6%	40.0%	5.0%	.0%
Total		138	64	43	105	147	8	12
		35.8%	16.6%	11.1%	28.8%	38.1%	2.1%	3.1%

Table 7: Frequencies of correct answers in part 2 and part 3 vs. educational level

The next and maybe the most important analysis is about finding out if those who think that they know about green buildings really know. In fact if we look at Table 8: Frequencies of correct answers in part 2 and part 3 vs. Q12 we can clearly see that if someone believes that he knows about green buildings does not mean that this respondent knows indeed. The table shows that for the best case, 42% of those who rate their knowledge as excellent had the right answer for a question. If we look at this table in parallel with the results of the open ended question world cloud in the results shown previously, we can conclude that the Lebanese population is not well aware about the concept of green buildings. And in fact they are not aware about the damage that can be caused by the buildings in general. Even though when it comes to Lebanon, the answers were exaggerated. Probably this is due to the general thinking in Lebanon that the industrial sector is weak, and not because the buildings are thought to be very harmful to the environment.

		Part 2			Part 3			
		Q13	Q14	Q15	Q16	Q17	Q18	Q19
How do you rate your knowledge about green buildings Green buildings are equally referred to as Sustainable Buildings	Poor	19	11	3	14	17	3	3
		31.7%	18.3%	5.0%	23.3%	28.3%	5.0%	5.0%
	Below Average	26	13	13	19	27	1	1
		38.8%	19.4%	19.4%	28.8%	40.3%	1.5%	1.5%
	Average	54	20	15	40	46	1	4
		40.3%	14.9%	11.2%	33.1%	34.3%	.7%	3.0%
	Good	34	18	10	26	47	3	3
		33.3%	17.6%	9.8%	26.8%	46.1%	2.9%	2.9%
	Excellent	5	2	2	6	8	0	0
		26.3%	10.5%	10.5%	33.3%	42.1%	.0%	.0%
Total		138	64	43	105	145	8	11
		36.1%	16.8%	11.3%	29.0%	38.0%	2.1%	2.9%

Table 8: Frequencies of correct answers in part 2 and part 3 vs. Q12

How do you rate your knowledge about green buildings Green buildings are equally referred to as Sustainable Buildings * What is the range of your monthly Income

What is the range of your monthly Income	Mean	N	Std. Deviation
Below 500 USD	2.68	53	1.221
501 to 1500 USD	2.73	124	1.129
1501 to 2500 USD	2.90	88	1.040
Above 2501 USD	3.11	117	1.097
Total	2.88	382	1.122

Table 9: Comparison of means of Q12 based on income

The consultation of the results of Table 9: Comparison of means of Q12 based on income and Table 10: Frequencies of correct answers in part 2 and part 3 vs. income show that the income is not really a determinant of knowledge about green buildings as it can be seen in Table 10: Frequencies of correct answers in part 2 and part 3 vs. income.

		Part 2			Part 3			
		Q13	Q14	Q15	Q16	Q17	Q18	Q19
Monthly income	Below $500	20	8	6	22	17	2	3
		37.7%	15.1%	11.3%	41.5%	32.1%	3.8%	5.7%
	$501-$1500	50	22	9	31	41	3	4
		40.3%	17.7%	7.3%	26.1%	33.1%	2.4%	3.2%
	$1501-$2500	29	12	12	23	31	1	2
		32.6%	13.5%	13.5%	28.0%	34.8%	1.1%	2.2%
	Above $2501	39	22	16	29	58	2	3
		32.5%	18.3%	13.3%	26.1%	48.3%	1.7%	2.5%
Total		138	64	43	105	147	8	12
		35.8%	16.6%	11.1%	28.8%	38.1%	2.1%	3.1%

Table 10: Frequencies of correct answers in part 2 and part 3 vs. income

A complete analysis of the data in a an approach similar to what has been done in table 8 and table 9, show that there is no significant relationship between having the correct answers from one side and any of the other independent variables from the other side.

Part Four

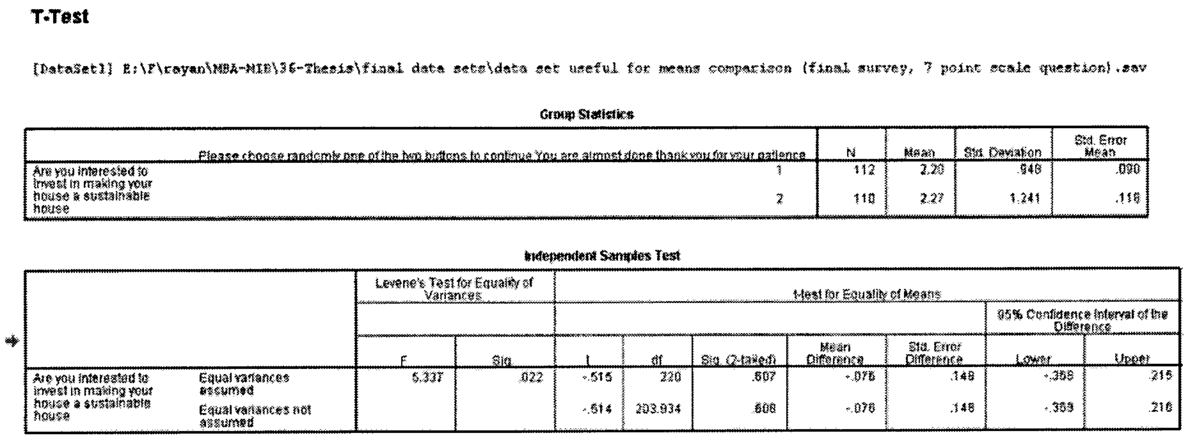
Even though the knowledge about green buildings has been shown in part three to be weak, the sample shows that there is a tendency to invest in green buildings with a mean of 2.1, which is at the "interested" answer. This can be understood after many researches have shown that the Lebanese people have a tendency towards environmental responsibility. On the other hand, the experimental exercise of this part showed that the mean has moved by 3.5% towards the very interested side for the informed sample. Even though the information was very little, it was enough to affect the choice of the respondents.

On the other hand, the t-test was executed using SPSS 17 package, with a null hypothesis:

$\mu=0$: The two groups have similar variances

$\mu\neq0$: The two groups do not have similar variances

The results in Figure 19: T-test results (willingness to invest in green buildings, informed vs non informed) of this test and specifically from the result of Levene's Test for Equality of Variances where the significance is equal to 0.022, being smaller than 0.05 which we consider to be our confidence interval, we can reject the null hypothesis that there is no difference in the variances between the groups and accept the alternative hypothesis that there is a significant difference in the variances between groups. In fact, the mean of the informed group was 3.2% lower than the mean of the non informed group, which shows a significant increase of willingness to invest in green when informed.



T-Test

```
[DataSet1] E:\F\rayan\MBA-MIB\36-Thesis\final data sets\data set useful for means comparison (final survey, 7 point scale question).sav
```

Group Statistics

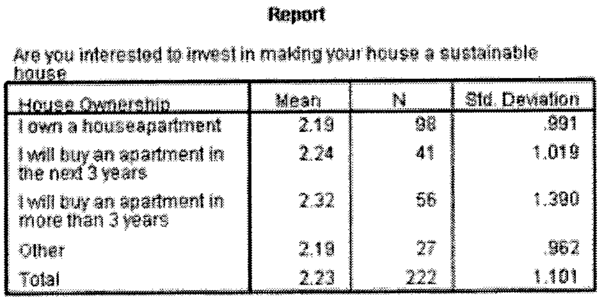
	Please choose randomly one of the two buttons to continue You are almost done thank you for your patience	N	Mean	Std. Deviation	Std. Error Mean
Are you interested to invest in making your house a sustainable house	1	112	2.20	.948	.090
	2	110	2.27	1.241	.118

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Are you interested to invest in making your house a sustainable house	Equal variances assumed	5.337	.022	-.515	220	.607	-.076	.148	-.368	.215
	Equal variances not assumed			-.514	203.934	.608	-.076	.148	-.369	.216

Figure 19: T-test results (willingness to invest in green buildings, informed vs non informed)

Finally, figure 20 shows clearly the fact that those who own an apartment are more willing to invest than those who were willing to buy an apartment in the coming 3 years and both are more willing to invest than those who will buy an apartment after 3 years. Would it be because they recognize the importance of a healthy and economical house?



Report

Are you interested to invest in making your house a sustainable house

House Ownership	Mean	N	Std. Deviation
I own a houseapartment	2.19	98	.991
I will buy an apartment in the next 3 years	2.24	41	1.019
I will buy an apartment in more than 3 years	2.32	56	1.390
Other	2.19	27	.962
Total	2.23	222	1.101

Figure 20: Willingness to invest in making one's house green vs. house ownership

Part Five

This part is very descriptive and the results can be easily seen on the bar chart (see pages 53 and 54). The most important reason to invest in green buildings is health and the most encouraging thing to invest in green buildings is the availability of a specialist, followed by a bank loan. Actually, the first factor was the perceived own knowledge about green buildings. Actually, the analysis done in part 2 and part 3 shows that even when the individuals believe that they know about green buildings, the truth is their knowledge is limited to very basic concepts. However, the results of this part are very important in terms of marketing and to find the best way to approach the consumers to sell them the idea of green buildings. And in consistency with the literature, financial incentives are very important and are at the top of the factors that would push the consumers to invest in green buildings.

4.1.4. Conclusions

Hypothesis 1: The population is not aware that the built environment is among the major causes of environmental damage.	ACCEPTED
Hypothesis 2: Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).	ACCEPTED
Hypothesis 3: The population, if well informed is more willing to invest in green buildings.	ACCEPTED
Hypothesis 4 - Financial incentives are amongst the most important for the Lebanese consumer to invest in sustainable buildings	ACCEPTED

Table 11 : Summary of hypothesis status

Chapter 5

5. CONCLUSIONS AND RECOMMENDATIONS

5.1.1. Introduction

The results of this study were aligned with the initial hypothesis and the initial observations of the population. They were coherent with the literature that addressed the green buildings concept and its evolution around the world with time. The Lebanese population is recently getting aware about the green buildings. And just like any other population that is new to the subject, the population has little and biased information. Therefore, a lot of work should be done at the informative level before we can say that we are ready to implement green buildings in Lebanon. The hypothesis that has been set at the beginning of the study have been accepted based on different statistical analysis techniques and can now be used to develop future plans.

5.1.2. Main findings

Hypothesis 1: The population is not aware that the built environment is among the major causes of environmental damage

Hypothesis 2: Population is not aware about the concept of green building. (Their knowledge is limited to few aspects of the whole concept).

Hypothesis 3: The population, if well informed is more willing to invest in green buildings

Hypothesis 4 - Financial incentives are amongst the most important for the Lebanese consumer to invest in sustainable buildings

5.1.3. Limitation of the research

This section describes the limitations of this research. These limitations should be taken into consideration when reading this report and shall be considered as a part of the research. All of the above information are validated to the extent where the limitations do not impose any violation of the results.

1- Available information about Lebanon.

Finding reliable data about Lebanon is so difficult especially that the official authorities do not always have up to date information. Therefore this study relied very much upon data published by the private sector and by the academic body. These results are pretty much accepted in the country even though they are not governmental publications.

