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Green Buildings in Lebanon: Firm's Resources, Managerial Perceptions, and Environmental Decision-making

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Green Buildings in Lebanon: Firm's Resources, Managerial Perceptions, and Environmental Decision-making

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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

Climate change is without any doubt the most critical environmental issue of the twenty first century (Orsato, 2009). Buildings have a huge environmental impact: they generate GHG emissions, consume energy, water, and raw materials. Managers of firms working in the building sector take important decisions by choosing whether to build green or not. The thesis aims to study the effect of firms' resources and capabilities (R&C) on managers' environmental perceptions. Also, the effect of these variables on the environmental pro-activeness of firm managers is examined. The study model, designed by Lopez-Gamero et al. (2008), is based on the resource-based view of the firm to examine the relationship among all these variables. A questionnaire was developed to test the model on Lebanese firms working in the building sector. The sample consists of the environmental managers or senior managers of these firms.

SmartPLS was used as a statistical tool to test the theoretical model. A confirmatory factor analysis was performed to estimate the model's parameters and assess the fit of the model.

The research presents important insights for managers to determine the factors that affect their environmental perceptions as a competitive advantage for their firms.

Keywords

Resource-based view- Green Buildings- Environmental Strategy- Managerial Perceptions

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CHAPTER 1

INTRODUCTION

1.1 General Background

In 1987, the *World Commission on Environment and Development* (WCED) defined the term sustainability as a development "that meets the need of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 16). This definition implies that societies can meet the economic development, the social welfare, and the conservation of the environment if and only if they think in terms of sustainability.

Based on the definition of the WCED, the *Encyclopedia of Sustainability* defines Facilities Management as designing, building, and operating buildings in such a way that the occupants meet their needs and at the same time leave sufficient resources to future generations (Laszlo et al., 2010). These buildings are commonly referred to as "Green Buildings". In fact, Yudelson (2008) defines a green building as a ''high-performance property that considers and reduces its impact on the environment and human health'' (p. 13).

The United States Green Building Council (USGBC) considers that planners and designers of green buildings should lessen the environmental damage of the building by concentrating on five areas. These are: (1) planning for a sustainable site, (2) conserving water and taking water efficiency measures, (3) being energy efficient and using renewable energy, (4) safeguarding material and resources, and (5) ensuring an indoor environmental quality (USGBC, 2011).

Moreover, according to the U.S. Environmental Protection Agency (EPA), a conventional building uses lot of resources and has different effects on the built environment as shown in Table 1; a green building manages these effects by using

efficient processes vis-à-vis the environment and the natural resources during the life cycle of the building (EPA, 2010).

Table 1. Impacts of the built environment

Aspects of Built Environment	Consumption	Environmental Effects	Ultimate Effects
Siting Design Construction Operation Maintenance Renovation Deconstruction	Energy Water Materials Natural Resources	Waste Air pollution Water pollution Indoor pollution Heat islands Storm water runoff Noise	Harm to Human Health Environment Degradation Loss of Resources

Source: Environmental Protection Agency (2010).

The concept of green buildings has been in progress during the last two decades. (Laszlo *et al*, 2010). According to Boake (2004), there were many attempts to build and market green buildings in the 1960s, but green projects did not meet the aesthetic expectations of people. For them, green referred to experimental projects (Lockwood, 2006). In 1992, the architectural firm Sir Normer Foster and Associates succeeded to build a green skyscraper in Germany that was a mixture of efficient green features and up to a standard architectural aspect. This project was the turning point for green buildings, which developed at a fast pace, especially in Europe where people were aware of the benefits of green features such as day-lighting and natural ventilation on the health of people and productivity of workers (Boake, 2004).

In Lebanon, and after more than 20 years of its development in the western world, green construction is still making its first attempts. In the last two years, conferences and forums took place under the patronage of the Ministry of Electricity and Water (MoEW) like the "Beirut Energy Forum" and "Build it Green Conference". Minister Gibran Bassil expressed during the *Build it Green Conference* (2011) that the purchasing behavior of Lebanese customers will change in the coming five years. The ministry is aware of the urgency of developing new mandatory building standards, setting stringent specifications for the public sector's buildings, and updating the construction permits' law.

Currently, many green projects are under development or under construction in Lebanon. These projects are seeking certifications like the U.S. Leadership in Energy and Environmental Design (LEED) or the Building Research Environmental Assessment Method (BREEAM) developed in the UK. Table 2 lists some of these projects, the clients, locations, and provides a brief description of each.

Table 2. List of Green Projects in Lebanon

Project	Client	Location	Description
American University of Beirut (AUB)- Irani Oxy Engineering Complex (IOEC) Building	American University of Beirut (AUB)	Beirut	New laboratory Engineering Facilities for AUB students
Beirut City Center Mall	Suburban Development Company	Hazmieh	Shopping Center housing retail shops, restaurants, supermarket, movie theater.
International College (IC) Elementary School	IC	Ras Beirut	Three school buildings housing classrooms, gymnasiums and laboratories
La Brocéliande	Greenstone Real Estate Developers	Yarze	Residential project with a private garden
Mika Real Estate	M1 Real Estate	BCD	Three office buildings with a retail area at the base

Source: Eco Consulting. (2011).

Green buildings will not gain the attention of the great public without the involvement and commitment of companies working in the construction field. Worldwide, after the Earth Summit in Rio, companies were convinced that social, economic, and environmental goals should go together to achieve sustainability. Hence, and based on the Brundtland definition of sustainability, the concept of corporate sustainability was defined as "meeting the needs of a firm's direct and indirect stakeholders without compromising its ability to meet the need of future stakeholders as well". (Dyllick and Hockerts, 2002, p. 131)

Previous research shows that three main factors drive the corporate sustainability: legislations, competitiveness, and ethical concern (Bansal and Roth, 2000; Hendry and Vesilind, 2005). Companies comply with the law, just for the fear of being punished and because they have no other choice. The financial motivations are those where the company calculates the profitability of embracing environmental conducts. Also, environmental concern arises from the feeling of "doing the right thing" (Hendry and Vesilind, 2005). These drivers affect the decisions made by the firm, mainly by the manager who takes the financial decisions and the decisions of complying with the law or not. The third motivator, ethical concern, is also attributed to the managers of the firm, who play the role of the champion inside the company. Carroll (1987) calls them moral managers. These managers constitute the subject of our study.

On the other hand, the resource-based view of the firm emphasizes the role of resources in the competitive advantage sought and gained by the firms. The aim of this thesis is to show how the complementary resources and capabilities of the firm affect the environmental perceptions of managers, leading to proactive environmental management. For this purpose, we use the model developed by Lopez-Gamero et al. (2008) showing the relationship among those variables cited above.

1.2 Need for the study

The natural environment has become a major concern for corporations when setting their strategies and planning for new projects. This thesis targets the managers of firms working in the building industry in Lebanon and seeking an environmental certification for their projects. The study is important on two levels, practical and theoretical.

On the practical level, climate change is a serious issue that threatens our existence on earth. The Intergovernmental Panel on Climate Change (IPCC), in its 2007 report, forecasts a temperature rise ranging between 1.1 and 6.4°C by 2100 and a sea level raise between 0.18 and 0.59 meters. The IPCC assures the likelihood of the human's responsibility for these changes (IPCC, 2007a). While preparing for the fifth assessment

report expected to be released in 2013, the panelists were holding workshops that show even more worrying figures like an expectation for the sea level to increase by 0.8 meters by 2100 (IPCC, 2010). The Middle East region is not exempt of climate change impacts; studies show that the temperature is expected to increase by 1.4°C by 2050 and 4°C by 2100 in this region (Evans, 2008).

Laszlo *et al.* (2010) indicated that 50 percent of the global CO_2 emissions are generated by the built environment and 50 percent of Green House Gases (GHG) emissions and agents of acid rain are generated by the building construction industry. Developed countries have already started implementing measures that would help decrease pollution in the construction field. In Lebanon, however, the society is still under-informed about the concept of "green building" and its importance to the environment. Companies working in the construction industry have many characteristics that make them an important subject for our study. First, they have the theoretical knowledge in energy, water, and waste management. Thus, they take important decisions relative to the products they are promoting, green building or non-green building, and the processes they are using when dealing with the different aspects of the built environment. Second, there is a big difference in the perceptions of firms' managers towards sustainability; some of the companies in this sector have already developed a culture that fosters environmental practices while others are still far away from applying the regulatory standards. Third, these companies have close relationships with customers, they know their needs, and are somehow influenced by them.

On the theoretical level, the study is based on the model developed by Lopez-Gamero et al. (2008). The study model was tested on firms in Spain. The present thesis will present an opportunity to test the model in Lebanon where the cultural dimensions are different. Currently, most firms in Lebanon are taking voluntary decisions regarding their ecological involvement. Hence, conducting such a research at this time presents important insights for managers to determine the factors that affect their perceptions of the environment as a competitive advantage for their firms.

1.3 Purpose of the study

The thesis aims to study the effect of firms' resources and capabilities on managers' environmental perceptions. Also, it measures the effect of these two variables, in addition to the company's size, on the environmental pro-activeness and pioneering entry strategy. The studied Resources and Capabilities (R&C) are mainly the management's involvement in firms' activities, learning and knowledge of employees, and firm's capability to adapt to new environmental conditions.

As stated before, the targeted companies are firms working in the building industry. The main product of firms in the construction sector is buildings. These buildings are planned, designed, built, operated, and demolished, and in each of these stages, they may constitute a threat to the environment. Since designers, contractors, and real-estate developers take strategic decisions that affect urban development, understanding the motives behind their decision-making is crucial to the promotion of green buildings. The results of the study can help us understand the factors that affect the decision-making of the managers vis-à-vis the environment and the involvement of firms in environmental initiatives. In addition, it sets the ground for managers to know how to manipulate these factors.

1.4 Brief overview of all chapters

Chapter 1 opens with definitions of sustainability, facilities management, and green buildings followed by a general historical look over green construction. This history is followed by a description of the state of green construction in Lebanon with the listing of green projects currently under construction or development. Then, corporate sustainability is defined and drivers for firms' commitment are briefly explained. In the part that follows, the need for the study and the purpose of this thesis are revealed.

Chapter 2, dedicated to the review of literature, thoroughly examines the climate change, pollution, and effects of buildings on the environment. Then, it examines the

status of green buildings and the incentives offered in Lebanon, in addition to the involvement of construction firms. Finally, it details the concepts of environmental management, complementary resources and capabilities, entry strategies, and managerial interpretation of the environment, and explains the relationship among them.

In chapter 3, the adopted theoretical model is explained; the hypotheses and variables are described. Next, a methodology is chosen which is best-suited to match the objective of the research study. Hence, there will be a quantitative approach to the studied issue via the analysis of questionnaires designed for this study. Chapter 4 starts with descriptive statistics of the questionnaires. Then the main results will be discussed. The last chapter presents the conclusions along with the limitations of the research and the managerial implications.

CHAPTER 2

LITERATURE REVIEW

2.1 Climate Change, Pollution and the Effects of Buildings

2.1.1 Facts and Statistics on climate change

The world has become so interconnected that every problem faced by one nation influences other countries. Problems of the twenty first century are various, from global warming, to water scarcity, to increased energy demands, to financial breakdown. Historically, societies have collapsed because of some environmental factors: (1) loss of habitat and ecosystem services, (2) overfishing, (3) loss of biodiversity, (4) soil erosion and degradation, (5) energy limits, (6) freshwater limits, (7) photosynthetic capacity limits, (8) toxic chemicals, (9) alien species introduction, (10) climate change, (11) population growth, and (12) human consumption levels. The situation becomes more critical when several factors are present at the same time, a situation that describes the current condition of the Earth (Costanza *et al.*, 2007).

The overuse of natural resources by humanity has led to irreconcilable consequences as expressed by the *Global Footprint Network* (2010). In fact, people are using the equivalent of 1.5 planets, and it is expected that this figure will increase to 2.5 in 2050 if the behavior does not change. This implies that it is taking the Earth 1.5 year to regenerate what humanity is using in one year.

Scientists and environmental organizations have been conducting studies to reveal the status of the Earth. The IPCC established by the United Nations (UN) in 1988, releases every six years a detailed study of the Earth's climate. The latest data shows a rise of the global air temperature, the years 1995-2006 being the twelve warmest years since 1850. In addition, data shows a yearly rise of the sea level by 3.1mm since 1993, melting of polar ice sheets, decrease of snow, significant increase of the precipitations

in some countries, and significant decrease in some others, as well as the acidification of the ocean (IPCC, 2007a). The same report forecasts a temperature increase between 1.1°C and 6.4°C relatively to the average levels of years 1980-1999 by 2100 and a sea level rise between 18cm and 59cm by the same year. While preparing for the fifth assessment report expected to be released in 2013, the panelists were holding workshops that show even more worrying figures like an expectation for the sea level to increase by 80cm by 2100 (IPCC, 2010).