2- Breadth of the topic

The topic of green buildings is a very broad topic and it is not easy to study it in a single paper. The points discussed in this paper, even though they represent very well the basics of the topic, are not a full study about the green buildings in its technical part. For further technical information, it is recommended refer to the many sources indicated throughout this paper.

3- Short informative message

The experiment in part four is very affected by the fact that the informative message is a very short one. It is very well known that the education of a population to a certain topic is a very time consuming topic. Therefore, the message in this survey cannot be used as a true informative presentation and relied on to educate a population. That's why the results of the experimental statistics came very close.

4- Online survey

The online survey proved itself a very efficient tool when it comes to the reach to respondents in a large geographical area. However, the control over respondents cannot be guaranteed. Hence, for the experiment respondents could have gone online for a research before answering the questions. Such an attitude could affect the results. However, for our case, even with this kind of help, the respondents did not show excellent knowledge about the green buildings, which strengthens the hypothesis.

5- Online: access of respondents.

In terms of reach, the online survey does not consider all of those who do not have access to internet or those who do not frequently check their email boxes.

6- Online understanding the question.

In online surveys, there is no chance for the respondent to ask about the exact meaning of the question which might lead to biased responses.

5.1.4. Future Research

The main purpose of the study was to find incentives for the private sector to be a real player in implementing green buildings in Lebanon. The findings show that the Lebanese population is excited about the topic. In fact a large majority believes that they are well aware about the green buildings and would invest because they know what it is. Therefore from a marketing point of view, there is a "want" for the implementation of green buildings and the concept of green buildings seems to be a "star". Therefore we find it very pressing at the moment to push the concerned institutions in Lebanon to make use of this consumer attitude and to direct their efforts in the correct direction in what ensures their benefits and the well being of the environment and the Lebanese people. As discussed previously, the banking sector is really a strong player in this regard. As consumers consider the financial support among the top of incentives to invest in green buildings, and as the great majority of the Lebanese consumers finance their house's purchase through bank loans, we find a great opportunity to make excellent marketing plans which will help the population to move towards buying sustainable houses. Future research is required from a financial point of view to assess the feasibility of financing plans especially plans correctly supported by the government to create a shift in the market and boost the rate of construction of sustainable in the country which is in the benefit everyone.

Technical research is required as well in order to find the best technical option for the specific case of Lebanon. Since sustainability is very related to the geography and available resources, talking about sustainability without assessing the local situation is missing a lot.

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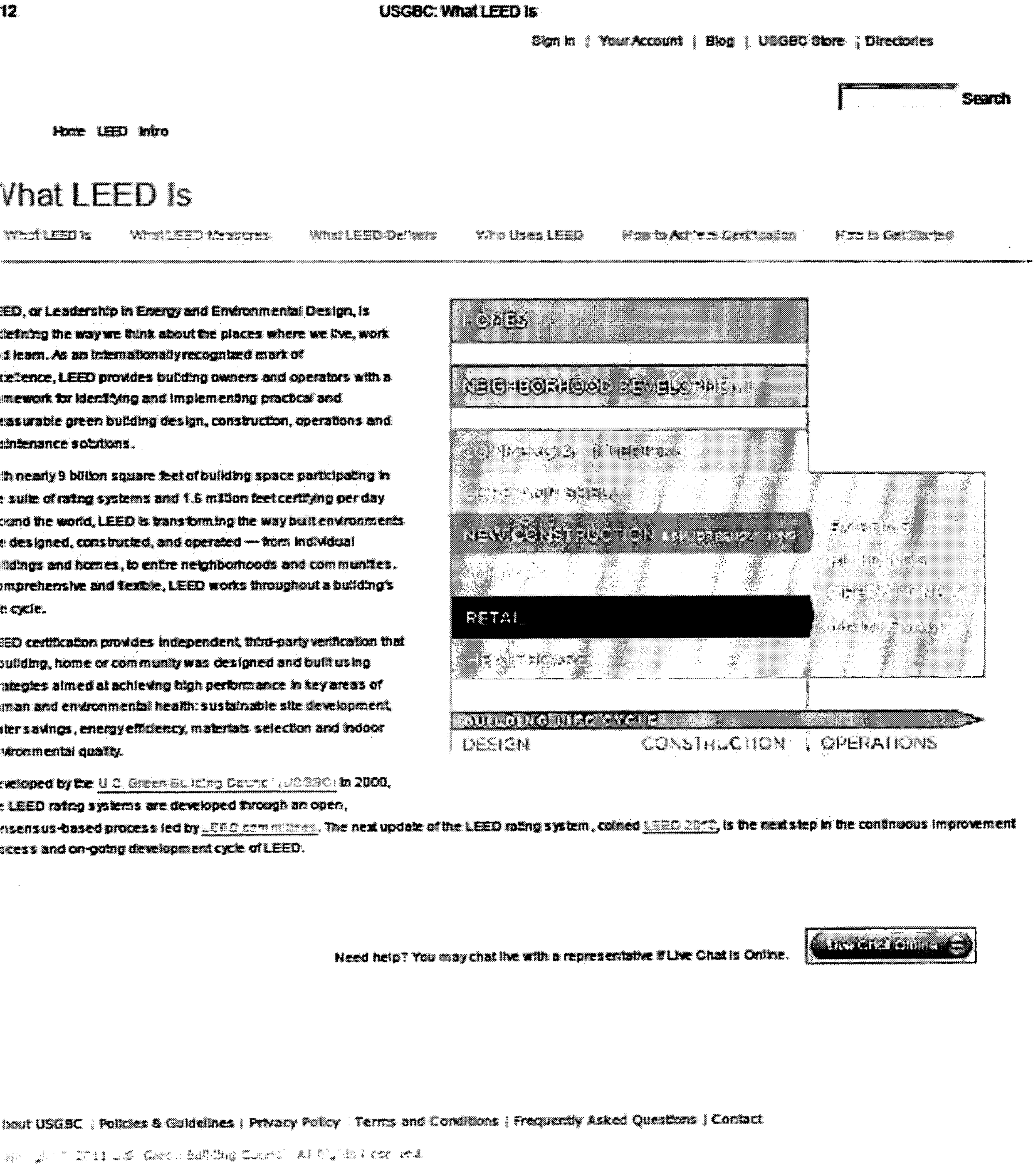
APPENDIX A-LEED Rating System



12 USGBC: What LEED Is

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Home LEED Intro

Vhat LEED Is

What LEED Is What LEED Measures What LEED Delivers Who Uses LEED How to Achieve Certification How to Get Started

ED, or Leadership in Energy and Environmental Design, is defining the way we think about the places where we live, work d learn. As an internationally recognized mark of cellence, LEED provides building owners and operators with a mework for identifying and implementing practical and easurable green building design, construction, operations and intenance solutions.

th nearly 9 billion square feet of building space participating in suite of rating systems and 1.6 million feet certifying per day ound the world, LEED is transforming the way built environments designed, constructed, and operated — from individual ildings and homes, to entire neighborhoods and communities. omprehensive and flexible, LEED works throughout a building's e cycle.

ED certification provides independent, third-party verification that building, home or community was designed and built using ategies aimed at achieving high performance in key areas of man and environmental health: sustainable site development, ter savings, energy efficiency, materials selection and indoor vironmental quality.

HOMES
NEIGHBORHOOD DEVELOPMENT
COMMERCIAL INTERIORS
CORE AND SHELL
NEW CONSTRUCTION AND MAJOR RENOVATIONS
SCHOOLS
RETAIL
HEALTHCARE
EXISTING BUILDINGS OPERATIONS & MAINTENANCE
BUILDING LIFECYCLE
DESIGN
CONSTRUCTION
OPERATIONS

veloped by the U.S. Green Building Council (USGBC) in 2000, e LEED rating systems are developed through an open, nsensus-based process led by LEED committees. The next update of the LEED rating system, coined LEED 2012, is the next step in the continuous improvement ocess and on-going development cycle of LEED.

Need help? You may chat live with a representative if Live Chat is Online.

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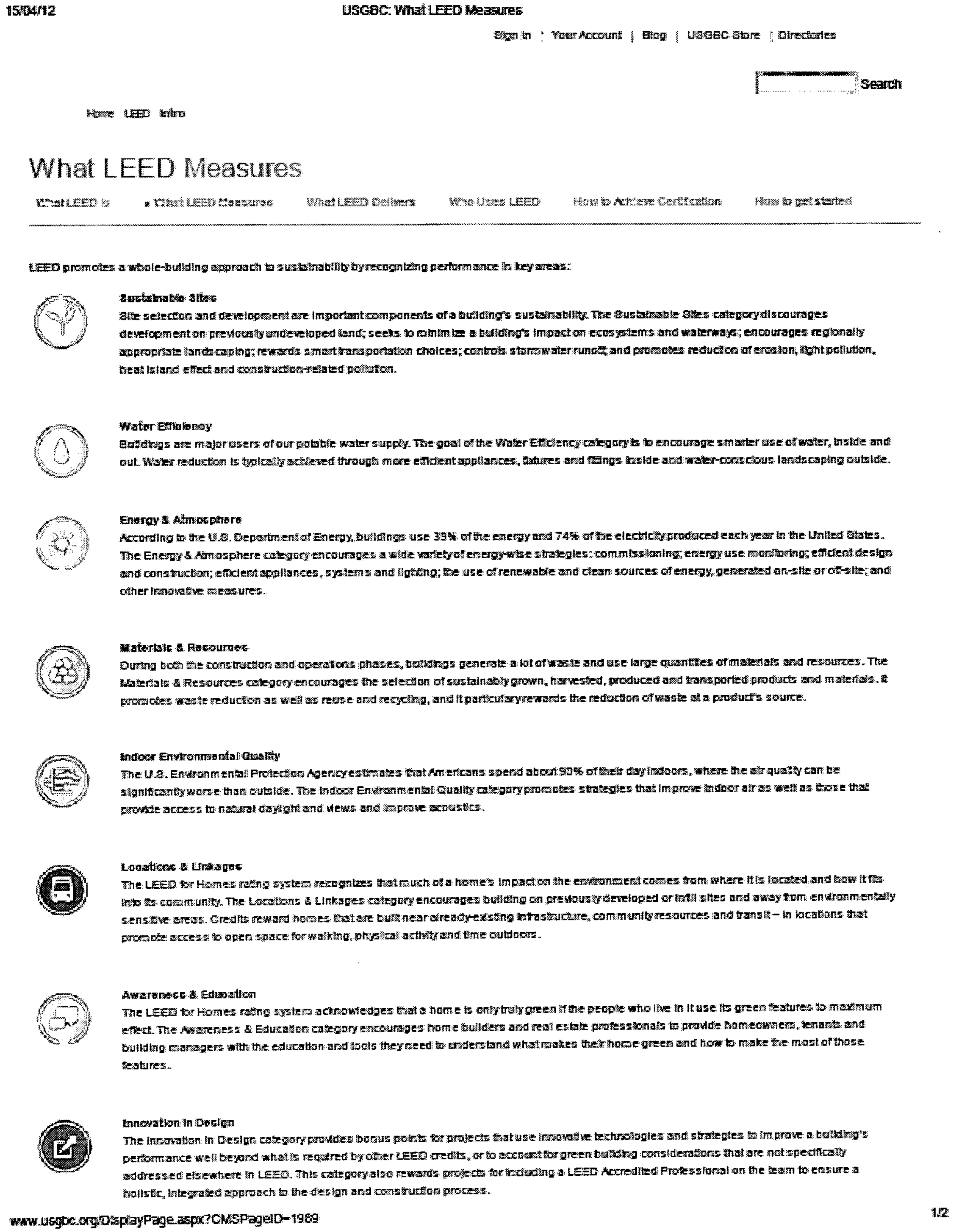

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Home LEED Intro

What LEED Measures

What LEED is » What LEED Measures What LEED Delivers Who Uses LEED How to Achieve Certification How to get started

LEED promotes a whole-building approach to sustainability by recognizing performance in key areas:

Sustainable Sites

Site selection and development are important components of a building's sustainability. The Sustainable Sites category discourages development on previously undeveloped land; seeks to minimize a building's impact on ecosystems and waterways; encourages regionally appropriate landscaping; rewards smart transportation choices; controls stormwater runoff; and promotes reduction of erosion, light pollution, heat island effect and construction-related pollution.