It is very likely that the GHG emissions like Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) are responsible for the temperature increase, and humans are responsible for the generation of theses gazes. Many sectors are contributing to these emissions: energy supply, transportation, buildings, industry, agriculture, forestry, and waste. The use of fossil fuels for energy supply, for example, generates 56.6 percent of GHG emissions (IPCC, 2011).

This harm made to nature and to the environment is not very recent. The industrialization that happened 250 years ago constituted a turning point in the history of humankind. It led to the concentration of people in big cities while decreasing the number of rural from 90 percent to 10 percent, subsequently producing a huge impact on the environment (Pitts, 2004). According to Clapp and Dauvergne (2005), the damage caused by the burning of coal led to a lot of harm to nature and consequently to human health. In fact, more than 1,150 people died in London in 1873 due to air pollution from burning coal, and 4,000 died in 1952 due to smog in the same city; the smog killed also 200 people in 1953 in New York. The situation worsened all over the years and currently, it is still in degradation. Orsato (2009) states that climate change is without any doubt the most crucial environmental issue of the twenty first century. This change is harming the ecosystems, causing water scarcity, and has a bad impact on agriculture and human health.

Lebanon, like all other countries, is influenced by the global climate change. As expressed during the 16th session of the United Nations Framework Convention on

Climate Change (UNFCC) Conference of parties held in Mexico on December 2010, the rainfall in Lebanon is expected to decrease between 25 and 50 percent by the end of the century (UNFCC, 2010a). As studied by a model named "Providing Regional Climates for Impacts Studies" (PRECIS), temperature in Lebanon will increase by minimum 4.5°C on the coast and 5.5°C in the mainland by 2090. In addition, by 2100, the number of hot days where the temperature is higher than 35°C will last 50 additional days and the number of tropical nights where the temperature is higher than 25°C will last 35 additional days (UNFCC, 2011). Lebanon produced 3.7 metric tons of CO_2 emissions per capita in 2007, while the global rate is 4.6 (World Bank, 2011). For a non-industrialized small country, this figure is high and might cause environmental problems.

2.1.2 Mitigation Techniques

After the Second World War, many environmental organizations emerged and the 1980s saw the settlement of many conventions. Examples are the World Conservation Strategy in 1980 where the word "sustainability" was introduced for the first time as a link between development and the environment, the Vienna Convention for the Protection of the Ozone layer in 1985, the Basel Convention on the transboundary movement of hazardous wastes and their disposal in 1989, and most importantly, the UNFCC in 1992 (Clapp and Dauvergne, 2005). The latter was developed after the Rio Earth Summit in 1992 with the aim of stabilizing the GHG emissions at the 1990s levels by the year 2000 (Orsato, 2009). After the establishment of the UNFCC, sustainability suggests that economic development, social justice, and environmental concern should be interdependent and not conflicting goals (Helgeson and Lippiatt, 2009). According to Abdel Gelil (2009), and since all countries are not equally responsible for the GHG emissions, the Rio declared the "common but differentiated responsibilities" principle. During the same period, the "Architecture at the crossroads" convention was signed during the "World Congress for architects" that was held in 1993 in Chicago (BDC, 2003). This convention is considered a turning point for the development of the Green Buildings' concept.

According to Orsato (2009), the IPCC reports triggered policy actions; the UNFCC conference held in Kyoto, Japan in 1997 issued the Kyoto protocol calling for the reduction of emissions by 5 percent compared to the 1990 level, the target being set for the years 2008-2012. It is not until 2005 that the protocol became an international law and mechanisms for its implementation were proposed. These mechanisms include the International Emission Trading Schemes (ETS), Clean Development Mechanism (CDM), and Joint Implementation (JI) projects. Developing countries mainly hosted CDMs such as the generation of renewable energy, and taking energy efficiency measures. According to UNFCC (2011), the Kyoto protocol divides the countries that signed it into three groups: the industrialized countries under Annex I, the developed countries that help the developing countries under Annex II, and the developing countries. Annex I and II countries have legal obligations to reduce greenhouse gases. The results attained will be viewed in 2012 during the 15th meeting of these countries in Copenhagen, Denmark where it is expected to announce a new protocol with stringer commitments. It is important to mention that Lebanon ratified the Kyoto Protocol in 2006 and set a framework for the implementation of CDM mitigation techniques.

In 2002, the World Summit on Sustainable Development (WSSD) was held in Johannesburg, South Africa, where the focus was on globalization and issues such as water, agriculture, energy, health, and biodiversity (Clapp and Dauvergne, 2005). It was obvious from the WSSD that sustainability and economic development are not so easy to be realized; this conflict is shown clearly in the construction industry, where buildings fail to be cost effective and to encompass green features at the same time (Helgeson and Lippiatt, 2009).

Environmental organizations were not the sole party to make efforts in order to spread the awareness on climate change. Individual actions were taken by environmentally aware people such as Al Gore who showed the impact of climate change in his film "The inconvenient truth" for which he obtained a Nobel prize in 2006 (Orsato, 2009). Recently, many authorities have called for actions to limit the GHG emissions; the Cancun agreements, settled in 2010, called for the limitation of the temperature raise to

1.5°C relatively to the preindustrial level, hence to limit these emissions to 445-490 ppm CO_2 equivalent (CO_2 eq) (IPCC, 2011).

In order to achieve this goal, many techniques should be employed in different sectors. In the building sector, for example, residents should use efficient lighting devices, energy efficient electrical appliances and heating and cooling devices; they should take advantage of day lighting, improve insulation, and use solar energy for heating and cooling. According to Lazlo *et al* (2010), the government and environmental organizations in Europe are issuing Energy Performance Certificates and Display Energy Certificates in order to assess the energy performance and carbon emissions of buildings. In the energy sector, renewable energy sources should replace the fossil fuel. In this way, people will not be dependent on the rise of fuel prices as it happened in the years of 1973, 1980, 1991, and recently in 2008.

According to a research by Mckinsey Global Institute (MGI), developing countries have the potential to decrease the growth on energy demand from 3.4 percent to 1.4 percent per year by 2020 (Farrell and Remes, 2009). Although Arab countries are responsible for a small part of the emissions, they are doing steps towards being more energy efficient. The United Arab Emirates (UAE) established the Emirates Green Building Code in 2005 and they are building a city in Abu Dhabi they named "MASDAR City" characterized by being the first zero-carbon, zero-waste and car free city in the world. According to Abdel Gelil (2009), Jordan, Syria, Kuwait, and Egypt are developing building energy codes and legislations to push people into building efficiently insulated buildings and using energy efficient air conditioners. Also, Tunisia and Algeria are working on standards for low energy consumption home appliances. The Sudan is developing liquefied petroleum gas in the household sector for cooking purposes. In 2002, and in harmony with the mitigation processes, the Lebanese Center for Energy Conservation (LCEC) was created with the objective of giving technical and financial support for environmentally friendly projects, raising awareness of people, and analyzing policies (Abdel Gelil, 2009).

As presented during the Beirut Energy Forum (2010), the Paris Summit Meeting was held on July 13, 2008 with the participation of the heads of states and governments of the Mediterranean Basin. In this meeting, the Union for the Mediterranean (UfM) was launched, and most importantly a project called "Mediterranean Solar Plan" (MSP). The goal of the project is to achieve a 20 percent energy reduction by 2020 in the Mediterranean countries. Lebanon is working to achieve the 12 percent increase of renewable energy mix by 2020 as agreed in Copenhagen in 2009 and as stated in the Electricity Policy Paper (UNFCC, 2010b). Djoundourian (2009) cites that Lebanon has more than 130 Environmental Non-Governmental Organizations (ENGOs) and the level of awareness towards environmental issues has been increasing year after year. In addition, Lebanon ranks second in the list of countries signing regional environmental conventions.

2.1.3 Effects of buildings on pollution

Buildings have a huge impact on the environment. On a global level, the building sector accounts for three Gt of CO_2 emissions every year (IPCC, 2007b). According to the US Department of Energy (2008), residential and commercial buildings in the USA consume 72 percent of the US total consumption of electricity and 36 percent of total natural gas consumption. These buildings account for 40 percent of all energy consumption, greater than the consumption of either the transportation or the industry sectors (Eves and Kippes, 2010). In addition, the United States Green Building Council (USGBC) stated that American residential and commercial buildings emit 30 percent of the greenhouse gases, use 30 percent of the raw materials, are responsible for 40 percent of non-industrial waste, and use 12 percent of total potable water (Yudelson, 2007). Lazlo *et al.* (2010) indicate that 50 percent of the global CO_2 emissions are generated by the built environment and 50 percent of GHG emissions and agents of acid rain are generated by the building construction industry. As stated in Lebanon's Second National communication to the UNFCC, Lebanon produced in the year 2000, 18.5 Million tons (Mt) of CO_2 eq. The energy sector in Lebanon is responsible for 74.86 percent of these emissions. Energy industries account for 31 percent of the total

emissions, manufacturing industries and construction comprise 15 percent of the total national emissions (UNFCC, 2011). In 2000, Hydro Fluoro Carbons (HFC) gases produced from cooling and air conditioning amount to 0.01 Gg only but their CO_2 eq. is 11Gg since they have a high global warming potential (UNFCC, 2011)

According to Laszlo *et al* (2010), the construction and operation of buildings have huge impact on the environment. Many elements contribute to air pollution: emissions of CO_2 from energy use inside buildings and from vehicles used for transportation from and to buildings, use and disposal of materials, water and waste, ecosystem pollution, as well as many other contributions. In addition, buildings have a long life cycle; they are designed to last at least 50 years. Thus, the decision taken for the design and construction of buildings will have an impact on the environment for a long time (Edwards, 1998).

In fact, buildings need resources during the construction and operation phases. Also, they produce waste throughout their life cycle from construction to use and even during their demolition. Their location plays also a role for the ecology and for the transportation, which is by its own a pollutant source (Pitts, 2004). Thus, in order to lessen the impact of buildings on the climate, many areas should be examined: energy, water, waste, the built environment, and transportation. The concept of green buildings implies that all these areas are studied when planning for a new building. For this purpose, many organizations have been developing standards in order to assess and improve the performance of green buildings. We can name the Green Star applied in Australia, the Comprehensive Assessment System for built Environment Efficiency (CASBEE) in Japan, and the Green Building Tool (GBTool) software. In addition, there is the Green Globes in Canada, and most importantly the Leadership in Energy and Environmental Design (LEED) developed by the USGBC and the Building Research Environmental Assessment Method (BREEAM) developed in the UK (Lazlo *et al*, 2010).

The LEED assessment tool covers six categories; namely sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process. Points are awarded for each item in these categories, and according to the sum of points, the building is rated as certified, silver, gold, or platinum (USGBC, 2011). The BREEAM, developed in 1990, assesses buildings against eight criteria; namely management, the internal environment meaning health and well-being, energy and water, transport, waste, materials, ecology, and pollution. The points awarded for each category will be added and the building will obtain a rating varying between pass, good, very good, excellent, or outstanding (BREEAM, 2011). Finally, the Lebanese ARZ rating system covers nine modules: energy performance, thermal energy, electrical energy, building envelope, materials, indoor environmental quality, operation and management, water conservation, and bonus items (ARZrating, 2012). The credits required by each of these assessments tools are detailed in Appendix 2.

2.2 Green Buildings and the involvement of construction firms

2.2.1 Green Buildings in Lebanon: status, benefits, and barriers

According to Majdalani (2011), Lebanese consumers in general are heading more and more towards green products and services. In 2009, the Ministry of Economy and Trade recorded $382 million in trading in environmental goods, a 33 percent increase in comparison to the figures of 2006. This situation expands to the building market. Lebanese are more aware of building and living in a green environment. In fact, the commercial construction that took place in Lebanon during the last ten years and especially after the increase in the real estate prices, made new buildings wrongly oriented, full of chemical resins and curtain walls and exempt of any energy efficient features (Bathiche, 2011). Nowadays, green buildings are gaining popularity and many developers are moving towards the green construction; examples of projects are Badaro Gardens developed by FFA Real Estate, Sama Beirut, a 50-story skyscraper in Achrafieh, La Broceliande, a residential building in Yarze, District//S developed by

Estates (Bathiche and Rizk, 2011). Lebanese projects aiming a green certification chose the local ARZ rating system, LEED and BREEAM. Four have already applied for ARZ, a dozen for LEED and three for BREEAM (Bathiche and Rizk, 2011).

According to Bathiche (2011), building green in Lebanon can have many financial benefits: developers can benefit from a sale price 20 percent higher than regular buildings while only paying an extra three percent on the initial cost of design and construction. In addition, according to a new building law, builders can exploit 15 percent additional land if they build energy efficient double walls. People residing in green buildings can also benefit from the operating savings: office tenants can save 25 percent on the heating and cooling bills and residential owners can save 32 percent if they apply the Lebanese Thermal Standard. Applying these standards incur an extra cost between $6 and $8 per square meter of external envelope (Bathiche, 2011).

Data in Lebanon is still insufficient to assess the real savings from green buildings. However, the Lebanese Association for Energy and Environment Conservation did a pilot study on five projects and drew up the following conclusion: 30 to 50 percent reduction in energy consumption, 1500 KWH savings per year for a cost surplus of 5 to 10 percent (Rizk, 2011).

The use of alternative sources of energy such as photovoltaic cells, solar water heaters, and wind turbines make residents less dependent on conventional sources of energy, thus, less dependent on fuel price fluctuations. In addition, the world has been putting strategies to fight oil shortage for the last 100 years; water will follow as subject of international strategies (Yudelson, 2007). Since Lebanon suffers from the lack of electricity and its high dependency on imported fuel, green buildings can be the solution to this problem. Developers can also benefit from a positive image when marketing their buildings, thus they attract more customers.

On the social level, residents are less exposed to health problems due to day lighting and use of natural ventilation systems, their productivity increase and they develop a

sense of well-being termed in the U.S as a "feel good factor" (Edwards, 1998). Paumgartten (2003) reports a 24 percent increase in job satisfaction and 6 to 16 percent increase of productivity due to working in a green building. In the same spirit, Richardson (2007) expresses that green campuses help reduce absenteeism by 45 percent. Boake (2004) declares that allowing natural day lighting to penetrate deeply in a building can reduce absenteeism by 15 percent.

On the environmental level, green buildings help reduce global warming through using energy efficient appliances and systems (Edwards, 1998). They play a role in saving water resources through the reuse of water collected from rain for non-potable needs (Pitts, 2004). In addition, the plants and insects existing on the site are taken into consideration during the site planning and construction phases; the outcome helps preserve biodiversity. Further, the impact of buildings on the environment is reduced through the use of local material and the choice of sites to be close to public transportation in order to reduce the pollution caused by private cars (Edwards, 1998). Additionally, encouraging the green expansion in Lebanon can offer the country new job opportunities, a cleaner environment, economic growth, and conservation of Lebanon's nature.

One of the barriers to the development of the green building concept is the commercialization part. The Australian experience in the reputable green project "The Bond" in 2006 shows how the net lease system adopted makes the resident beneficiary of the operation savings while the owner does not make any positive return from investing in green (Orsato, 2009). In Lebanon, where the residents pay the electricity and water bills, owner of green buildings may not benefit from the operational savings of green buildings, which can discourage the purchase of green offices and appartments when the intention is to rent them.

Another problem is the cost of building green; these costs are not minimal: Hiring a consultant to do an audit for existing buildings costs between $5,000 and $25,000, seeking a green design and certification costs between $80,000 and $150,000 for large

projects, and doing a green design for a medium residential building, costs around $20,000 (Bathiche, 2011). La Brocéliande, a green residential building in Yarze (Lebanon) developed by Greenstone, incurs between five and ten percent extra cost (Rizk, 2011). Also, the lack of regulations in Lebanon makes the development of green features of new buildings very slow. Even though there is a law to insulate walls in energy efficient manner since 2005, this law was not put into action until now. In addition, architects, who should be the pioneers of green buildings, fear the change of the construction law because then construction permits will be delayed (Perrier, 2011). Since the application of the concept of green buildings is still new in Lebanon, few data is provided, and the results for the benefits of green buildings are not concrete yet (Perrier, 2011).

In addition, one of the principles of sustainability calls for the use of local material. Lebanon is not an industrial country; thus, most of the material should be imported (Rizk, 2011). In the same spirit, LEED calls for reserving parking places for hybrid cars, when Toyota is the only car dealer to import hybrid cars to Lebanon.

Finally, Lebanese are still unaware of considering the benefits of green features inside homes when they decide to purchase a home (Perrier, 2011). The location of the building, the view it offers and the aesthetic aspect are factors that are more important (Perrier, 2011). This situation is common worldwide since Pitts and Jackson (2008) have reported that homebuyers are more inclined to think of the location and surface of the home, and other emotional issues rather than thinking of energy savings and operational expenses.

2.2.2 Incentives offered by the Government

Governments and environmental organizations should take many actions to encourage the green building movement. These actions include financing energy-efficient programs, giving incentives to people in order to implement energy cuts in their homes and offices, setting and implementing standards, and encouraging collaboration between

the private and public sector to encourage and finance energy efficient projects (Farrell and Remes, 2009).

A study done by the Ministry of Environment in Lebanon in 2001 estimated the cost of environmental degradation as $565 million every year, which constitutes 3.4% of the GDP (Majdalani, 2011). Nowadays, the Lebanese Government and environmental organizations are more aware of the drawbacks of this degradation. That is why Lebanon is taking steps to encourage sustainability, through the commitment of the Ministry of Energy and Water to the 12 percent renewable energy by 2020, the incentives offered by the Central Bank for environmentally friendly projects and other initiatives. In fact, the Central Bank (CB) offers a subsidized green loan on green and environmental projects in the construction industry, eco-tourism, and other sectors. Since the aim of the CB is to focus on energy efficient and renewable energy products, it sets up the National Energy Efficiency and Renewable Energy Account (NEEREA) in coordination with the LCEC and the United Nations Development Programme (UNDP), and with the financial support of the European Union, which granted $ 20 million to encourage green initiatives (Bathiche and Houella, 2011).

As stated by the circular 236 issued by the CB, new green projects benefit from loans with a repayment period of up to 10 years after a grace period ranging from six months to four years. Greening existing projects can benefit from 10-year loans including a grace period ranging from six months to two years. The amount of the loan will be 15, 25, 35, or 45 percent of the total project value according to the certification obtained: certified, silver, gold, or platinum respectively. The non-certified projects and existing projects are granted a loan equaling the environmental cost of the project. The loan relative to the energy related part of the project will be at 0.6 percent and the remaining amount at 3 percent interest rate. Energy related projects could also get loans with an affordable interest rate and long payment period. Banks are giving loans for solar water heaters, for example, at 0 percent interest rate and for a maturity period of 5 years (Beirut Energy Forum, 2011). The CB is encouraging banks to use their reserves in order to give environmental loans. Accordingly, HSBC Bank gives a free solar water

heater with every home loan, the Lebanese Canadian Bank offers a zero interest loan on solar panels, and the "Banque Libano Française" is already financing two big green projects through the CB initiative (Bathiche and Houella, 2011).

In addition, the MoEW, in collaboration with LCEC and UNDP, launched a campaign to raise people's awareness on the importance of Compact Fluorescent Lamps (CFL) and offered a certain number of lamps without any cost to houses. Since the lighting system is responsible for 1.9 billion tons of CO_2 emissions globally, this initiative consisting of replacing incandescent lighting with CFLs, plays a role in promoting for green features' implementation inside homes (Abdel Gelil, 2009).

2.2.3 The role of construction companies in building green

Mezher (2011) emphasizes the role of the players in the construction industry in changing the conventional cities into sustainable ones. The value chain of the construction industry includes many layers, as shown in Figure 1. It consists of players directly involved in the design, construction, operations and use of buildings, showed in layer 1, others involved in the manufacturing of material and equipment used inside buildings, as in layer 2. Layer 3 shows parties involved in the infrastructure works, and layer 4 includes institutions involved in innovating and advocating the green building concept. The coordination and collaboration among these parties are highly needed in order not to compromise sustainability at any time of the project. The knowledge and experience of the architects and engineers (A/E), and of contractors should be of higher importance than the cost. The contribution of suppliers to the choice of material and equipment helps the construction firms in meeting the sustainability criteria required by the owners and developers.

According to Majdalani *et al.* (2006), the Owners/Developers (O/D) should develop and finance sustainable projects. The A/Es should address the design, construction, operation and maintenance of a building in a more sustainable way, and the contractors

should be more aware of the environmental impact of their works from extracting raw materials, to building facilities to using these facilities.

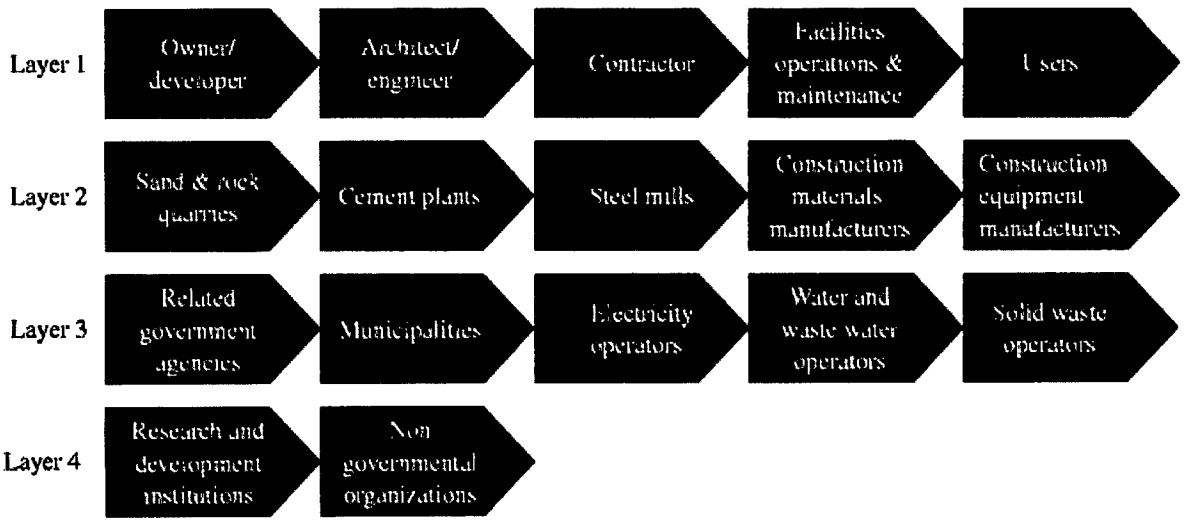

Figure 1. The construction industry value chain
Source: Mezher. (2011).

Majdalani *et al* (2006) demonstrate that A/Es show the highest awareness regarding the issue of designing and building green facilities; being legally responsible may be a stimulating factor. O/Ds are reasonably aware of the environmental impact of building green, but still give a higher importance to the cost and risk of being involved in such projects. Contractors are still focused on minimizing costs, regardless of the environmental impacts of their processes.

2.3 Environmental management and related factors

2.3.1 Environmental management of firms

Environmental management suggests that firms can gain competitive advantage while protecting the environment if the firm implements "best practices" of environmental management. Best practices can be process-based by redesigning production processes, recycling, and innovating. They can be also product-based when firms redesign products in a more environmentally aware way and advertise them (Christmann, 2000).

This section highlights the role of the economic structure of the company in its environmental decisions and it describes the role of the stakeholders.

Nowadays, firms are more aware of the importance and urgency of setting environmental targets and changing their strategic goals to involve sustainable innovation (Kahn, 2007). Khanna and Anton (2002) state that firms' environmental attitudes, previously only reactive to legislations, are now more proactive with the integration of environmental goals within the business strategy of the firms. However, we cannot deny that firms think primarily in terms of costs and environmental liabilities. Financial targets are of first priority. In fact, the development of green thinking during the last two decades is mirrored by the returns of the firms that are pioneers in environmental development. The Sustainability Index of Dow Jones, comprising the top 10 percent environmentally responsive companies, gives figures regarding this issue. The annual return of this index increased by 15.8 percent from 1996 to 2001 compared to 12.5 percent for the Dow Jones Global Index, reflecting the development of green thinking by firms (Paumgartten, 2003). Hence, companies are benefiting from the eco-investments on the financial scale.

Even when firms are engaging in environmental initiatives from the corporate social responsibility perspective, they think in terms of the economic self-interest of firms. In fact, managers want to maximize shareholder values according to the theory of the firm. The economic theory implies that firms seek to maximize returns, profits, and monetary values. This principle comes from the fact that humans always look for money and want to be as rich as possible, which makes them accumulate money throughout their life. The environment is only a commodity that abides by the selling and buying processes in the market without any concern for its interest (Trainer, 2011). Managers may not be that radical but their aim will be to gain competitive advantage. The solution is to be competitive through these environmental initiatives.

Khanna and Anton (2002) highlight the importance of stakeholders in the development of the environmental strategies. Companies tend to convey a good image to the public

and to stakeholders, and want to reduce market and public pressures. Statistics show that companies are highly influenced by regulations but the largest incentives are driven by the demand and pressure from consumers, investors, and competitive firms. Choi and Ng (2011) declare that the purchase intent of consumers is affected by the sustainability of the company, environmental sustainability having a greater impact than economic sustainability. Babiak and Trendafilova (2011) expressed after a survey done on sports firms that both strategic and legitimacy motivations influence the behavior of firms to implement environmentally efficient practices, strategic motives having the greater impact. These motives include image enhancement, customer satisfaction, and gaining competitive advantage. According to Fiedler and Deegan (2007), Australian companies working in the building and construction industry want to give legitimacy and credibility to their image; hence, they collaborate with organizations with "green credentials" to enhance their image.