Water Efficiency

Buildings are major users of our potable water supply. The goal of the Water Efficiency category is to encourage smarter use of water, inside and out. Water reduction is typically achieved through more efficient appliances, fixtures and fittings inside and water-conscious landscaping outside.

Energy & Atmosphere

According to the U.S. Department of Energy, buildings use 39% of the energy and 74% of the electricity produced each year in the United States. The Energy & Atmosphere category encourages a wide variety of energy-wise strategies: commissioning; energy use monitoring; efficient design and construction; efficient appliances, systems and lighting; the use of renewable and clean sources of energy, generated on-site or off-site; and other innovative measures.

Materials & Resources

During both the construction and operations phases, buildings generate a lot of waste and use large quantities of materials and resources. The Materials & Resources category encourages the selection of sustainably grown, harvested, produced and transported products and materials. It promotes waste reduction as well as reuse and recycling, and it particularly rewards the reduction of waste at a product's source.

Indoor Environmental Quality

The U.S. Environmental Protection Agency estimates that Americans spend about 90% of their day indoors, where the air quality can be significantly worse than outside. The Indoor Environmental Quality category promotes strategies that improve indoor air as well as those that provide access to natural daylight and views and improve acoustics.

Locations & Linkages

The LEED for Homes rating system recognizes that much of a home's impact on the environment comes from where it is located and how it fits into its community. The Locations & Linkages category encourages building on previously developed or infill sites and away from environmentally sensitive areas. Credits reward homes that are built near already-existing infrastructure, community resources and transit – in locations that promote access to open space for walking, physical activity and time outdoors.

Awareness & Education

The LEED for Homes rating system acknowledges that a home is only truly green if the people who live in it use its green features to maximum effect. The Awareness & Education category encourages home builders and real estate professionals to provide homeowners, tenants and building managers with the education and tools they need to understand what makes their home green and how to make the most of those features.

Innovation in Design

The Innovation in Design category provides bonus points for projects that use innovative technologies and strategies to improve a building's performance well beyond what is required by other LEED credits, or to account for green building considerations that are not specifically addressed elsewhere in LEED. This category also rewards projects for including a LEED Accredited Professional on the team to ensure a holistic, integrated approach to the design and construction process.

What LEED Delivers

LEED certification provides independent, third-party verification that a building or community was designed and built using strategies aimed at achieving high performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Certification occurs through the Green Building Certification Institute, an independent non-profit that was established in 2008 with the support of USGBC. GBCI includes a network of ISO-compliant international certifying bodies, ensuring the consistency, capacity and integrity of the LEED certification process.

Participation in LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. There are both environmental and financial benefits to earning LEED certification.

LEED-certified buildings are designed to:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities

Moreover, an organization's participation in the voluntary and technically rigorous LEED process demonstrates leadership, innovation, environmental stewardship and social responsibility.

LEED Project Profiles and Case Studies

Browse LEED project case studies, download project profiles, and read in-depth project team perspectives here.

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APPENDIX B-Draft Questionnaire Series A

Sustainable Buildings

This questionnaire is designed to complete the requirements of a Master's Degree in International Business. It is expected to take 10 minutes to complete. The results of the survey will be treated as confidential and will be used only for academic purposes. Please fill the survey to the best of your knowledge.

Part One-Demographics

Hint: Check the convenient box

1- Gender : ☐Male ☐Female
2- Date of birth :
3- Educational Level : ☐Elementary ☐Secondary

☐Bachelor ☐Master ☐Doctor

4- Marital Status : ☐Single ☐Fiancé ☐Married

☐Divorced ☐Widow

5- House Ownership : ☐I own an apartment/house

☐ Will buy an apartment/house within 3 years

☐Other (Specify):

6- Income : ☐Below 500 USD ☐500-1500 USD

☐1501-2500 USD ☐2501 and above

Hint: Fill the blank fields

7- Place of living :

8- Profession/Occupation:

Part Two-Environmental Awareness

Hint: read the question and check the box that best reflects your point of view based on the 5 points scale (SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

	SD	D	N	A	SA
9- Climate change is a fact.					
10- Fresh water shortage is a fact.					
11- Global warming is a fact					
12- The built environment is responsible for more than 30% of the emissions of greenhouse gases and ozone depleting substances.					
13- In Lebanon, the built environment (residential buildings) accounts for more than 30% of the national energy consumption.					
14- In Lebanon, the built environment (residential buildings) accounts for more than 30% of the national water consumption.					
15- The building indoor quality affects directly human health.					
16- The occupant's attitude plays a role in determining the amount of pollution generated by a household.					
17- The initial cost of a building is less than 2% of its life cycle cost					
18- You know what is a green building (sustainable building)					

Part Three-Green Buildings (Series-A)

19- Write down topics you know that a green building (sustainable building) design takes into consideration:
•
•
•
•
•

•
•
•
•
•

Part Four-Willingness to invest in Sustainable building

Hint: read the question and check the box that best reflects your point of view based on the 5 points scale (SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Disagree)

	SD	D	N	A	SA
I **WILL** invest in making my house a sustainable house:					
20- Even if I don't know anyone who did it.					
21- If I know someone who did it and recommends it					
22- If sustainable buildings are required by law.					
23- If a bank loan is available to cover the cost of the studies and make the necessary changes.					
24- If I can include the cost in my house loan.					
I **WOULD** invest in making my house a sustainable house:					
25- For financial reasons					
26- For environmental reasons					
27- For health reasons					
28- If everyone is doing it					
For other reasons:					

Thank you for participating in this survey. Your opinion is very important for us.

APPENDIX C-Draft Questionnaire Series B

Sustainable Buildings

This questionnaire is designed to complete the requirements of a Master's Degree in International Business. It is expected to take 10 minutes to complete. The results of the survey will be treated as confidential and will be used only for academic purposes. Please fill the survey to the best of your knowledge.

Part One-Demographics

Hint: Check the convenient box

1- Gender : ☐Male ☐Female

2- Date of birth :

3- Educational Level : ☐Elementary ☐Secondary ☐Bachelor ☐Master ☐Doctor

4- Marital Status : ☐Single ☐Fiancé ☐Married ☐Divorced ☐Widow

5- House Ownership : ☐I own an apartment/house ☐ Will buy an apartment/house within 3 years ☐Other (Specify):

6- Income : ☐Below 500 USD ☐500-1500 USD ☐1501-2500 USD ☐2501 and above

Hint: Fill the blank fields

7- Place of living :

8- Profession/Occupation:

Part Two-Environmental Awareness

Hint: read the question and check the box that best reflects your point of view based on the 5 points scale (SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Disagree)

	SD	D	N	A	SA
9- Climate change is a fact.					
10- Fresh water shortage is a fact.					
11- Global warming is a fact					
12- The built environment is responsible for more than 30% of the emissions of greenhouse gases and ozone depleting substances.					
13- In Lebanon, the built environment (residential buildings) accounts for more than 30% of the national energy consumption.					
14- In Lebanon, the built environment (residential buildings) accounts for more than 30% of the national water consumption.					
15- The building indoor quality affects directly human health.					
16- The occupant's attitude plays a role in determining the amount of pollution generated by a household.					
17- The initial cost of a building is less than 2% of its life cycle cost					
18- You know what is a green building (or sustainable building)					

Part Three-Green Buildings (Series-A)

LEED is one of many rating systems to assess the sustainability of a building. The assessment is based on the following. **Please read carefully before you proceed** to the next page.LEED promotes a whole-building approach to sustainability by recognizing performance in key areas:

Sustainable Sites
Discourages development on previously undeveloped land; seeks to minimize a building's impact on ecosystems and waterways; encourages regionally appropriate landscaping; rewards smart transportation choices; controls stormwater runoff; and promotes reduction of erosion, light pollution, heat island effect and construction-related pollution.

Water Efficiency
Encourage smarter use of water, inside and out
More efficient appliances, fixtures and fittings inside
Water-conscious landscaping outside.

Energy & Atmosphere
Energy-wise strategies: commissioning; energy use monitoring; efficient design and construction; efficient appliances, systems and lighting.
Use of renewable and clean sources of energy, generated on-site or off-site; and other innovative measures.

Materials & Resources
Encourages the selection of sustainably grown, harvested, produced and transported products and materials. It promotes waste reduction as well as reuse and recycling, and it particulary rewards the reduction of waste at a product's source.

Indoor Environmental Quality
The Indoor Environmental Quality category promotes strategies that improve indoor air as well as those that provide access to natural daylight and views and improve acoustics.

Locations & Linkages
The LEED for Homes rating system recognizes that much of a home's impact on the environment comes from where it is located and how it fits into its community. The Locations & Linkages category encourages building on previously developed or infill sites and away from environmentally sensitive areas. Credits reward homes that are built near already-existing infrastructure, community resources and transit – in locations that promote access to open space for walking, physical activity and time outdoors.

Awareness & Education
A home is only truly green if the people who live in it use its green features to maximum effect. The Awareness & Education category encourages home builders and real estate professionals to provide homeowners, tenants and building managers with the education and tools they need to understand what makes their home green and how to make the most of those features.