Berle and Means (1932) define the modern corporation as the one that meets the demand of the owners and of society. The stakeholder theory was based on this definition. Stanford Research Institute was the first to use the term "Stakeholders" in 1963 as "those groups without whose support the organization would cease to exist" (Freeman, 1984, p. 33). The stakeholder theory serves two areas. First, it allows a more concerned approach to non-shareholders in a capitalist structure of companies. Second, it legitimizes the corporate social responsibility (CSR) approach by showing interest towards society and not only shareholders. After all, stakeholders are the groups for whom a company is responsible and not groups that interact with the firm and influence its decisions and objectives (Kaler, 2006). Stakeholder theory focuses on the values that firms create and deliver to stakeholders (Freeman *et al.,* 2004). According to Freeman (1984), stakeholder theory lies on the fact that firms are conscious of people that influence or are influenced by the work of the firm. Dyllick and Hockerts (2002) define corporate sustainable development as realizing the interest of current stakeholders, taking into account that the firm should serve also future stakeholders. Thus, there are the three pillars of corporate sustainability: economic, social, and environmental. In accordance, the firm should be financially effective, while reducing the environmental

impact of its operations and processes, and enhancing the social conditions of its stakeholders.

In order to be competitive, firms must give the customer what he is willing to pay for (Porter, 1985). Porter (1996) identifies three forms of positional advantage: the first one is due to the structure of the industry, the second comes from heterogeneity within the industry, and the last arises from relations that a firm develops with the constituents of the supply chain and other stakeholders. In order to gain this advantage, the firm uses its competencies according to the resource-based view. The positional advantage allows the firm to gain profits, thus to enhance its financial performance.

2.3.2 Complementary Resources and Capabilities of firms

Teece (1986) considers complementary assets as a vital element in order to link Environmental Management's best practices to competitive advantage. Complementary assets are resources needed by the firm in order to profit from a strategy, a technology, or an innovation (Teece, 1986).

Arnold (2010) expresses that sustainable innovation is required inside the firms in order to implement sustainable goals and categorizes the different sets of factors influencing green initiatives under organizational, cultural, and structural conditions of a firm. Organizational influencing factors are cooperation and communication with partners, consultation of advisors and experts, and spreading knowledge among employees. Cultural factors of high importance are the values and orientation of the management, and the openness of the company to external networks. Structural factors are the identification of sustainable market opportunities, the competition, state and regulations, and stakeholders' pressure.

In the same spirit, Blum-Kusterer and Hussain (2001) analyze UK and German pharmaceutical firms. He concludes that internal factors such as employees and management commitment may play a role if they were well managed.

According to James *et al.* (1999), factors that influence the environmental decision making of firms are divided into external, mediating, and moderating factors. The external factors are regulations, market behavior, and the welfare of society. Mediating factors comprise the leadership style and objectives of the company. Moderating factors are the ones that constrain firms' activities, such as its resources, skills, and capabilities. According to Fenwick (2007), education is highly needed; spreading the knowledge on the importance of sustainability among managers, employees, and customers help to embrace a sustainability approach by the firm. Along with education, firms should start to implement environmental practices so that the daily behavior of employees and managers change towards a more environmentally aware one. What makes ecological sustainability in the heart of any business strategy is the commitment of all parties inside the company (Fenwick, 2007).

According to the Resource-Based View of the Firm, corporations seek to have sustainable competitive advantage. In order to achieve this goal, the resource-based view of the firm stresses on the role of competencies- those competencies being rare, non-imitable and valuable resources that may be in the form of physical assets, employee skills or organizational processes (Barney, 1991; Rugman and Verbeke, 2002; Buysse and Verbeke, 2003). The choices of resources and procurement strategies are affected by internal profitability motives as well as external industry factors. Factor market imperfection makes the acquisition and deployment of resources different from one firm to another. "Consistent with a strategic orientation, the resource-based view assumes that economic motives drive resource procurement decisions and that economic factors in the firm's competitive and resource environments drive firm conduct and outcomes" (Oliver,1997, p.699). Resources are not easily imitable when they require highly specialized people or techniques to acquire, or are made through unknown actions, or when they are socially complex such as reputation of a firm which takes a time to be gained and cannot be modified easily (Barney, 1999; Bowman and Ambrosini, 2003). The resource-based view concludes that firms tend to be heterogeneous because of the scarcity, specialization, and inimitability of resources; having differentiated and hard to get resources makes the firm gain sustainable

competitive advantage (Oliver, 1997). CSR may be a way for firms to achieve sustainable competitive advantage. According to the resource-based view of the firm, corporations gain internal and external benefits by applying CSR. The former creates intangible resources specially related to employees' morale and skills. External benefits emerge in the form of good reputation of the firm, which affects clients, employees, and other stakeholders (Branco and Rodrigues, 2006). The resource-based view of the firm believes that corporations benefit from CSR through the creation of differentiated resources (McWilliams *et al.* 2006).

2.3.3 Entry Strategies of firms

Fiedler and Deegan (2007), express that firms choose to be leaders in their industry and set an example for other companies in the sector. However, not all firms can be leaders in their environmental practices. They need specific resources without which they cannot compete, hence cannot gain competitive advantage as explained in section 2.2.2.

On the other hand, an early entry strategy allows firms to incur lower environmental costs than its competitors at a certain time due to the learning curve effects (Lieberman and Montgomery, 1988). This means that companies that make an early entry into the market, profit from the position advantage they gain. Positional advantage allows firms to gain customers who share the environmental concern of the firm (Castelo and Lima, 2006). Also, they can develop their processes. When other firms follow, early entrants would have gained their position in the market. Others will fail to compete. Finally, when firms decide to enter the new market, they know about the incentives offered by the government and financial institutions; hence, they can benefit from reduced interest rates and other subsidies as detailed in section 2.2.2

2.3.4 Managerial interpretation of the environment

Many research described the role of managerial values in shaping the decisions of firms. Normative CSR arises from the personal values of managers. According to Carroll (1987), there are immoral, amoral, and moral managers and there is a necessity to have

managers with moral conscience. Moral managers play the role of a champion inside the firm. Especially when they are young, they have more awareness regarding critical issues such as sustainability and can help spread the culture inside the firm. CEOs will define the code of ethics based on their personal values when dealing with social issues, and the managerial discretion will frame the way CEOs transmit these values to the rest of the firm. The importance of these values being transmitted to the rest of the corporation is expressed in the expression "tone at the top" (Sirsly, 2009).

Hemingway (2005) claims that personal values may affect the organization even when they come from regular employees, not necessarily playing a managerial role. Personal values play a role in the decision making process of firms. The author defines corporate social entrepreneurship (CSE) as being a champion of social awareness inside companies despite the culture of the firm. CSE requires the person to have collectivist personal values. He will be either a frustrated or an active CSE according to the culture, whether it is unsupportive or supportive.

Sharma (2000) indicates that managerial interpretation of environmental issues as an opportunity rather than a threat influences the environmental strategy of the firm. Managerial interpretation is influenced by several factors. First of all, managers are influenced by the legitimation of environmental issues; they see the environment as an opportunity if they perceive that the environment concern should be at the heart of the firm's culture. Second, the time and the resources available to managers allow these managers to innovate and find solutions to environmental issues. These resources are termed discretionary slack. Discretion being the latitude of managerial actions, and slack being the "resource that enables an organization both to adjust to gross shifts in the external environment with minimal trauma, and to experiment with new postures in relation to that environment, either through new product introductions or through innovations in management style" (Hambrick and Finkelstein, 1987; Bourgeois, 1981, p.313). Managers' interpretation of strategic issues as opportunities or threats depends on "negative or positive emotional considerations, loss or gain considerations, and a sense of the issues as uncontrollable or controllable" (Sharma, 2000, p.4).

CHAPTER 3

PROCEDURES AND METHODOLOGY

In this chapter, the research questions and hypotheses are described, the theoretical model used in this study is explained, and the methodology is detailed.

3.1 Research Questions and Hypotheses

The research questions comprise the following:

1) How do the resources and capabilities of the firms influence managers' perceptions towards the natural environment as a competitive opportunity?
2) Are managers' perceptions and the firms' resources and capabilities linked to the way environmental management is evaluated and building green is prioritized?

The research hypotheses include:

1.1) H1: The greater the firm has complementary resources and capabilities, the more managers perceive the environment as an opportunity rather than a threat for the business.

2.1) H2: The greater the firm has complementary resources and capabilities, the more probable the firm develops a proactive environmental management comprising designing, developing or constructing green buildings.

2.2) H3: The more the managers perceive the environment as a business opportunity, the more the firm develops a proactive environmental management comprising designing, developing, or constructing green buildings.

3.2 Theoretical model

The model developed by López-Gamero et al. (2008) recognizes contexts that influence the pioneering entry strategy and proactive environmental management of a firm. These influencing factors are the complementary resources and capabilities (R&Cs) of the

firms and the managerial interpretation of the environment as a business opportunity. The authors identified three different R&Cs: (1) employees' involvement and knowledge levels, (2) action and involvement of the management in the firm's activity, and (3) the rapidity and flexibility with which the firm introduces change. When these R&Cs are available, managers perceive the environment as a competitive opportunity. This will lead to a pioneering entry strategy as well as to the development of a proactive environmental management system.

López-Gamero et al. (2008) developed a model showing all these variables based on the literature review and on data gathered from a qualitative study conducted on Spanish firms working in different sectors. The model was then tested using quantitative data obtained through a questionnaire distributed to the managers of other firms comprising hotels and firms affected by the Integrated Pollution Prevention and Control, an environmental Spanish law. Figure 2. below presents Lopez-Gamero's model showing all the variables and the relationships between them.

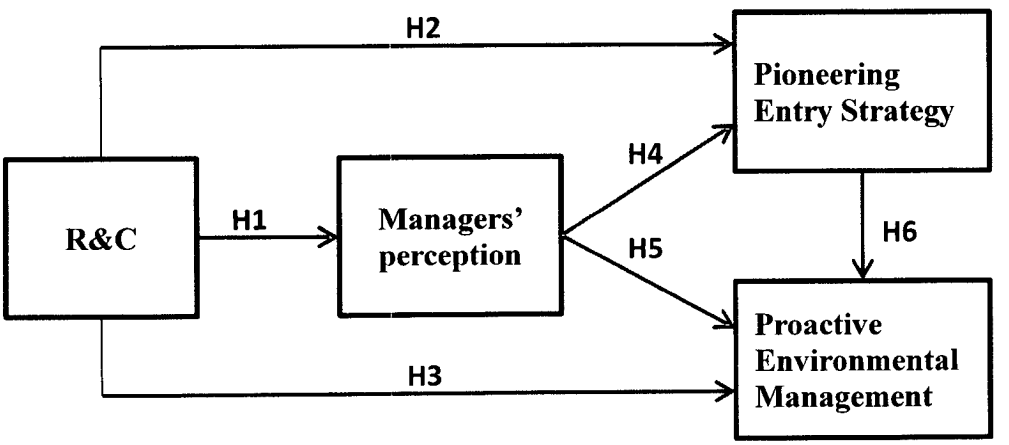

Figure 2. Model showing the impact of R&C and managers' perception on environmental strategies.
Source: Lopez-Gamero et al. (2008).

We adapted in our study the model shown above without the variable "Pioneering entry strategy" since the concept of green buildings is still new in Lebanon and the aim of getting certification for new projects started to emerge only recently.

The model we used showing the relationship between the variables and the hypotheses to test is shown in Figure 3 below.

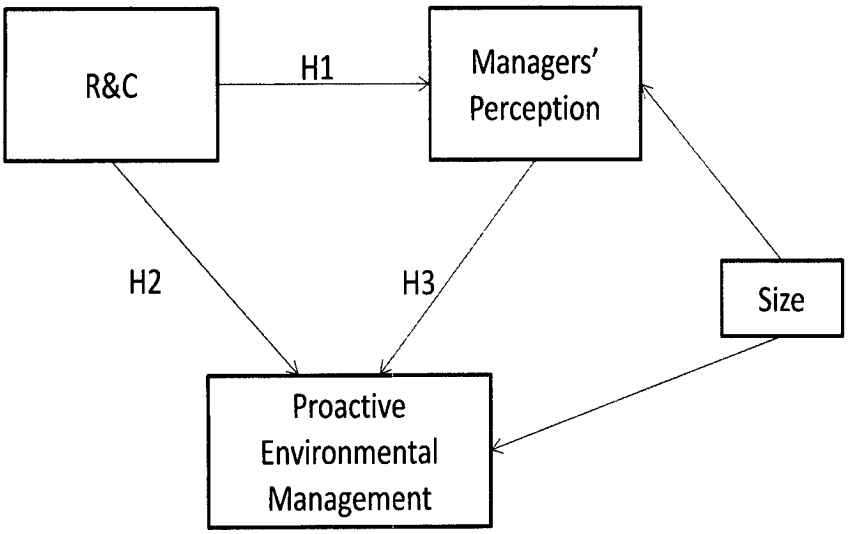

Figure 3. Model adopted in our study

3.3 Methods

This thesis is characterized by its originality due to the absence of in-depth studies about the studied topic in Lebanon; hence, the use of a quantitative approach is best-suited to give precise ideas about the subject.