Sustainable buildings properties:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water (Reduce energy consumption by 34% on average)
- Be healthier and safer for occupants (for example, productivity increased by more than 20%)
- Reduce harmful greenhouse gas emissions
- The cost of such a building is typically 1.5% higher than a conventional building.
- The cost of construction of a building constitutes less than 2% of its life time cost (cost of operation)
- Data from the world bank show that the residential sector consumes more than 37% of the whole water consumption in Lebanon.
- In Lebanon, the built environment (residential buildings) accounts for more than 30% of the energy consumption

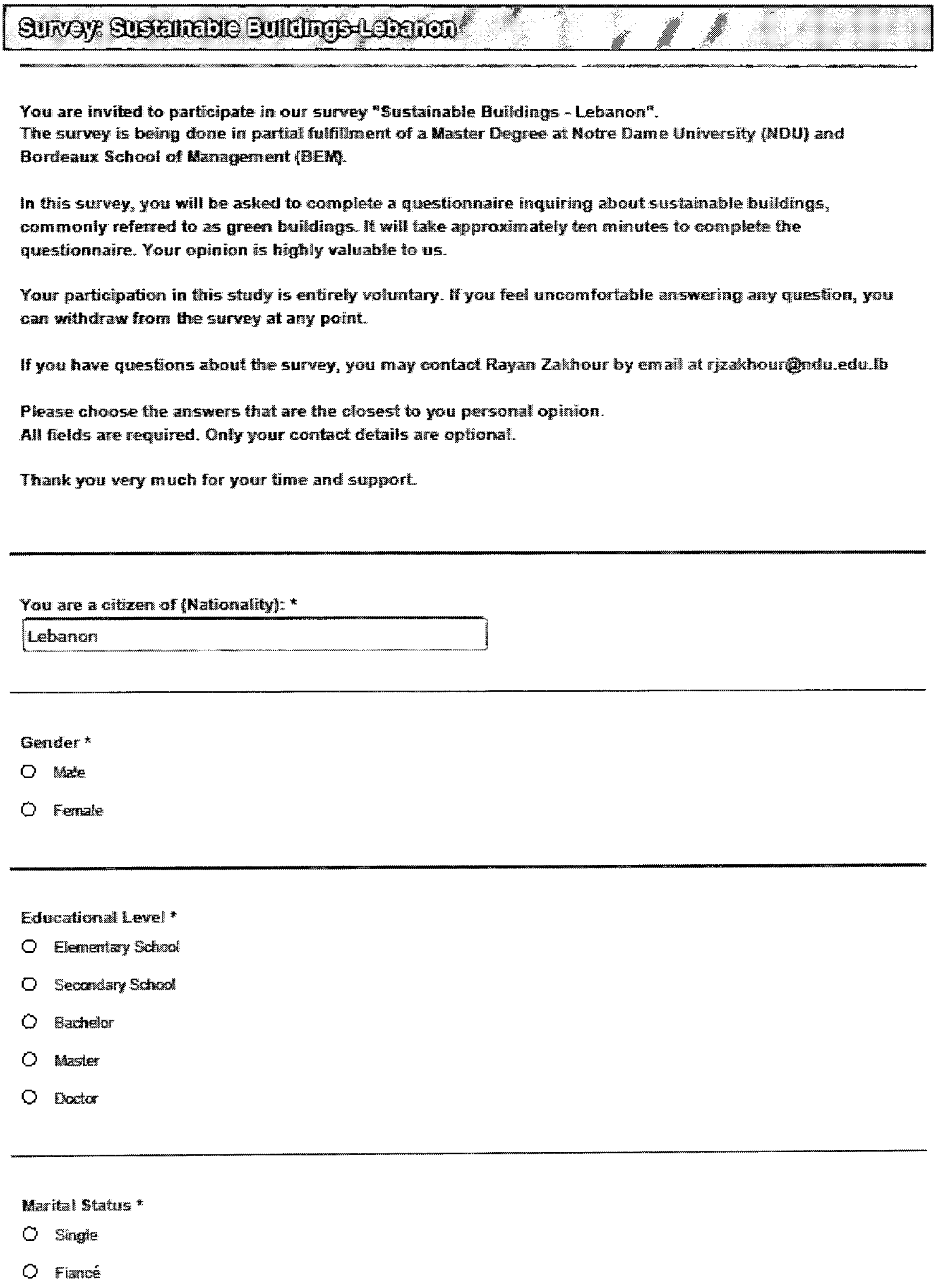
Part Four-Willingness to invest in Sustainable building

Hint: based on the information in the previous page about LEED as an example for sustainable buildings, read the question and check the box that best reflects your point of view based on the 5 points scale (SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

	SD	D	N	A	SA
I **WILL** invest in making my house a sustainable house:					
19- Even if I don't know anyone who did it.					
20- If I know someone who did it and recommends it					
21- If sustainable buildings are required by law.					
22- If I bank loan is available to cover the cost of the studies and make the necessary changes.					
23- If I can include the cost in my house loan.					
I **WOULD** invest in making my house a sustainable house:					
24- For financial reasons					
25- For environmental reasons					
26- For health reasons					
27- If everyone is doing it					
For other reasons:					

Thank you for participating in this survey. Your opinion is very important for us.

APPENDIX D-Pilot Test



Survey: Sustainable Buildings-Lebanon

You are invited to participate in our survey "Sustainable Buildings - Lebanon".
The survey is being done in partial fulfillment of a Master Degree at Notre Dame University (NDU) and Bordeaux School of Management (BEM).

In this survey, you will be asked to complete a questionnaire inquiring about sustainable buildings, commonly referred to as green buildings. It will take approximately ten minutes to complete the questionnaire. Your opinion is highly valuable to us.

Your participation in this study is entirely voluntary. If you feel uncomfortable answering any question, you can withdraw from the survey at any point.

If you have questions about the survey, you may contact Rayan Zakhour by email at rjzakhour@ndu.edu.lb

Please choose the answers that are the closest to you personal opinion.
All fields are required. Only your contact details are optional.

Thank you very much for your time and support.