3.3.1 Study Questionnaire

A questionnaire was needed to measure the impact of the resources and capabilities of the firms, in addition to the managerial perceptions of the environment, on the environmental strategy of the firms. The study questionnaire, composed of 51 questions, was adapted from the indicators of the different variables developed by Lopez-Gamero et al. (2008). The types of companies in the building industry for which the questionnaire was addressed are the ones directly involved in the choice of green features of the buildings; the firms are designers, contractors, and developers of buildings.

The questionnaire was designed to measure four variables: Complementary Resources and Capabilities labeled R&C, Managerial Perception of the environment as a business opportunity labeled MAN, Proactive Environmental Management of the firm labeled EM, and the size labeled SIZE. The indicators used to measure the variables R&C (Questions 6-16), MAN (Questions 17-23), and EM (Questions 24-51) were based on five-point Likert scale. The five-point scale consisted of the following: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA).
The questions used to measure the R&C, MAN, and the organizational aspects of the environmental management were based on the indicators used by Lopez-Gamero et al. (2008). However, the questions related to the technical aspects of environmental management were modified to match the green building development. The questions were adopted from the six categories used by LEED, the international assessment tool (LEEDuser, 2012).

The size of the firm, used as a control variable, was measured using the number of employees. According to the World Bank (2007), Lebanese firms are classified as micro, small, medium, and large. Micro firms have less than 10 employees, small firms have between 10 and 49 employees, and medium firms have between 50 and 99 employees. The companies having more than 99 employees are considered large. We will adopt this classification in our analysis of the results.

A pilot test of six questionnaires was performed on April 22, 2012 and May 2, 2012 to ensure all the questions are clear. The final part of the questionnaire, relative to the technical environmental management of the firms, was modified to ensure all the firms, especially those working in specialized systems, can answer properly. Minor modifications were also made to make questions clearer. The questionnaire and cover letter used in the study are detailed in Appendix 1.

3.3.2 Data Collection

The final questionnaire, addressed to environmental managers or senior managers responsible of the environmental strategy of the firms, was sent by e-mail during the second week of May 2012 to the targeted companies. The e-mail survey was performed in English since most of the firms consider the English language as the official language for communication.

We chose to target firms aiming a certification as a sign of their environmental pro-activeness. This choice was in accordance with Lopez-Gamero's sample that consisted of firms having the EMAS Regulation or the ISO 14001. The questionnaire was sent to all the firms in Lebanon that aim a certification. The population consists of 62 firms distributed between Architecture and Design Engineering firms, Owners/ Developers, and Contracting firms. These firms are developing, designing, or executing projects with the aim of getting a certification. The certifications targeted by these companies are the Leadership in Energy and Environmental Design (LEED) developed by the USGBC, the Building Research Environmental Assessment Method (BREEAM) developed in the UK, and the ARZ rating system, an assessment tool recently developed by the Lebanese Green Building Council (LGBC). The list of projects having or aiming a LEED certification was obtained through the registered project list published by USGBC in their official website (2011b). For the BREEAM rating system, environmental consulting firms were contacted (Eco Consulting, 2011; M. Karkour, personal communication, May 9, 2012; D. Hamra, personal communication, May 2, 2012). Finally, for ARZ rating system, the LGBC was consulted (S. Traboulsi, personal communication, May 6, 2012). The firms working on these projects constituted the targeted population, i.e. the 62 firms mentioned earlier.

The questionnaire was designed using online survey software, esurveyspro, by creating an account then registering the different questions and possible answers. After that, we sent an e-mail to the targeted companies explaining the purpose of the questionnaire, and

assuring that the answers will be anonymous and confidential. This method was used to obtain, as much as possible, non-biased answers.

The questionnaire was e-mailed during the second week of May. E-mails were sent to each company individually in order to personalize the survey. We sent reminder e-mails one week after the initial e-mail date, and at the beginning of each week for one month. Follow-up phone calls were made two weeks after the initial e-mailing to encourage responses. Forty three firms answered the questionnaire, which makes the response rate to be 69 percent.

3.4 Measurement of exogenous and endogenous variables

The questionnaire was used to measure the variables presented in the theoretical model. Since the model is causal, the terms endogenous and exogenous variables are used instead of dependent and independent variables. In fact, exogenous variables are the ones that are not affected by any other variable, like the Resources and Capabilities and the control variable Size in our case. They act as independent variables. Endogenous variables act like dependent variables for some variables and like independent variables for others. The variables MAN and EM are the endogenous variables. MAN, for example, acts as a dependent variable relatively to R&C, and as an independent variable for the variable EM. Each variable is measured using different indicators, thus has a corresponding number of questions as detailed in Table 3. The variable "Complementary Resources and Capabilities" is divided into three subcategories or factors: action and involvement of the management in the firm's activity, employees' learning and knowledge, and the rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions. Also, three factors are used to measure the organizational aspects to the EM variable: knowledge and learning in the development of environmental practices, link between the firm and the stakeholders during the development of its environmental management, and the link between environmental management and the firm's economic structure. Finally, the technical environmental management variable was divided into the optimization of material and optimization of processes used during the development of green buildings.

Table 3. Questionnaire items used to measure the variables

Variables	Items in the Questionnaire	Item #	Indicators
Size	Number of Employees	2	Size
Entry Strategy (ENTRS)*			
Time	When did the firm start working on green buildings?	5	entrs1
Certification	Type of certification obtained (if any)	4	entrs2
Complementary Resources and Capabilities (R&C)			
Action and involvement of the management in the firm's activity (F1RC)	The behavior of top management inspires the acceptance of change by all other organization members	6	RC1
	All the organization members know and share the firm's mission and objectives	7	RC2
Employees' learning and knowledge (F2RC)	Employees are aware of the progress made in their work areas (new knowledge, new practice development)	10	RC3
	The knowledge owned by individuals is transmitted and readily accessible to all their workmates	11	RC4
	Employees are able to take initiatives and decisions on their own thanks to the encouragement of authority delegation	12	RC5
Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions (F3RC)	We adapt to the new market conditions more rapidly and in better conditions than our competitors do	8	RC6
	We identify the new consumer and market opportunities because we establish a watch and monitoring system	9	RC7
	Our close relationships with suppliers and consumers allowed us to know at first hand and before the rest of firms the existence of new products or services, needs, new technologies or machinery	13	RC8
	On some occasions, other firms are consulted in order to improve in some specific aspects	14	RC9
	We are able to make rapid changes in building design	15	RC10
	We act in accordance with quality management principles and practices	16	RC11
Managerial Interpretation of environmental issues (MAN)			
	Environmental initiatives slow down growth	17	Man1
	The environment represents an opportunity for the firm	18	Man2
	The environment entails an additional cost	19	Man3
	Reasonable environmental management is not an option, but a necessity	20	Man4
	Environmental issues can only be attended during periods of economic prosperity, since they do not generate profit for the firm	21	Man5
	The solution to technological problems depends on new technologies, not on the actions that the firm may perform	22	Man6
	Concern for the environment is a passing trend	23	Man7

Table 3 (continued). Questionnaire items used to measure the variables

Variables	Items in the Questionnaire	Item #	Indicators
Environmental management (EM)			
Organizational aspects			
Organizational aspects linked to knowledge and learning in the development of environmental practices (F1emorg)	The firm communicates its environmental policy and strategy to all its employees	24	F1emorg1
	The management team encourages and participates in environmental management initiatives	25	F1emorg2
	Procedures are defined and documented for all the activities, products and processes which have a significant direct or indirect impact on the environment	26	F1emorg3
	The organizational structures (the organizational chart and the description of roles within the firm) are adapted or modified, if necessary, with the purpose of facilitating environmental management	27	F1emorg4
	Barriers to environmental communications are removed, including the encouragement for employees to communicate directly with their managers or with other firm employees	28	F1emorg5
	The employees have the environmental competencies required to develop their professional activity	29	F1emorg6
	When there is a wish to improve in some environmental aspect, collaboration is established with other firms so that they can help to achieve the improvement	30	F1emorg7
	Support is given to experimentation with new methods with the aim of identifying possible environmental improvement areas	31	F1emorg8
	Emergency procedures are established in order to respond to environmental problems and accidents	32	F1emorg9
	Priority is given to the purchase of less harmful components and /or products	35	F1emorg10
Connection link between the firm and the stakeholders during the development of its environmental management (F2emorg)	The suppliers' environmental record is evaluated	36	F2emorg1
	A standardized system is used for the treatment of consumer complaints	37	F2emorg2
	An environmental report is evaluated	38	F2emorg3
	Information about environmental management, such as data related to costs and procedures of building green, is regularly provided to suppliers, consumers, and institutions	39	F2emorg4
Link between environmental management and the firm's economic structure (F3emorg)	The elaboration of financial and operational plans and indicators is carried out taking into account the environmental policy	33	F3emorg1
	Environmental savings and costs are quantified in the budget	34	F3emorg2
	Our strategy addressing the issue of building green improves our cost position relative to our competitors by beneficiating from incentives offered by the government	40	F3emorg3
	Environmental activities enhance revenues through the emerging market of consumers who go for eco-friendly products	41	F3emorg4
	The company reduces liabilities and environmental risk by using less energy and sustainable products	42	F3emorg5

Table 3 (continued). Questionnaire items used to measure the variables

Variables	Items in the Questionnaire	Item #	Indicators
Technical aspects			
Optimization of material used during the development of green buildings (F1emtec)	The firm encourages the use of water- conserving toilets, urinals, and plumbing fixtures	43	F1emtec1
	The firm goes for energy efficient material, uses renewable energy, and heating and cooling systems with low refrigerants	45	F1emtec2
	The firm prefers regional materials to imported materials	47	F1emtec3
	The firm uses low emitting material generating less harm to the environment	48	F1emtec4
Optimization of processes used during the development of green buildings (F2emtec)	The firm encourages the use of water efficient techniques for landscaping	44	F2emtec1
	The firm encourages material reuse and recycling	46	F2emtec2
	The firm encourages controllable lighting and controllable thermal system	49	F2emtec3
	The firm encourages sustainable site selection, storm water management, and light pollution reduction	50	F2emtec4
	The firm is innovative in its projects and operations	51	F2emtec5

* The variable ENTRS was not used in the analysis after deciding to target only the firms aiming a certification for their projects

3.5 Statistical method

Our aim is to test the theoretical model described earlier and to verify the causal relationships between the different variables. The variables listed in the first column of Table 3 are called Latent Variables (LV). "A LV is a statistical device used to summarize the information in a collection of correlated response variables. A LV describes the information of a set of items and reduces them to a single new measure" (Sharma, 1996). The last column of Table 3 lists the different response variables, also called indicators. For each indicator, one item corresponds in the questionnaire.

There are both a measurement model and a structural model. The measurement model specifies the link between observed indicators and corresponding latent variables. The structural model indicates how the latent variables are linked between each other. A measurement model is developed as shown in Figure 4 below showing the different LVs and their corresponding response variables.

The relationship between the different LVs is shown in the structural model in Figure 5 below.

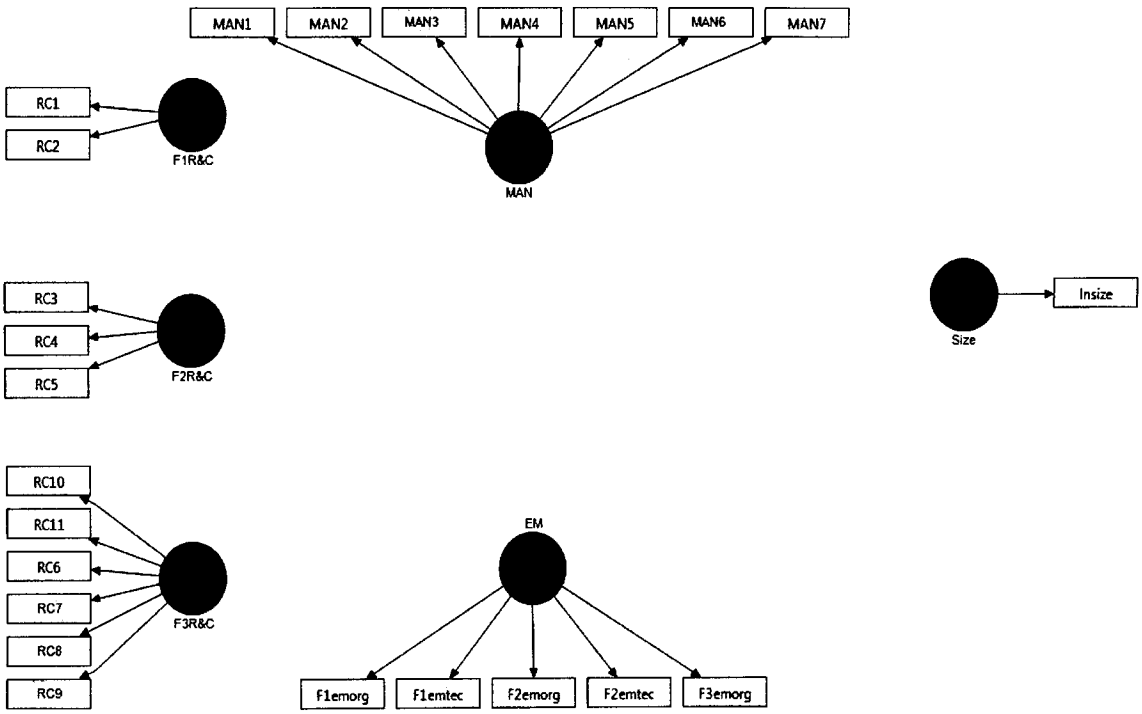

Figure 4. Measurement model showing the Latent Variables and their corresponding response variables.

Source: SmartPLS Output.

Note: Each of the indicators F1emorg, F2emorg, F3emorg, F1emtec and F2emtec is represented by a number of questions in the questionnaire. The factor extraction allowed representing each set of questions by one indicator only. F1emorg is the result of the factor extraction performed on items F1emorg1 to F1emorg10; F2emorg represents items F2emorg1 to F2emorg4, F3emorg represents items F3emorg1 to F3emorg5, F1emtec represents items F1emtec1 to F1emtec4, and F2emtec represents items F2emtec1 to F2emtec5.

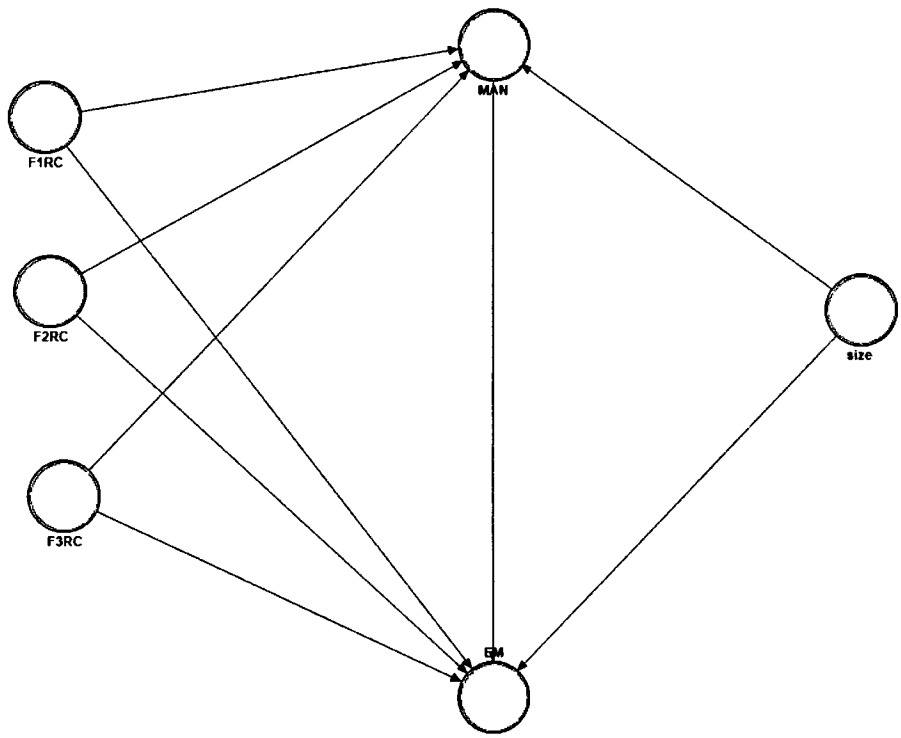

Figure 5. Structural model showing the causal relationships between the different latent variables
Source: SmartPLS Output.

We used two different statistical tools in order to analyze the results, namely SPSS and SmartPLS. First of all, the variable Environmental Management was treated in SPSS in order to perform a factor analysis. This method allows reducing the multiple response variables used for each construct F1emorg, F2emorg, F3emorg, F1emtec and F2emtec into one measure. This method is used to reduce the large number of indicators used to measure each of the five constructs. The Latent Variable EM can then be measured using these five factors as indicated in the measurement model in Figure 4.

Lopez-Gamero et al. (2008) used the software LISREL to test the hypotheses. LISREL, standing for Linear Structural Relations, is a program used to test covariance structure models. However, this software requires a large sample exceeding 100 or even 200 in order for the model to converge. Since the population tested is 62 firms (section 3.3.2), and the sample size is 43, we used another technique, which is Partial Least Squares

(PLS) Analysis. This method is used, like LISREL, for Structural Equation Models (SEM). While LISREL is a covariance-based SEM, PLS uses a variance-based or components based approach. First, it estimates the weight relations between constructs and their relative latent variables. These weights are then used as an input to calculate case values for each LV. These case values serve to calculate the relationships between the different LVs using regression equations (Haenlein and Kaplan, 2004). A software, called SmartPLS, is used to apply this method.

The sample data was extracted from the questionnaire after a thorough analysis of the answers. The outputs of SPSS and SmartPLS are then analyzed as detailed in chapter 4.

CHAPTER 4
FINDINGS

4.1 Introduction

After collecting the answers to the questionnaire, a total of 46 filled questionnaires were received. Three questionnaires were not completed, hence eliminated.
The results were entered into IBM SPSS 19 for analysis in order to perform a factor analysis for the variable EM. The result was used as an input to SmartPLS, then analyzed. The results are detailed in the following sections.

4.2 Main Results

4.2.1 Descriptive Statistics

Tables 4 to 9 below show the valid percent of the answers for the different indicators of the latent variables.

Complementary Resources and Capabilities

Most of the managers (53.5%) agree that their behavior influences employees to accept change in the organization. About 35% also strongly agree on this issue. Also, the majority (65.1%) believes that employees are aware of the mission and objectives of the firm as shown in Table 4.

Table 4. Action and involvement of the management in the firm's activity (F1RC)

Action and involvement of the management in the firm's activity	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
The behavior of top management inspires the acceptance of change by all other organization members (RC1)	-	-	11.6	**53.5**	**34.9**
All the organization members know and share the firm's mission and objectives (RC2)	2.3	4.7	11.6	**65.1**	16.3

Table 5 details the indicators related to employees' learning and knowledge. About half of the surveyed managers (53.5%) agree that employees are aware of the new knowledge and of the progress made in their working domains. They agree also that this knowledge is shared in the organization. The majority of the other half strongly agrees on these two issues with 39.5 percent for RC3 and 35.7 percent for RC4. As for the delegation, the majority (58.1%) agrees that employees are encouraged to take initiatives on their own.

Table 5. Employees' learning and knowledge (F2RC)

Employees' learning and knowledge	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
Employees are aware of the progress made in their work areas (new knowledge, new practice development) (RC3)	-	-	7	**53.5**	**39.5**
The knowledge owned by individuals is transmitted and readily accessible to all their workmates (RC4)	-	-	14.3	**50**	**35.7**
Employees are able to take initiatives and decisions on their own thanks to the encouragement of authority delegation (RC5)	-	7	14	**58.1**	20.9

As indicated in Table 6 below, more than half of the managers (58.1%) believe that they are more rapid than their competitors to adapt to the new market conditions. This indicator shows that these managers think they are being fast in the adaptation to the needs of the building sector.

As for the identification of new market opportunities through watch and monitoring systems, although half of the managers agree, 27.9 % are neutral vis-à-vis this issue; the reason may be that some firms are not using tools yet to identify the new market or have different approaches to do market research.

The majority of the respondents (65.1%) agree that they are benefiting from their relationships with consumers, suppliers, and other firms; the advantages are gaining

knowledge in some areas, gaining competitive advantage over other firms through the strategic window effect where they are the first to introduce a new concept, product, or using a certain innovative technology.

Less than half of the managers (46.5 %) agree that they can do rapid changes in building design. This number may be lower than that of the previous questions since some managers are still skeptic (27.9 % are neutral) regarding this issue; changing building design is not so simple since it requires specific competencies, a higher budget, and a market that accepts this change.

Finally, the majority of the managers (69.8%) agree that they act in accordance with quality management principles. The remaining 30.2% strongly agrees on this issue, meaning that the surveyed firms, that are entering the green building world, have already implemented quality management principles in their companies.

Table 6. Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions (F3RC)

Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
We adapt to the new market conditions more rapidly and in better conditions than our competitors do (RC6)	-	2.3	16.3	**58.1**	23.3
We identify the new consumer and market opportunities because we establish a watch and monitoring system (RC7)	-	11.6	**27.9**	**53.5**	7
Our close relationships with suppliers and consumers allowed us to know at first hand and before the rest of firms the existence of new products or services, needs, new technologies or machinery (RC8)	-	-	14	**65.1**	20.9
On some occasions, other firms are consulted in order to improve in some specific aspects (RC9)	-	-	14	**69.8**	16.3
We are able to make rapid changes in building design (RC10)	-	4.7	**27.9**	**46.5**	**20.9**
We act in accordance with quality management principles and practices (RC11)	-	-	-	**69.8**	**30.2**

Managerial interpretation of environmental issues

The majority of the managers (88.3%) do not believe that environmental initiatives slow down growth or that they do not generate profit for the firm. A high percentage of managers (93%) agree that the environment represents an opportunity for the firm and 88.4% emphasizes the necessity of having reasonable environmental management. Also, most of them (72.1%) agree on the importance of the actions taken by the firms to develop solutions to problems.

However, when it comes to the cost issue, the opinions vary: 41.9% agree that the environment entails an additional cost while 20.9 % disagree and 23.3% are neutral. This divergence in the opinions may have arisen since the concept of green buildings is still recent in Lebanon and there is still no precise data to evaluate the cost of building green. The figures are detailed in Table 7 below.

Table 7. Managerial interpretation of environmental issues (MAN)

Managerial interpretation of environmental issues	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
Environmental initiatives slow down growth (MAN1)	**39.5**	**48.8**	7	4.7	-
The environment represents an opportunity for the firm (MAN2)	-	-	7	**55.8**	**37.2**
The environment entails an additional cost (MAN3)	4.7	**20.9**	**23.3**	**41.9**	9.3
Reasonable environmental management is not an option, but a necessity (MAN4)	-	2.3	9.3	**58.1**	**30.2**
Environmental issues can only be attended during periods of economic prosperity, since they do not generate profit for the firm (MAN5)	**30.2**	**58.1**	2.3	9.3	-
The solution to technological problems depends on new technologies, not on the actions that the firm may perform (MAN6)	11.6	**72.1**	14	2.3	-
Concern for the environment is a passing trend (MAN7)	**39.5**	**51.2**	4.7	2.3	2.3

Environmental Management

The different indicators relative to the organizational aspects of Environmental Management are shown in Table 8.

For the knowledge and learning in the development of environmental practices, 10 indicators are assessed. The majority of the respondents (76.7% and 78.6%) respectively agree that the firm communicates its environmental policy to its employees and that management team participates in environmental management initiatives. Also, around 62.8% of the respondents believe that employees are encouraged to talk directly with their managers and other employees in order to reduce barriers to environmental management. The same percentage agrees that their employees have the environmental competencies necessary to do their work. About 79.1% of the managers agree that their firms collaborate with other firms when necessary, which is consistent with RC9 where 69.8% agreed that other firms are consulted in order to improve in some specific areas. Consistent with the above, 58.1% of the managers expressed that they purchase products having less harm to the environment.

However, regarding the development and documentation of procedures for all activities related to the environment, only 37.2 % agree and 41.9%, is neutral vis-à-vis this issue. The same distribution of answers arises for the adaptation of the organization structure to meet environmental needs, since 50% answered neutral while 37.2% agreed.
A high percentage of managers (46.5%) are also neutral regarding the support given to experimentation with new methods in order to improve in environmental areas and the establishment of emergency procedures in order to solve environmental problems.
It is worth noting after examining these figures that activities related to documentation, change in structure, emergency procedures, and experimentation are still not sufficiently implemented. The reason may be that these measures are usually taken at a later stage of the development of environmental initiatives. The surveyed companies, who are still new in the introduction of environmental initiatives, did not implement these measures yet.