You are a citizen of (Nationality): *

Lebanon

Gender *

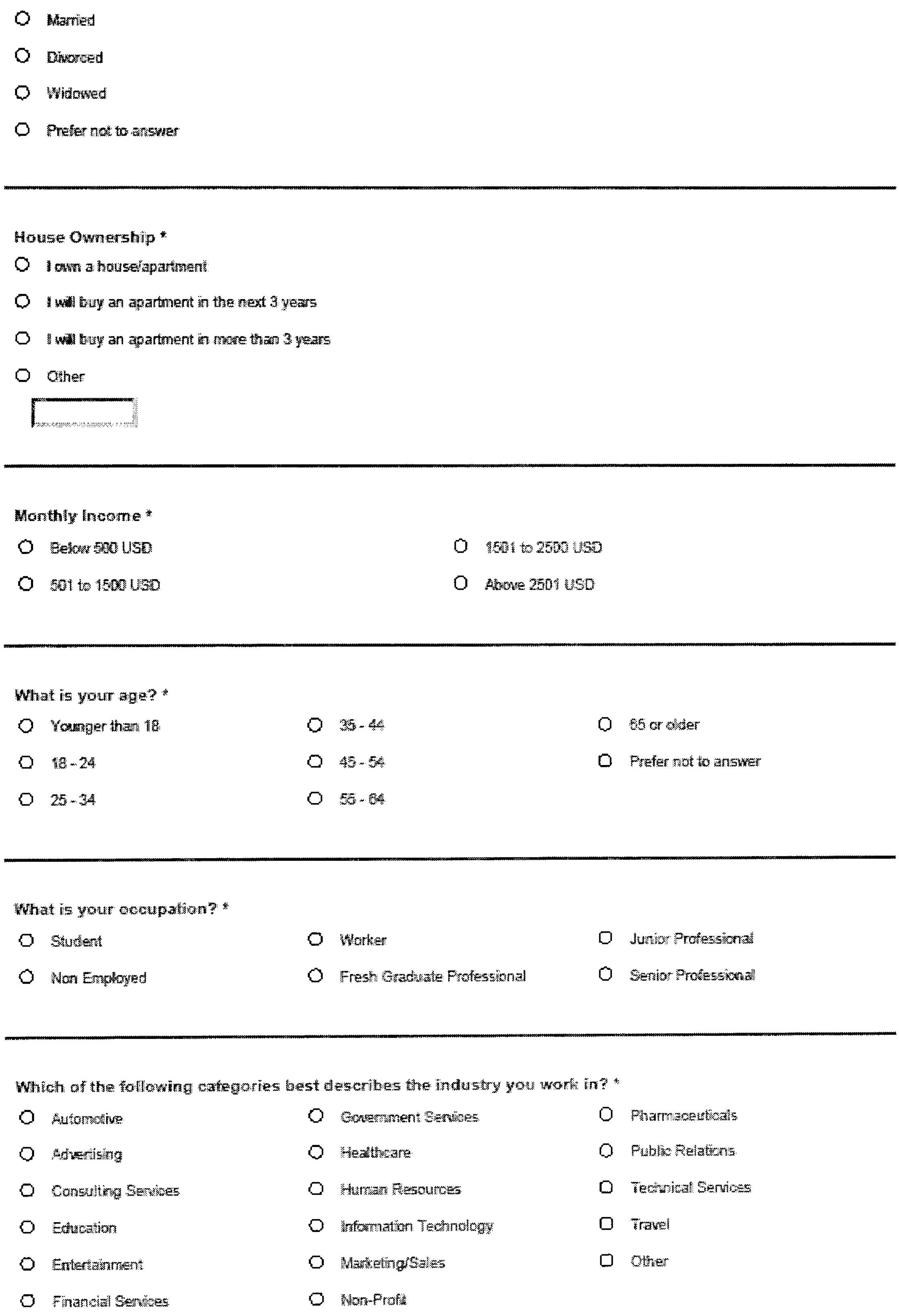
○ Male
○ Female

Educational Level *

○ Elementary School
○ Secondary School
○ Bachelor
○ Master
○ Doctor

Marital Status *

○ Single
○ Fiancé



○ Married

○ Divorced

○ Widowed

○ Prefer not to answer

House Ownership *

○ I own a house/apartment

○ I will buy an apartment in the next 3 years

○ I will buy an apartment in more than 3 years

○ Other

Monthly Income *

○ Below 500 USD

○ 501 to 1500 USD

○ 1501 to 2500 USD

○ Above 2501 USD

What is your age? *

○ Younger than 18

○ 18 - 24

○ 25 - 34

○ 35 - 44

○ 45 - 54

○ 55 - 64

○ 65 or older

○ Prefer not to answer

What is your occupation? *

○ Student

○ Non Employed

○ Worker

○ Fresh Graduate Professional

○ Junior Professional

○ Senior Professional

Which of the following categories best describes the industry you work in? *

○ Automotive

○ Advertising

○ Consulting Services

○ Education

○ Entertainment

○ Financial Services

○ Government Services

○ Healthcare

○ Human Resources

○ Information Technology

○ Marketing/Sales

○ Non-Profit

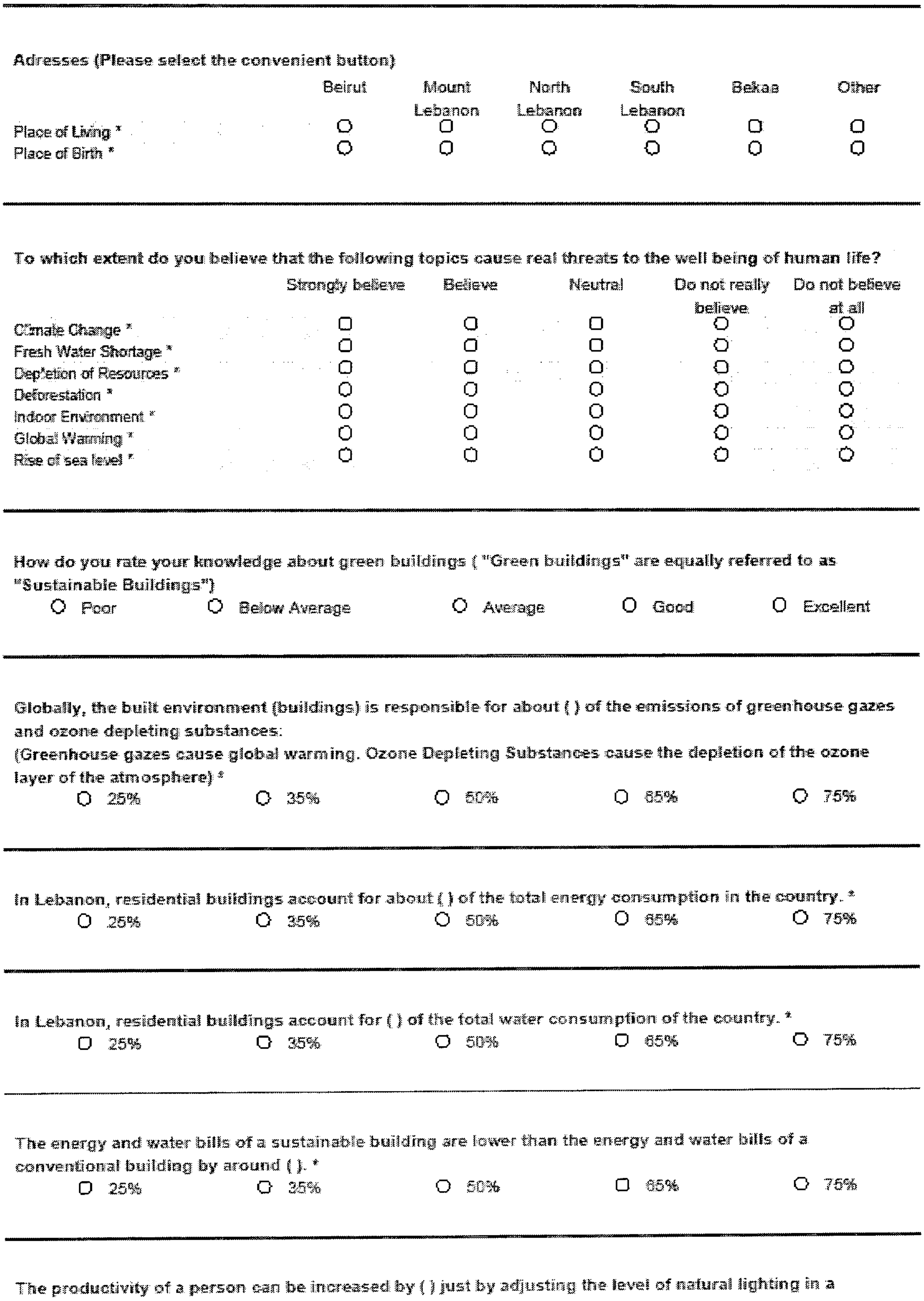
○ Pharmaceuticals

○ Public Relations

○ Technical Services

○ Travel

○ Other



Adresses (Please select the convenient button)

	Beirut	Mount Lebanon	North Lebanon	South Lebanon	Bekaa	Other
Place of Living *	○	○	○	○	○	○
Place of Birth *	○	○	○	○	○	○

To which extent do you believe that the following topics cause real threats to the well being of human life?

	Strongly believe	Believe	Neutral	Do not really believe	Do not believe at all
Climate Change *	○	○	○	○	○
Fresh Water Shortage *	○	○	○	○	○
Depletion of Resources *	○	○	○	○	○
Deforestation *	○	○	○	○	○
Indoor Environment *	○	○	○	○	○
Global Warming *	○	○	○	○	○
Rise of sea level *	○	○	○	○	○

How do you rate your knowledge about green buildings ("Green buildings" are equally referred to as "Sustainable Buildings")

○ Poor ○ Below Average ○ Average ○ Good ○ Excellent

Globally, the built environment (buildings) is responsible for about ( ) of the emissions of greenhouse gazes and ozone depleting substances:
(Greenhouse gazes cause global warming. Ozone Depleting Substances cause the depletion of the ozone layer of the atmosphere) *

○ 25% ○ 35% ○ 50% ○ 65% ○ 75%

In Lebanon, residential buildings account for about ( ) of the total energy consumption in the country. *

○ 25% ○ 35% ○ 50% ○ 65% ○ 75%

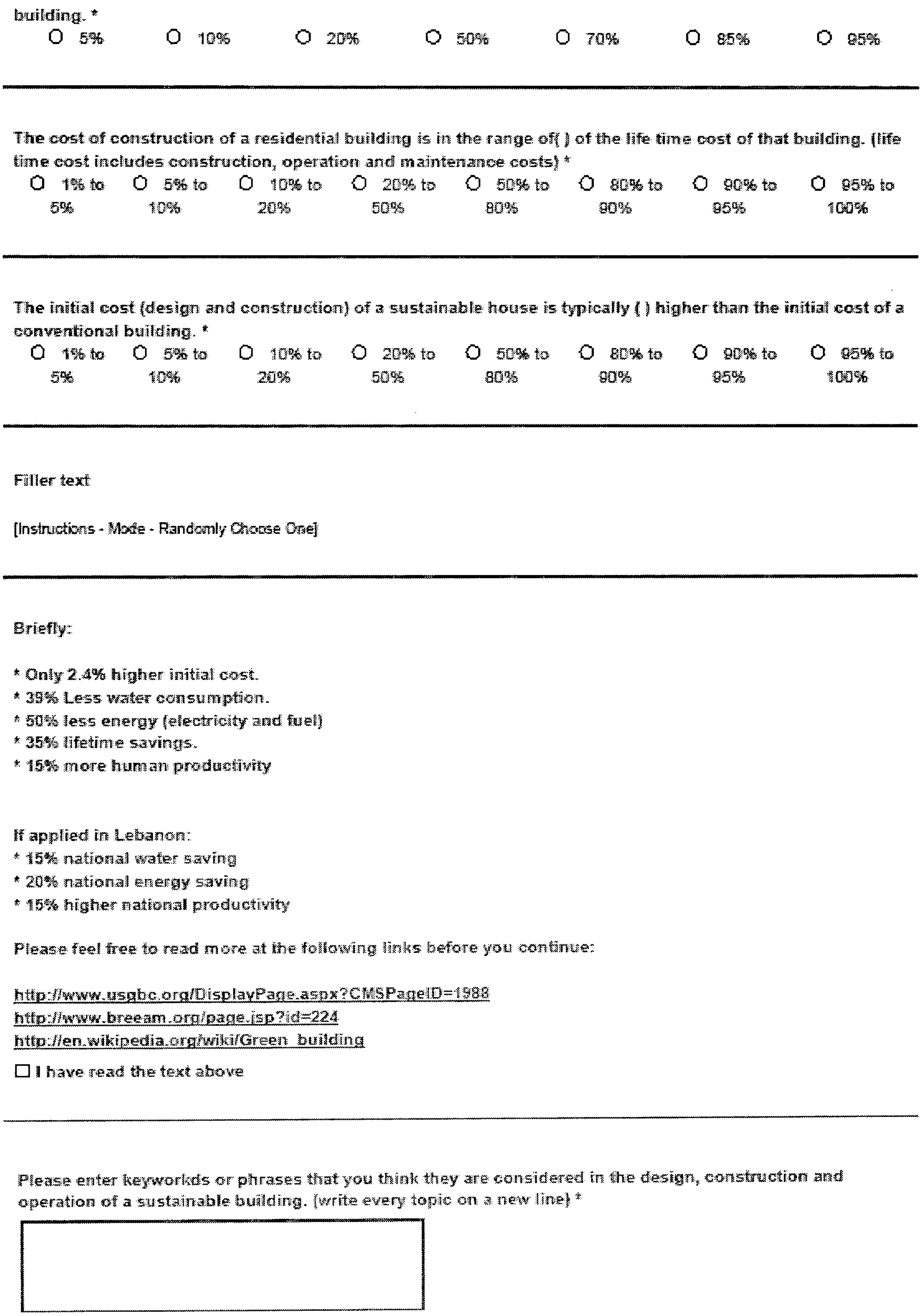
In Lebanon, residential buildings account for ( ) of the total water consumption of the country. *

○ 25% ○ 35% ○ 50% ○ 65% ○ 75%

The energy and water bills of a sustainable building are lower than the energy and water bills of a conventional building by around ( ). *

○ 25% ○ 35% ○ 50% ○ 65% ○ 75%

The productivity of a person can be increased by ( ) just by adjusting the level of natural lighting in a



building. *

○ 5% ○ 10% ○ 20% ○ 50% ○ 70% ○ 85% ○ 95%

The cost of construction of a residential building is in the range of( ) of the life time cost of that building. (life time cost includes construction, operation and maintenance costs) *

○ 1% to 5% ○ 5% to 10% ○ 10% to 20% ○ 20% to 50% ○ 50% to 80% ○ 80% to 90% ○ 90% to 95% ○ 95% to 100%

The initial cost (design and construction) of a sustainable house is typically ( ) higher than the initial cost of a conventional building. *

○ 1% to 5% ○ 5% to 10% ○ 10% to 20% ○ 20% to 50% ○ 50% to 80% ○ 80% to 90% ○ 90% to 95% ○ 95% to 100%

Filler text

[Instructions - Mode - Randomly Choose One]

Briefly:

* Only 2.4% higher initial cost.
* 39% Less water consumption.
* 50% less energy (electricity and fuel)
* 35% lifetime savings.
* 15% more human productivity

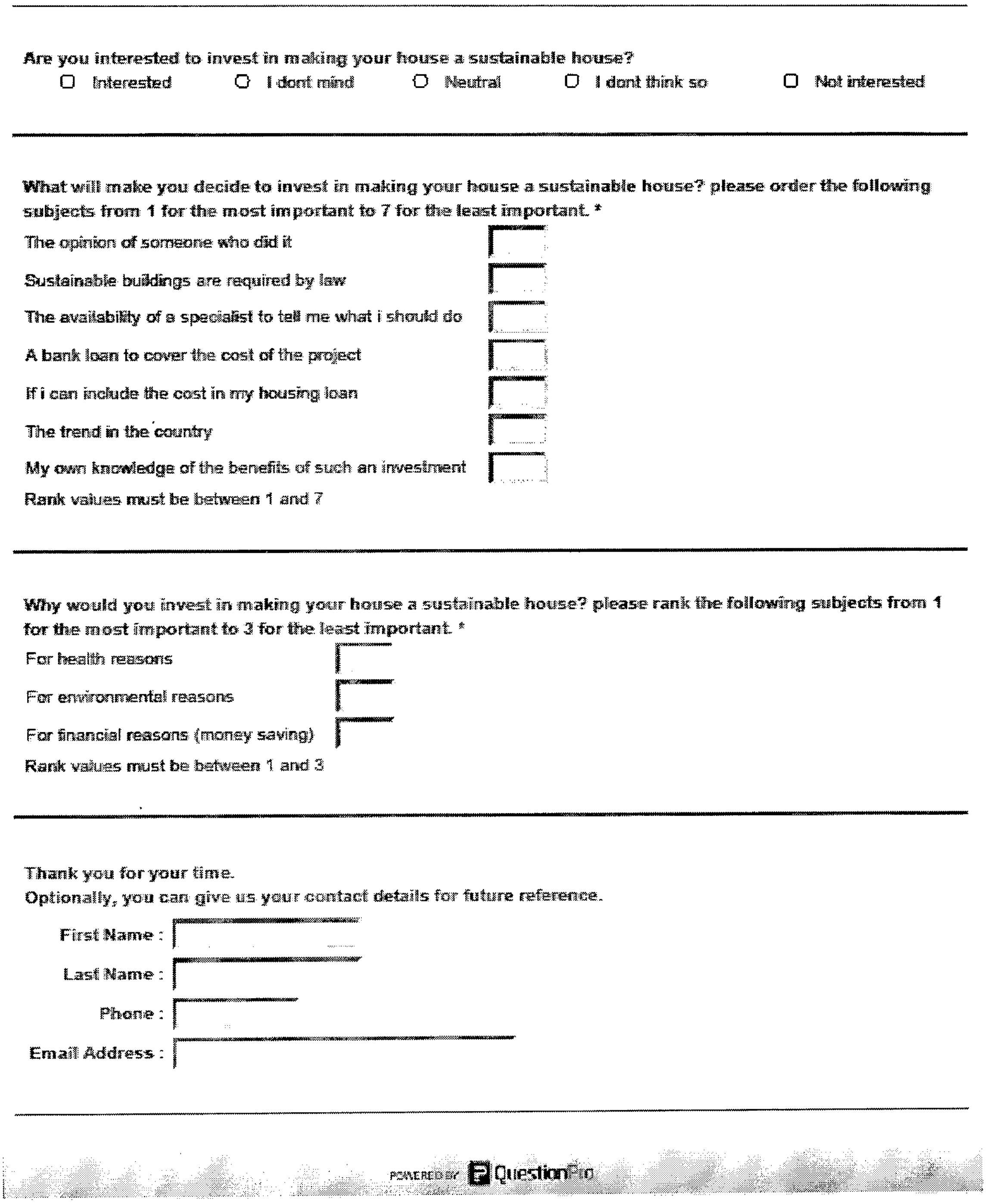
If applied in Lebanon:
* 15% national water saving
* 20% national energy saving
* 15% higher national productivity