Regarding the link between the firm and its stakeholders during the development of environmental initiatives, it is obvious that most of the Lebanese firms surveyed do not have yet an environmental record for suppliers, or a standardized system for treating consumer complaints, and do not evaluate an environmental report. Since 58.1%, 53.5%, and 44.2% of the surveyed managers respectively answered neutral on these three issues, we can infer that they did not develop or do not see their importance yet. However, half of them agreed that they are dispatching information related to the costs and procedures of building green to suppliers, consumers, and institutions. We can explain this by the attention these managers seek regarding their environmental initiatives. This is seen from the high number of articles published in Lebanese journals talking about green buildings and the yearly conferences held around this same issue (Beirut Energy Forum, 2011; Build it Green Conference, 2011; Bathiche, 2011; Bathiche and Rizk, 2011; Majdalani, 2011; Mezher, 2011).

Finally, we assess the answers relevant to the link between environmental initiatives and the firm's economic structure. It is evident that the majority of the managers are considering the environmental initiatives when elaborating financial and operation plans, and environmental savings and costs are quantified in the budget with 55.8% and 58.1% successively agreeing on these two points.

In addition, they believe that these environmental initiatives enhance revenues through the rising demand for eco-friendly products. More than half of these managers believe that they are reducing liabilities and environmental risk by using sustainable products Surprisingly, only 44.2% agree that the strategy they are following to build green can enhance their cost position relatively to competitors by benefiting from the incentives offered by the government. About 39% are still neutral regarding this issue. As explained in the literature review, the Lebanese Government and the Central Bank with the cooperation of the EU are launching initiatives to help developers and engineering firms getting loans with low interest rates for environmental projects. These initiatives should be more publicized in order to encourage concerned firms to adopt them and benefit from the savings they can incur.

Table 8. Organizational aspects of Environmental Management

Organizational Aspects	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
Knowledge and learning in the development of environmental practices (F1emorg)					
The firm communicates its environmental policy and strategy to all its employees (F1emorg1)	-	2.3	4.7	**76.7**	16.3
The management team encourages and participates in environmental management initiatives (F1emorg2)	-	2.4	4.8	**78.6**	14.3
Procedures are defined and documented for all the activities, products and processes which have a significant direct or indirect impact on the environment (F1emorg3)	-	9.3	**41.9**	**37.2**	11.6
The organizational structures (the organizational chart and the description of roles within the firm) are adapted or modified, if necessary, with the purpose of facilitating environmental management (F1emorg4)	-	4.8	**50**	**42.9**	2.4
Barriers to environmental communications are removed, including the encouragement for employees to communicate directly with their managers or with other firm employees (F1emorg5)	-	4.7	20.9	**62.8**	11.6
The employees have the environmental competencies required to develop their professional activity (F1emorg6)	-	2.3	20.9	**62.8**	14
When there is a wish to improve in some environmental aspect, collaboration is established with other firms so that they can help to achieve the improvement (F1emorg7)	-	-	11.6	**79.1**	9.3
Support is given to experimentation with new methods with the aim of identifying possible environmental improvement areas (F1emorg8)	-	7	**46.5**	**41.9**	4.7
Emergency procedures are established in order to respond to environmental problems and accidents (F1emorg9)	2.3	11.6	**46.5**	**39.5**	-
Priority is given to the purchase of less harmful components and /or products (F1emorg10)	-	-	25.6	**58.1**	16.3

Table 8 (continued). Organizational aspects of Environmental Management

Organizational Aspects	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
Connection link between the firm and the stakeholders during the development of its environmental management (F2emorg)					
The suppliers' environmental record is evaluated (F2emorg1)	-	9.3	**58.1**	**30.2**	2.3
A standardized system is used for the treatment of consumer complaints (F2emorg2)	-	7	**53.5**	**39.5**	-
An environmental report is evaluated (F2emorg3)	-	14	**44.2**	**39.5**	2.3
Information about environmental management, such as data related to costs and procedures of building green, is regularly provided to suppliers, consumers, and institutions (F2emorg4)	-	11.6	34.9	**51.2**	2.3
Link between environmental management and the firm's economic structure (F3emorg)					
The elaboration of financial and operational plans and indicators is carried out taking into account the environmental policy (F3emorg1)	-	2.3	20.9	**55.8**	20.9
Environmental savings and costs are quantified in the budget (F3emorg2)	-	2.3	**32.6**	**58.1**	7
Our strategy addressing the issue of building green improves our cost position relative to our competitors by beneficiating from incentives offered by the government (F3emorg3)	-	11.6	**39.5**	**44.2**	4.7
Environmental activities enhance revenues through the emerging market of consumers who go for eco-friendly products (F3emorg4)	2.3	-	4.7	**69.8**	23.3
The company reduces liabilities and environmental risk by using less energy and sustainable products (F3emorg5)	-	4.7	27.9	**55.8**	11.6

The different indicators relative to the two factors of the technical aspects of Environmental Management are shown in Table 9. For the optimization of material used during the development of green buildings, four indicators are assessed. The majority of the respondents (85%, 100%, and 90%) respectively agrees and/or strongly agrees on the use of water efficient products, energy efficient material, renewable energy, heating and cooling systems with low refrigerants, and low emitting products

generating less harm to the environment. Around 83% also prefer regional material to imported material.

Respondents in their majority (90.2%, 75.6%, and 88.1%) respectively agree on the optimization of processes used such as water efficient techniques, material reuse and recycling, controllable systems such as using photo-sensors and individual control for lighting and controllable thermal system. They encourage also sustainable site selection, storm water management, and light pollution reduction in their majority (90%). Finally, most of the firms (86%) think they are being innovative in their projects and operations.

These results are expected since the targeted companies are seeking environmental certifications for their projects. Hence, they are implementing these measures, which constitute the credits their projects have to comply with in order to get the certification. The variability in the answers is caused by the fact that a project may not comply with a certain credit or another according to the type of certification sought (certified, silver, gold, or platinum) as detailed in the literature review.

Table 9. Technical aspects of Environmental Management

Technical Aspects	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
Optimization of material used during the development of green buildings (F1emtec)					
The firm encourages the use of water- conserving toilets, urinals, and plumbing fixtures (F1emtec1)	-	7.5	7.5	**55**	30
The firm goes for energy efficient material, uses renewable energy, and heating and cooling systems with low refrigerants (F1emtec2)	-	-	-	**50**	**50**
The firm prefers regional materials to imported materials (F1emtec3)	-	5	5	**62.5**	27.5
The firm uses low emitting material generating less harm to the environment (F1emtec4)	-	-	17.1	**43.9**	**39**

Table 9 (continued). Technical aspects of Environmental Management

Technical Aspects	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Valid Percent (%)				
Optimization of processes used during the development of green buildings (F2emtec)					
The firm encourages the use of water efficient techniques for landscaping (F2emtec1)	-	-	9.8	**56.1**	**34.1**
The firm encourages material reuse and recycling (F2emtec2)	-	-	24.4	**51.2**	24.4
The firm encourages controllable lighting and controllable thermal system (F2emtec3)	-	2.4	9.5	**50**	**38.1**
The firm encourages sustainable site selection, storm water management, and light pollution reduction (F2emtec4)	-	-	10	**67.5**	22.5
The firm is innovative in its projects and operations (F2emtec5)	-	-	14.3	**50**	**35.7**

4.2.2 Reliability and Factor analysis of the variable Environmental Management

As detailed in chapter 3, the variable Environmental management has five different factors (F1emorg, F2emorg, F3emorg, F1emtec, and F2emtec). Each of these factors has a large number of indicators, and we need to extract one variable out of each set of these indicators in order to represent these factors in the measurement model. For this purpose, we perform a factor analysis, which is "an analytic technique that permits the reduction of a large number of correlated variables to a smaller number of latent dimensions" (Tinsley and Tinsley, 1987, p.414). The variables extracted will be considered as the indicators of the variable EM. According to the same authors, factor analysis uses the correlation matrix and gives the output that best describes the variance in this matrix. In order to obtain a reliable scale, we assess first the reliability of the indicators constituting each factor to retain reliable items and delete non-reliable ones. Then, we perform the factor extraction.

4.2.2.1 Reliability Analysis

Reliability of the different indicators for each factor is assessed by analyzing Cronbach's Alpha and the corrected item-total correlations. "Corrected item-total correlations reflect the extent to which any one item is correlated with the remaining items in a set of items under consideration" (Bala and Sandhu, 2011, p.6). Malhotra (2007) recommends deleting the items having low corrected item-total correlations. Hence, values below 0.2 should be deleted (Kerlinger, 1978). In addition, Cronbach's Alpha's value should be higher than 0.6 (Vinzi et al., 2010).

These two criteria will be measured for the indicators of the factors F1emorg, F2emorg, F3emorg, F1emtec, and F2emtec.

Table 10 below shows the values of Cronbach's Alpha for each of the factors. Scale reliability is proved for factors F3emorg, F1emtec and F2emtec since the value of Cronbach's Alpha is higher than 0.6. However, F1emorg and F2emorg are not reliable if all the items that constitute them are considered.

Table 10. Values of Cronbach's Alpha for the different factors

Factor	Description	Cronbach's Alpha
F1emorg	Knowledge and learning in the development of environmental practices	0.55
F2emorg	Connection link between the firm and the stakeholders during the development of its environmental management	0.54
F3emorg	Link between environmental management and the firm's economic structure	0.69
F1emtec	Optimization of material used during the development of green buildings	0.68
F2emtec	Optimization of processes used during the development of green buildings	0.68

Now, we assess corrected item-total correlations for each factor. Tables 11 to 15 below show the results for the different factors and highlight the values lower than the 0.2 cut-off value.

Table 11. Corrected item-total correlations for the indicators of F1emorg

Indicator	Corrected Item-total correlations
F1emorg1	0.34
F1emorg2	0.62
F1emorg3	0.22
F1emorg4	**0.12**
F1emorg5	**-0.14**
F1emorg6	0.53
F1emorg7	0.27
F1emorg8	0.27
F1emorg9	**0.05**
F1emorg10	0.36

Items F1emorg4, F1emorg5, and F1emorg9 should be deleted from the scale F1emorg since they did not prove to be reliable.

Table 12. Corrected item-total correlations for the indicators of F2emorg

Indicator	Corrected Item-total correlations
F2emorg1	0.39
F2emorg2	**0.12**
F2emorg3	0.34
F2emorg4	0.47

F2emorg2 should be deleted from the scale F2emorg since it did not prove to be reliable

Table 13. Corrected item-total correlations for the indicators of F3emorg

Indicator	Corrected Item-total correlations
F3emorg1	0.34
F3emorg2	0.26
F3emorg3	0.59
F3emorg4	0.49
F3emorg5	0.55

All items are reliable. This result is consistent with the scale reliability of factor F3emorg proved by its Cronbach's Alpha's value of 0.69.

Table 14. Corrected item-total correlations for the indicators of F1emtec

Indicator	Corrected Item-total correlations
F1emtec1	0.46
F1emtec2	0.43
F1emtec3	0.39
F1emtec4	0.62

All items are reliable. This result is consistent with the scale reliability of factor F1emtec proved by its Cronbach's Alpha's value of 0.68.

Table 15. Item-total correlations for the indicators of F2emtec

Indicator	Corrected Item-total correlations
F2emtec1	0.29
F2emtec2	0.24
F2emtec3	0.35
F2emtec4	**0.17**
F2emtec5	0.44

Item F2emtec4 should be deleted from the scale F2emtec since it did not prove to be reliable.

After deletion of the non-reliable items, Cronbach Alpha's value of F1emorg, F2emorg, and F2emtec are respectively 0.65, 0.61, and 0.69.

All items accounted for are now reliable. Hence, we can perform a factor extraction.

4.2.2.2 Dimension Reduction

In order to reduce the set of items into one indicator for each factor, a factor extraction is performed using Principal Component method. We measure first the adequacy of data

for factor analysis using Kaiser-Meyer-Oklin (KMO), which is a Measure of Sampling Adequacy (MSA). A minimum value of 0.5 is required for KMO (Fied, 2009). Table 16 below shows that the value of KMO for all the factors is acceptable indicating that the sample size is adequate for factor extraction.