Please feel free to read more at the following links before you continue:

http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988
http://www.breeam.org/page.jsp?id=224
http://en.wikipedia.org/wiki/Green_building

☐ I have read the text above

Please enter keyworkds or phrases that you think they are considered in the design, construction and operation of a sustainable building. (write every topic on a new line) *



Are you interested to invest in making your house a sustainable house?

○ Interested ○ I dont mind ○ Neutral ○ I dont think so ○ Not interested

What will make you decide to invest in making your house a sustainable house? please order the following subjects from 1 for the most important to 7 for the least important. *

The opinion of someone who did it

Sustainable buildings are required by law

The availability of a specialist to tell me what i should do

A bank loan to cover the cost of the project

If i can include the cost in my housing loan

The trend in the country

My own knowledge of the benefits of such an investment

Rank values must be between 1 and 7

Why would you invest in making your house a sustainable house? please rank the following subjects from 1 for the most important to 3 for the least important. *

For health reasons

For environmental reasons

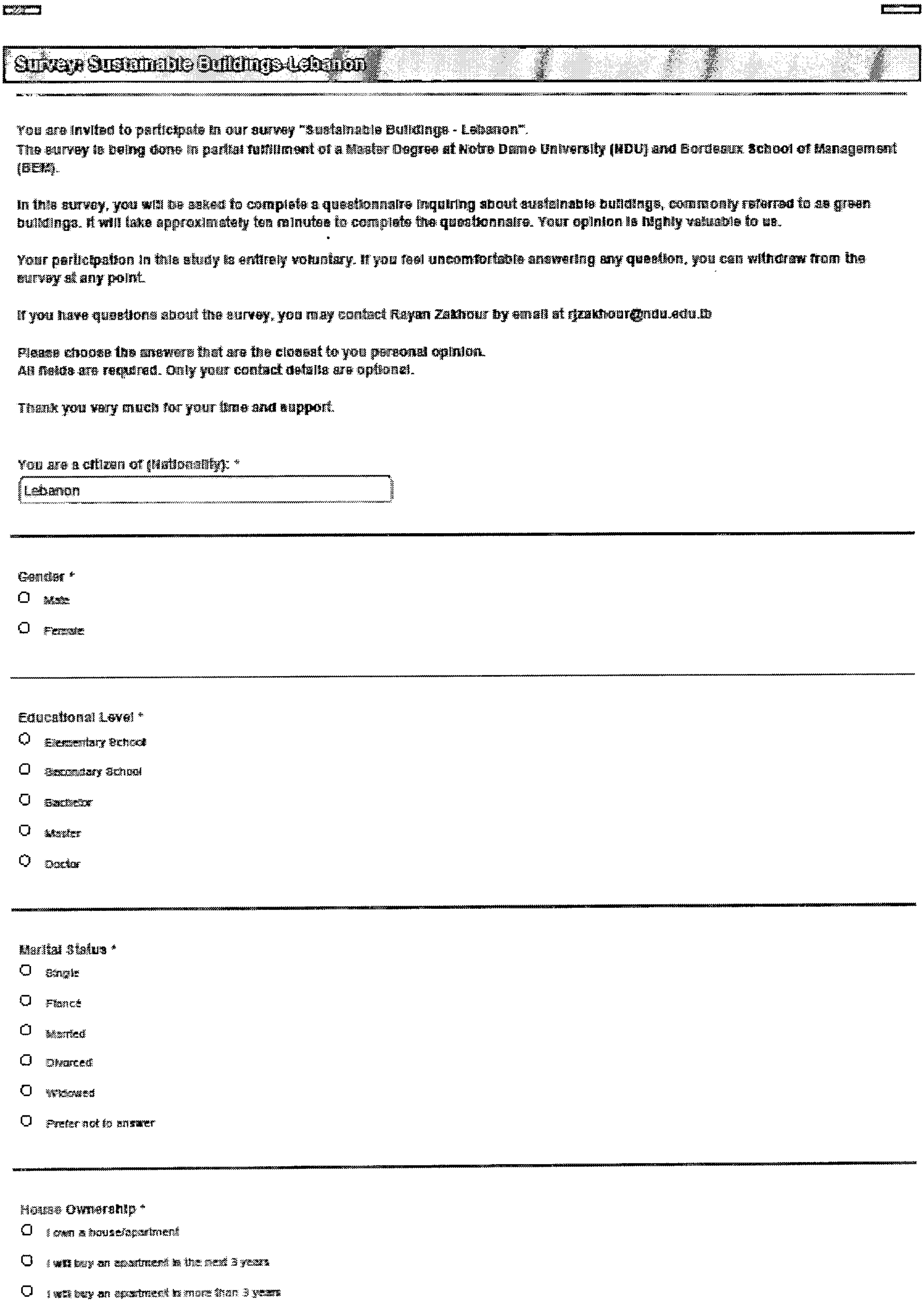
For financial reasons (money saving)

Rank values must be between 1 and 3

Thank you for your time.
Optionally, you can give us your contact details for future reference.

First Name :
Last Name :
Phone :
Email Address :

APPENDIX E – Final Questionnaire



Survey: Sustainable Buildings-Lebanon

You are invited to participate in our survey "Sustainable Buildings - Lebanon".
The survey is being done in partial fulfillment of a Master Degree at Notre Dame University (NDU) and Bordeaux School of Management (BEM).

In this survey, you will be asked to complete a questionnaire inquiring about sustainable buildings, commonly referred to as green buildings. It will take approximately ten minutes to complete the questionnaire. Your opinion is highly valuable to us.

Your participation in this study is entirely voluntary. If you feel uncomfortable answering any question, you can withdraw from the survey at any point.

If you have questions about the survey, you may contact Rayan Zakhour by email at rjzakhour@ndu.edu.lb

Please choose the answers that are the closest to you personal opinion.
All fields are required. Only your contact details are optional.

Thank you very much for your time and support.

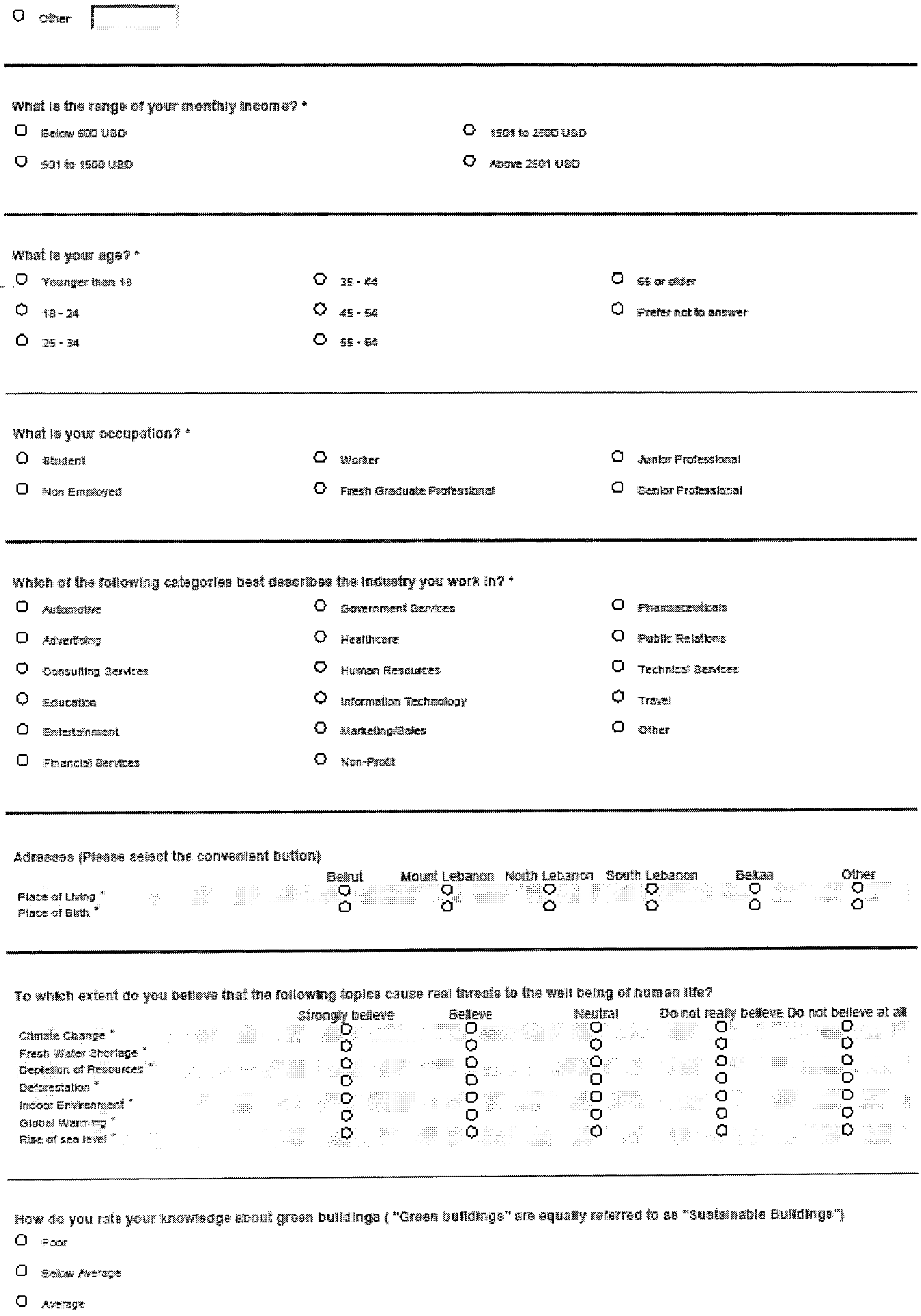
You are a citizen of (Nationality): *
Lebanon

Gender *
○ Male
○ Female

Educational Level *
○ Elementary School
○ Secondary School
○ Bachelor
○ Master
○ Doctor

Marital Status *
○ Single
○ Fiancé
○ Married
○ Divorced
○ Widowed
○ Prefer not to answer

House Ownership *
○ I own a house/apartment
○ I will buy an apartment in the next 3 years
○ I will buy an apartment in more than 3 years



○ Other ☐

What is the range of your monthly income? *

○ Below 500 USD
○ 501 to 1500 USD
○ 1501 to 2500 USD
○ Above 2501 USD

What is your age? *

○ Younger than 18
○ 18 - 24
○ 25 - 34
○ 35 - 44
○ 45 - 54
○ 55 - 64
○ 65 or older
○ Prefer not to answer

What is your occupation? *

○ Student
○ Non Employed
○ Worker
○ Fresh Graduate Professional
○ Junior Professional
○ Senior Professional

Which of the following categories best describes the industry you work in? *

○ Automotive
○ Advertising
○ Consulting Services
○ Education
○ Entertainment
○ Financial Services
○ Government Services
○ Healthcare
○ Human Resources
○ Information Technology
○ Marketing/Sales
○ Non-Profit
○ Pharmaceuticals
○ Public Relations
○ Technical Services
○ Travel
○ Other

Adresses (Please select the convenient button)

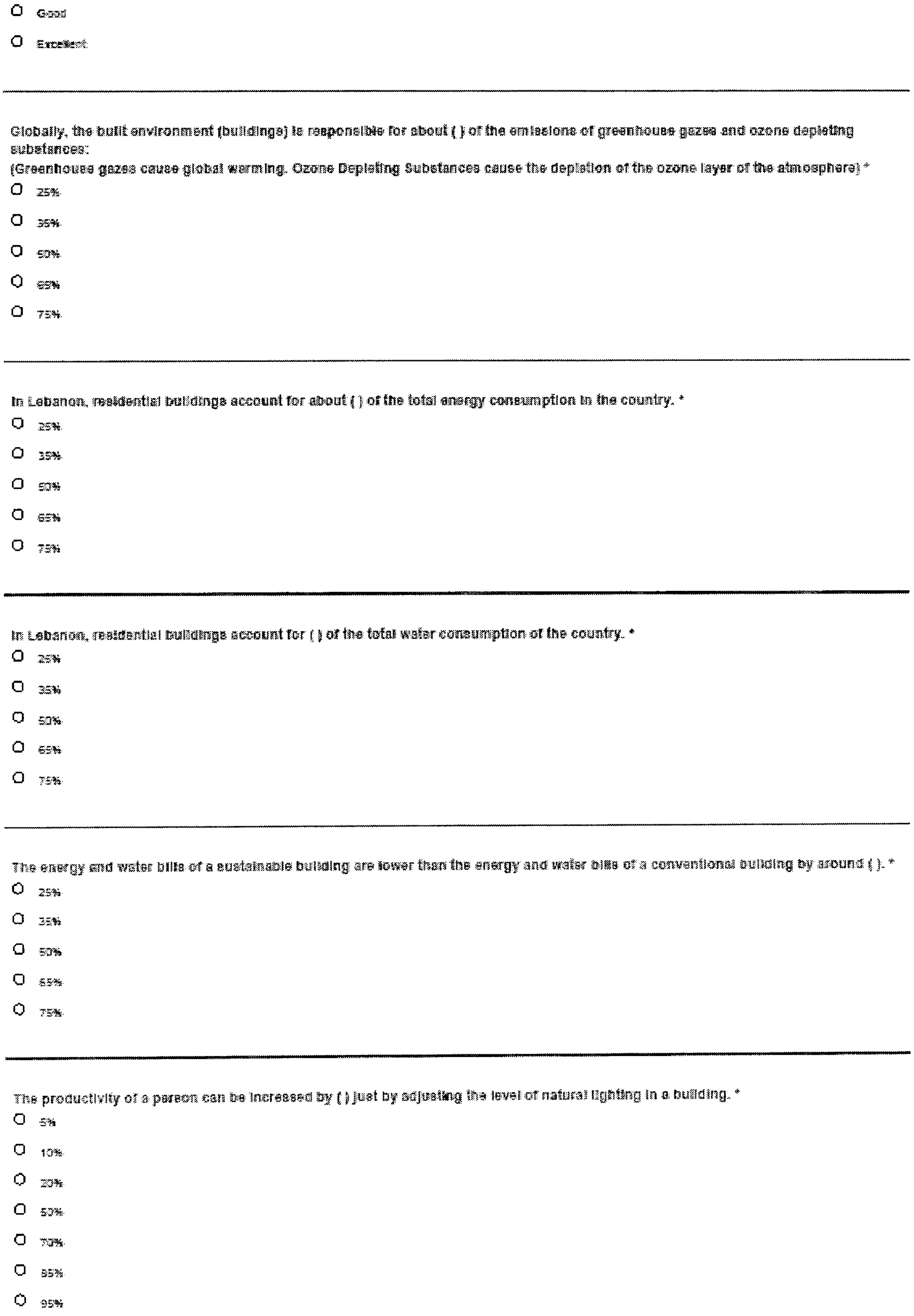
	Beirut	Mount Lebanon	North Lebanon	South Lebanon	Bekaa	Other
Place of Living *	○	○	○	○	○	○
Place of Birth *	○	○	○	○	○	○

To which extent do you believe that the following topics cause real threats to the well being of human life?

	Strongly believe	Believe	Neutral	Do not really believe	Do not believe at all
Climate Change *	○	○	○	○	○
Fresh Water Shortage *	○	○	○	○	○
Depletion of Resources *	○	○	○	○	○
Deforestation *	○	○	○	○	○
Indoor Environment *	○	○	○	○	○
Global Warming *	○	○	○	○	○
Rise of sea level *	○	○	○	○	○

How do you rate your knowledge about green buildings ("Green buildings" are equally referred to as "Sustainable Buildings")

○ Poor
○ Below Average
○ Average



○ Good

○ Excellent

Globally, the built environment (buildings) is responsible for about ( ) of the emissions of greenhouse gazes and ozone depleting substances:
(Greenhouse gazes cause global warming. Ozone Depleting Substances cause the depletion of the ozone layer of the atmosphere) *

○ 25%

○ 35%

○ 50%

○ 65%

○ 75%

In Lebanon, residential buildings account for about ( ) of the total energy consumption in the country. *

○ 25%

○ 35%

○ 50%

○ 65%

○ 75%

In Lebanon, residential buildings account for ( ) of the total water consumption of the country. *

○ 25%

○ 35%

○ 50%

○ 65%

○ 75%

The energy and water bills of a sustainable building are lower than the energy and water bills of a conventional building by around ( ). *

○ 25%

○ 35%

○ 50%

○ 65%

○ 75%

The productivity of a person can be increased by ( ) just by adjusting the level of natural lighting in a building. *

○ 5%

○ 10%

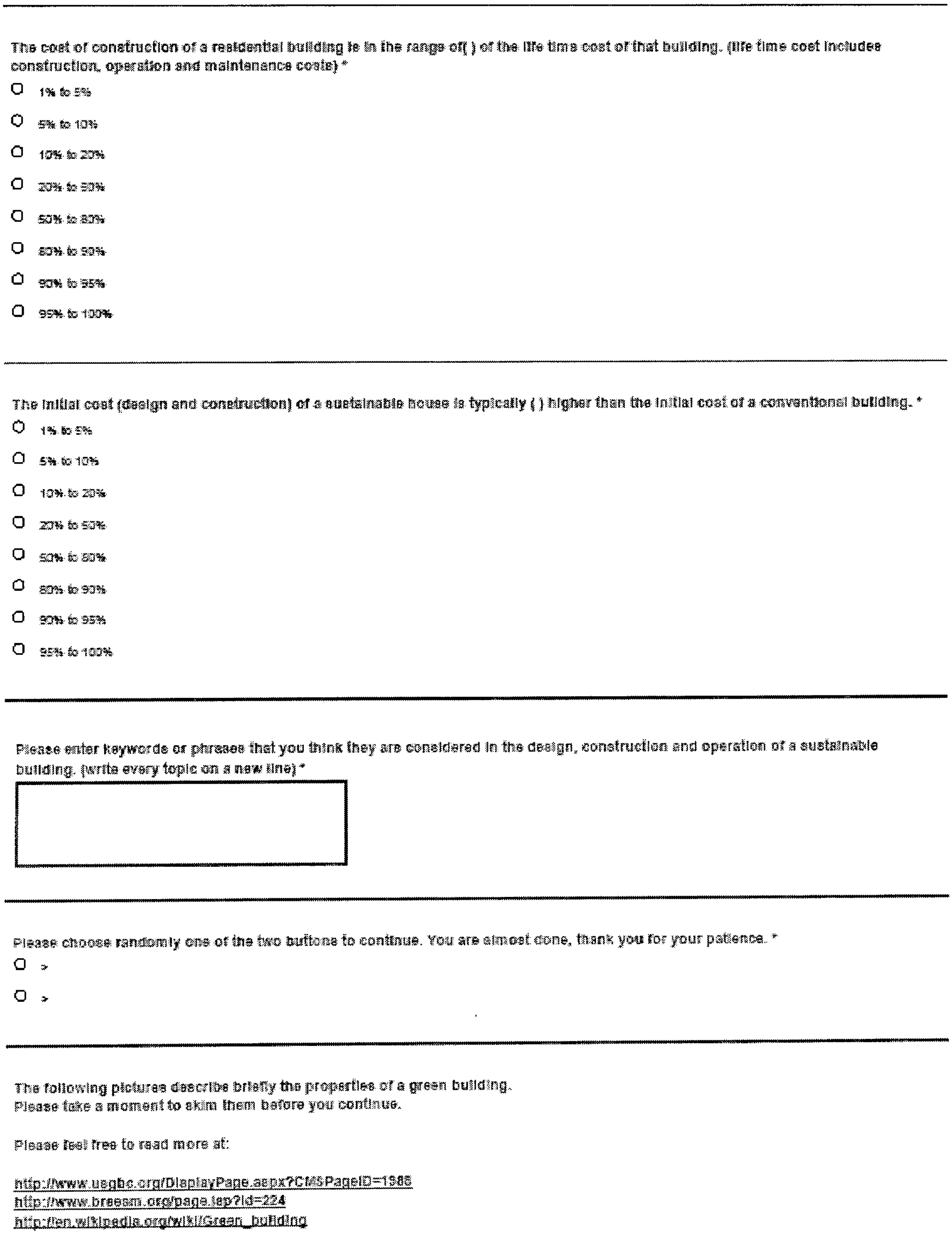
○ 20%

○ 50%

○ 70%

○ 85%

○ 95%



The cost of construction of a residential building is in the range of( ) of the life time cost of that building. (life time cost includes construction, operation and maintenance costs) *

- ○ 1% to 5%
- ○ 5% to 10%
- ○ 10% to 20%
- ○ 20% to 50%
- ○ 50% to 80%
- ○ 80% to 90%
- ○ 90% to 95%
- ○ 95% to 100%

The initial cost (design and construction) of a sustainable house is typically ( ) higher than the initial cost of a conventional building. *

- ○ 1% to 5%
- ○ 5% to 10%
- ○ 10% to 20%
- ○ 20% to 50%
- ○ 50% to 80%
- ○ 80% to 90%
- ○ 90% to 95%
- ○ 95% to 100%

Please enter keywords or phrases that you think they are considered in the design, construction and operation of a sustainable building. (write every topic on a new line) *

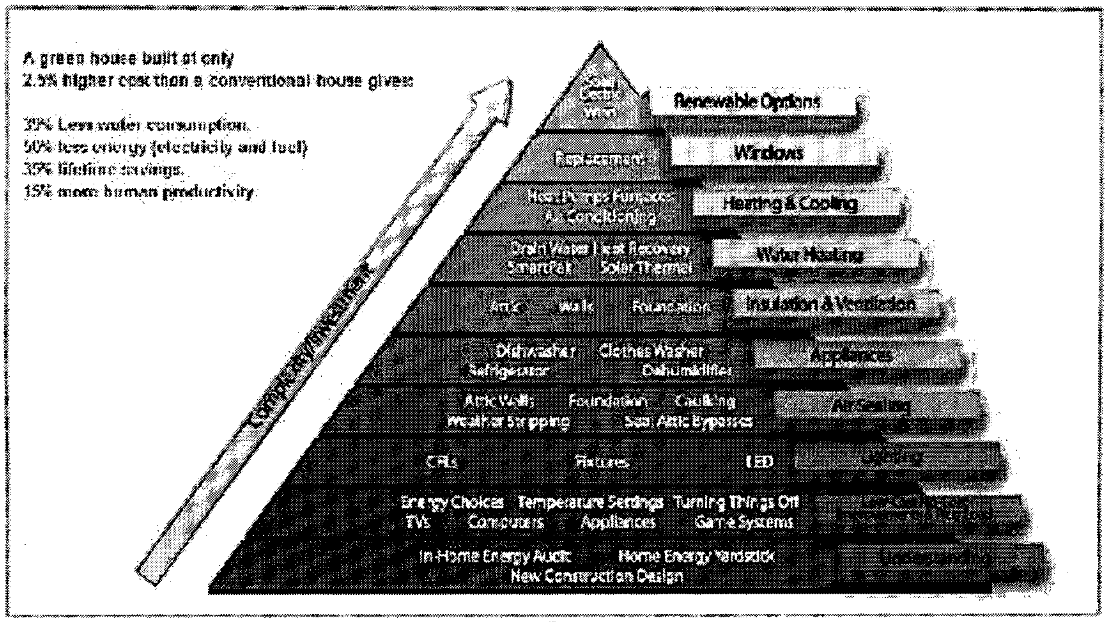
Please choose randomly one of the two buttons to continue. You are almost done, thank you for your patience. *

- ○ >
- ○ >

The following pictures describe briefly the properties of a green building.
Please take a moment to skim them before you continue.

Please feel free to read more at:

http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988
http://www.breeam.org/page.jsp?id=224
http://en.wikipedia.org/wiki/Green_building

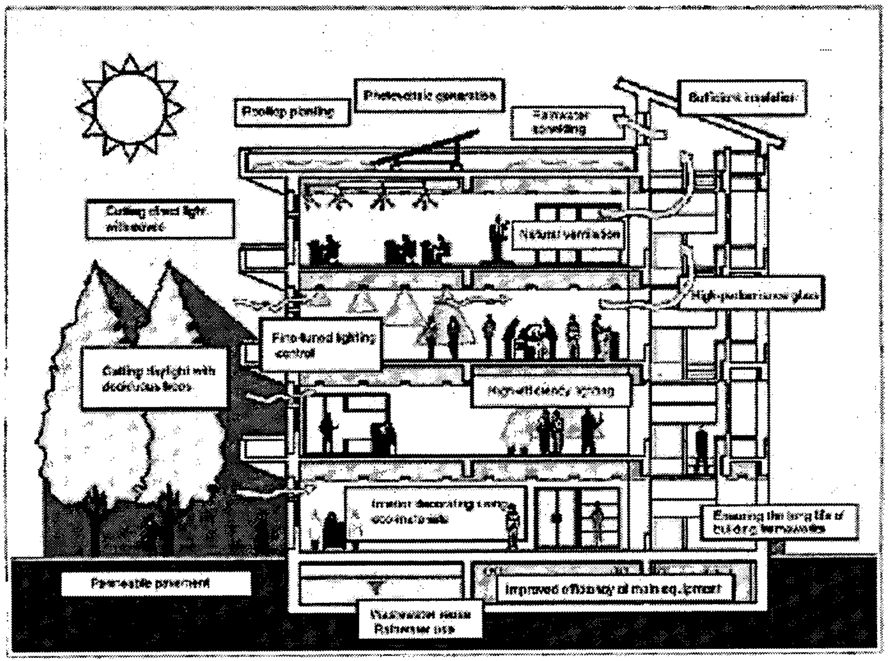


A green house built at only
2.5% higher cost than a conventional house gives:

33% Less water consumption.
50% less energy (electricity and fuel)
35% lifetime savings.
15% more human productivity

Complexity/Investment
Renewable Options
Windows
Replacement
Heating & Cooling
Heat Pumps Furnaces
Air Conditioning
Water Heating
Drain Water Heat Recovery
SmartPak
Solar Thermal
Insulation & Ventilation
Attic
Walls
Foundation
Appliances
Dishwasher
Clothes Washer
Refrigerator
Dehumidifier
Air Sealing
Attic Walls
Foundation
Caulking
Weather Stripping
Seal Attic Bypasses
Lighting
CFLs
Fixtures
LED
Energy Choices
Temperature Settings
Turning Things Off
TVs
Computers
Appliances
Game Systems
Understanding
In-Home Energy Audit
Home Energy Yardstick
New Construction Design

S



Rooftop planting
Photovoltaic generation
Rainwater recycling
Sufficient insulation
Cutting direct light with eaves
Natural ventilation
High-performance glass
Fine-tuned lighting control
Cutting daylight with deciduous trees
High-efficiency lighting
Interior decorating using eco-materials
Ensuring the long life of building frameworks
Permeable pavement
Improved efficiency of main equipment
Wastewater reuse
Rainwater use

A

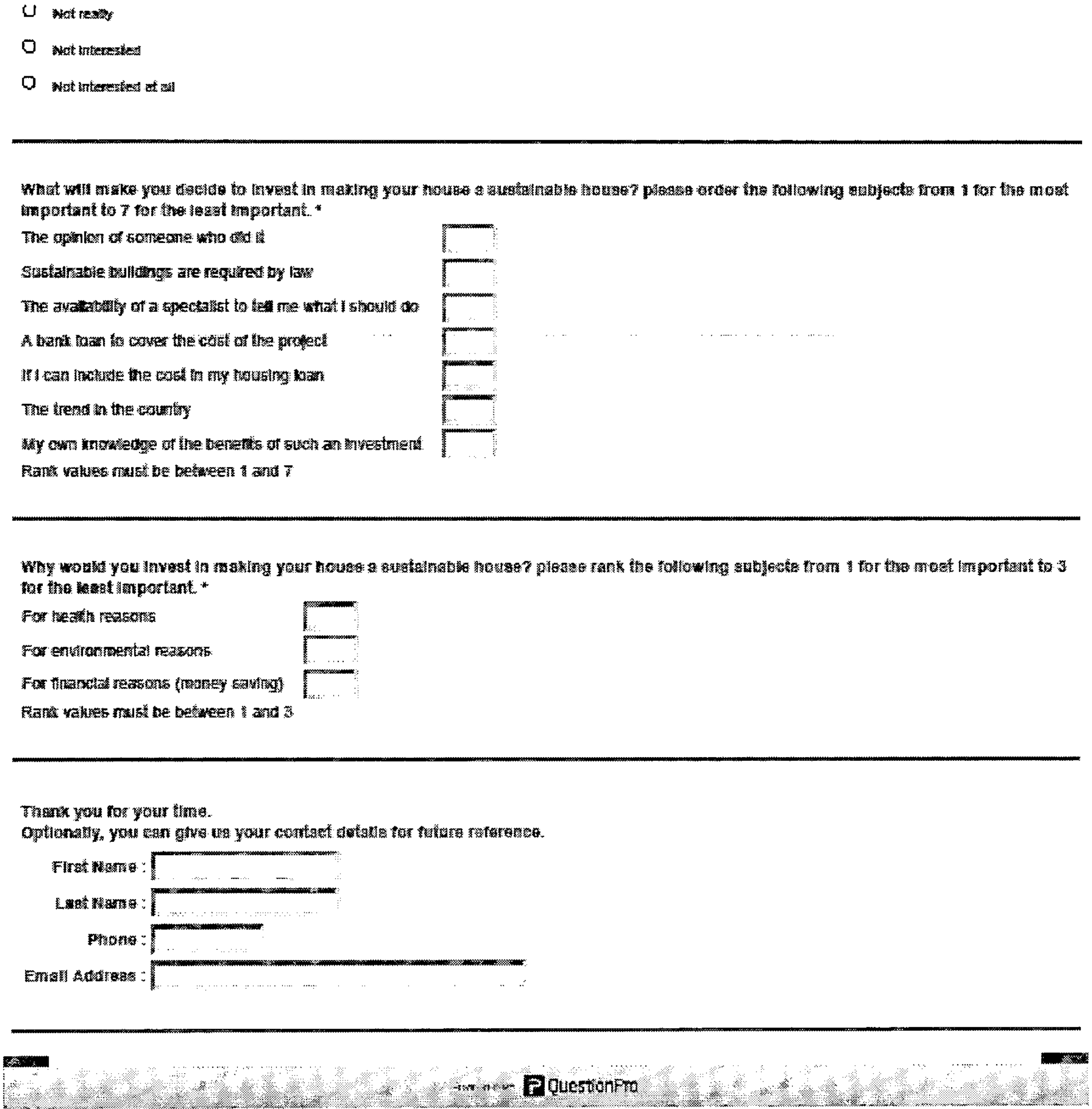
Are you interested to invest in making your house a sustainable house? *

○ Very interested

○ Interested

○ Why not?

○ Neutral



○ Not really

○ Not interested

○ Not interested at all

What will make you decide to invest in making your house a sustainable house? please order the following subjects from 1 for the most important to 7 for the least important. *

The opinion of someone who did it

Sustainable buildings are required by law

The availability of a specialist to tell me what I should do

A bank loan to cover the cost of the project

If I can include the cost in my housing loan

The trend in the country

My own knowledge of the benefits of such an investment

Rank values must be between 1 and 7

Why would you invest in making your house a sustainable house? please rank the following subjects from 1 for the most important to 3 for the least important. *

For health reasons

For environmental reasons

For financial reasons (money saving)

Rank values must be between 1 and 3

Thank you for your time.
Optionally, you can give us your contact details for future reference.

First Name :

Last Name :

Phone :

Email Address :