Table 16. Values of KMO for the different factors

Factor	Description	KMO
F1emorg	Knowledge and learning in the development of environmental practices	0.65
F2emorg	Connection link between the firm and the stakeholders during the development of its environmental management	0.59
F3emorg	Link between environmental management and the firm's economic structure	0.70
F1emtec	Optimization of material used during the development of green buildings	0.53
F2emtec	Optimization of processes used during the development of green buildings	0.65

We follow the rule proposed by Kaiser (1960) which consists of retaining the factors having an eigenvalue greater than 1. According to this rule, we obtain one factor for F2emorg, F3emorg, F1emtec, and F2emtec. Two factors are obtained for F1emorg for which we perform a weighted average, the weights being the ratio of the individual variance of each component to the cumulative variances of the two components having an eigenvalue greater than 1. The factors extracted are saved as new variables labeled F1emorg, F2emorg, F3emorg, F1emtec, and F2emtec. The total variances accounted for by the reduced scales are listed in Table 17.

Table 17. Total variance extracted

	F1emorg	F2emorg	F3emorg	F1emtec	F2emtec
Variance (%)	50.6	57.3	45.4	52.5	52.6

The new values of the factors F1emorg, F2emorg, F3emorg, F1emtec, and F2emtec are saved in the data file and exported to the software SmartPLS for analysis.

4.2.3 Results of SmartPLS

As detailed in chapter 3, our model is a network of relationships linking latent variables measured by observed indicators; the model is referred to as a Structural Equation Model (SEM). Our aim is to assess the reliability of the observed variables and then to assess the significance of the relationship between the different latent variables. This test will allow accepting or rejecting the hypotheses. For this purpose, we chose Partial Least Squares-Path Modeling (PLS-PM) as a statistical approach. PLS is a component-based approach where "causality is formulated in terms of linear conditional expectation" (Vinzi et al., 2010, p.17). This tool solves first the different blocks of the measurement model, and then estimates the path coefficients between the different latent variables in the structural model.

The structural equation model linking the different latent variables can be expressed by the following formula:

$$\eta_n = \mathrm{B}\eta_n + \Gamma\eta_x + \xi$$

where η_n is the subvector of endogenous latent variables, η_x the subvector of exogenous latent variables, ξ a residual vector, and B and Γ two conformable matrices. The measurement model showing the relation between each latent variable η_q and its corresponding indicators is expressed by the following equation:

$$y_{pq} = \gamma_{pq}\eta_q + \epsilon_{pq}$$

where y_{pq} is the vector of p indicators for the q^{th} latent variable, γ_{pq} is the vector of loadings, and ϵ_{pq} is the vector of measurement errors.

The data obtained after the factor analysis in SPSS was exported to the software SmartPLS.

A measurement model was first drawn. We assess first the homogeneity and uni-dimensionality of the different blocks.

First of all, individual item reliability is assessed. Theoretically, only values of the loadings which are higher than 0.7 are acceptable. However, one can keep indicators with loadings' values higher than 0.5 if the LV has other indicators having high values of the loadings (Chin, 1998; Barclay et al, 1995). The indicators are observed and whenever the values of the loadings do not meet the criteria explained above, indicators are eliminated. Tables 18, 19, and 20 below show the values of the loadings of the different indicators for the different latent variables

Table 18. Loadings of the indicators of the exogenous variables related to Complementary Resources and Capabilities

Latent Variable	Indicators	Loadings (γ_{pq})
Action and involvement of the management in the firm's activity (F1RC)	The behavior of top management inspires the acceptance of change by all other organization members (RC1)	0.868 (γ_{11})
	All the organization members know and share the firm's mission and objectives (RC2)	0.808 (γ_{12})
Employees' learning and knowledge (F2RC)	Employees are aware of the progress made in their work areas (new knowledge, new practice development) (RC3)	0.770 (γ_{21})
	The knowledge owned by individuals is transmitted and readily accessible to all their workmates (RC4)	0.884 (γ_{22})
	Employees are able to take initiatives and decisions on their own thanks to the encouragement of authority delegation (RC5)	0.342 (γ_{23}) *
Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions (F3RC)	We adapt to the new market conditions more rapidly and in better conditions than our competitors do (RC6)	0.575 (γ_{31})
	We identify the new consumer and market opportunities because we establish a watch and monitoring system (RC7)	0.470 (γ_{32}) *
	Our close relationships with suppliers and consumers allowed us to know at first hand and before the rest of firms the existence of new products or services, needs, new technologies or machinery (RC8)	0.558 (γ_{33})
	On some occasions, other firms are consulted in order to improve in some specific aspects (RC9)	0.320(γ_{34}) *
	We are able to make rapid changes in building design (RC10)	0.800 (γ_{35})
	We act in accordance with quality management principles and practices (RC11)	0.362 (γ_{36}) *

Table 19. Loadings of the indicators of the endogenous variable Managerial Interpretation of Environmental Issues (MAN)

Latent Variable	Indicators	Loadings (γ_{pq})
Managerial interpretation of environmental issues (MAN)	Environmental initiatives slow down growth (MAN1)	0.837 (γ_{41})
	The environment represents an opportunity for the firm (MAN2)	0.916 (γ_{42})
	The environment entails an additional cost (MAN3)	0.056 (γ_{43}) *
	Reasonable environmental management is not an option, but a necessity (MAN4)	0.698 (γ_{44})
	Environmental issues can only be attended during periods of economic prosperity, since they do not generate profit for the firm (MAN5)	0.631 (γ_{45})
	The solution to technological problems depends on new technologies, not on the actions that the firm may perform (MAN6)	0.604 (γ_{46})
	Concern for the environment is a passing trend (MAN7)	0.343 (γ_{47}) *

Table 20. Loadings of the indicators of the endogenous variable Environmental Management (EM)

Latent Variable	Indicators	Loadings (γ_{pq})
Environmental Management (EM)	Knowledge and learning in the development of environmental practices (F1emorg)	0.839 (γ_{51})
	Connection link between the firm and the stakeholders during the development of its environmental management (F2emorg)	0.526 (γ_{52})
	Link between environmental management and the firm's economic structure (F3emorg)	0.786 (γ_{53})
	Optimization of material used during the development of green buildings (F1emtec)	0.514 (γ_{54})
	Optimization of processes used during the development of green buildings (F2emtec)	0.862 (γ_{55})

After eliminating the indicators whose loading are <0.5, we rerun SmartPLS and obtain the values of the loadings and significance of the different indicators for the revised measurement model as shown in Table 21 below.

Table 21. Loadings, t-values, and significance for all manifest variables

Indicators	Loadings (γ_{pq})	T-Value	Significance
The behavior of top management inspires the acceptance of change by all other organization members (RC1)	0.865 (γ_{11})	26.22	***
All the organization members know and share the firm's mission and objectives (RC2)	0.812 (γ_{12})	13.06	***
Employees are aware of the progress made in their work areas (new knowledge, new practice development) (RC3)	0.760 (γ_{21})	10.59	***
The knowledge owned by individuals is transmitted and readily accessible to all their workmates (RC4)	0.891 (γ_{22})	25.37	***
We adapt to the new market conditions more rapidly and in better conditions than our competitors do (RC6)	0.618 (γ_{31})	6.24	***
Our close relationships with suppliers and consumers allowed us to know at first hand and before the rest of firms the existence of new products or services, needs, new technologies or machinery (RC8)	0.609 (γ_{33})	6.00	***
We are able to make rapid changes in building design (RC10)	0.867 (γ_{35})	18.32	***
Environmental initiatives slow down growth (MAN1)	0.847 (γ_{41})	26.39	***
The environment represents an opportunity for the firm (MAN2)	0.923 (γ_{42})	72.32	***
Reasonable environmental management is not an option, but a necessity (MAN4)	0.704 (γ_{44})	11.58	***
Environmental issues can only be attended during periods of economic prosperity, since they do not generate profit for the firm (MAN5)	0.597 (γ_{45})	7.83	***
The solution to technological problems depends on new technologies, not on the actions that the firm may perform (MAN6)	0.630 (γ_{46})	7.61	***
Knowledge and learning in the development of environmental practices (F1emorg)	0.826 (γ_{51})	25.77	***
Connection link between the firm and the stakeholders during the development of its environmental management (F2emorg)	0.505 (γ_{52})	5.91	***
Link between environmental management and the firm's economic structure (F3emorg)	0.789 (γ_{53})	19.09	***
Optimization of material used during the development of green buildings (F1emtec)	0.542 (γ_{54})	5.62	***
Optimization of processes used during the development of green buildings (F2emtec)	0.866 (γ_{55})	32.55	***

Note: *** Significant at 99.9%; the critical z-value is 3.310

As clearly shown, all the loadings are significant at the 99.9% level.
Now we assess the reliability, composite reliability, and convergent and discriminant validity of the latent variables. Single and Composite Reliability measure the extent to which a variable "is consistent in what it intends to measure" (Vinzi et al., 2010, p. 448).

Single reliability is measured by the value of Cronbach's alpha. A value > 0.7 is considered a very good indicator of reliability. However, many studies adopt the value of 0.6 (Vinzi et al., 2010). The results obtained are shown in Table 22.

Table 22. Cronbach's Alpha for the latent variables

Latent Variable	Cronbach's Alpha
Action and involvement of the management in the firm's activity (F1RC)	0.58
Employees' learning and knowledge (F2RC)	0.55
Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions (F3RC)	0.53
Managerial interpretation of environmental issues (MAN)	0.80
Environmental Management (EM)	0.76

The variables MAN and EM prove to be reliable according to Cronbach's Alpha measure. However, F1RC, F2RC, and F3RC do not meet the criteria of reliability since Cronbach Alpha's values are less than 0.6. Chin (1998) considers that Cronbach's Alpha is not the best measure of reliability since it estimates that all the indicators of a latent variable are of the same importance to the latent variable. He proposes to measure Dillon-Goldstein's ρ since it is based on the loadings of the indicators calculated. Dillon-Goldstein's (or Joreskog's) Rho is an indicator of composite reliability. Values higher than 0.7 are indicators of the homogeneity of latent variables (Vinzi et al., 2010). Table 23 below shows that all latent variables have a composite reliability higher than 0.7. Hence, all the latent variables prove to be reliable.

Table 23. Composite Reliabillity of the latent variables

Latent Variable	Composite Reliability (ρ)
Action and involvement of the management in the firm's activity (F1RC)	0.82
Employees' learning and knowledge (F2RC)	0.81
Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions (F3RC)	0.74
Managerial interpretation of environmental issues (MAN)	0.86
Environmental Management (EM)	0.84

Now we measure convergent validity, which is "the extent to which blocks of items strongly agree (i.e., converge) in their representation of the underlying construct they were created to measure" (Vinzi et al., 2010, p.674). We look at the Average Variance Explained (AVE), which measures the variance of the indicators corresponding to a latent variable relative to the total variance including the measurement error. All the values are higher than the acceptable 0.5 value, meaning that each latent variable is explained by its own indicators. Values of AVE are detailed in Table 24 below.

Finally, we measure discriminant validity, which is the extent to which certain construct, or latent variable differs from other constructs in the measurement model. In order to measure discriminant validity, AVE should be greater than the variance between the construct and other constructs in the model, or the squared correlations between these constructs (Vinzi et al., 2010). Hence, we compare the square root of the AVE to the correlations between the different variables and we observe that $\sqrt{AVE}$is always higher. This means that the variance explained by any construct is higher than the variance shared with any other construct in the model (Vinzi et al., 2010).
The values of AVE and correlations between the variables are shown in Table 24 below.

Table 24. Average Variance Extracted compared to correlations between variables

Correlation	EM	F1RC	F2RC	F3RC	MAN	SIZE
EM	1					
F1RC	0.63	1				
F2RC	0.49	0.44	1			
F3RC	0.60	0.44	0.51	1		
MAN	0.64	0.47	0.47	0.53	1	
SIZE	-0.18	-0.05	-0.05	-0.19	0.20	1
$\sqrt{AVE}$	0.72	0.84	0.83	0.71	0.75	1
AVE	0.52	0.70	0.69	0.50	0.56	1

Now, quality indexes are assessed in order to evaluate the measurement model, the structural model, and the overall model. There is no global fitting function in PLS. We will study the communality index instead. The communality index measures the goodness of each block of the measurement model; it explains how the variability of the indicators is explained by the scores of their corresponding latent variables. The values of the communalities are shown in Table 25 below. The average weighted communality index is obtained by summing the product of the communality and the number of indicators for each block, and then dividing by the total number of indicators. The value of 0.57 is acceptable since it meets the minimum value of 0.5 required (Vinzi et al., 2010).

Table 25. Communality of the latent variables

Latent Variable	Communality
Action and involvement of the management in the firm's activity (F1RC)	0.7
Employees' learning and knowledge (F2RC)	0.69
Rapidity and flexibility with which the firm introduces change to adapt to the new environmental conditions (F3RC)	0.50
Managerial interpretation of environmental issues (MAN)	0.56
Environmental Management (EM)	0.52

In order to measure the fit of the structural model, R^2 is evaluated for each endogenous variable. R^2 of the variable EM is 0.64 and of variable MAN is 0.46, which means that 64% of the variability in EM and 46% of the variability in MAN are explained by the model's variables.

Most importantly, we will look at the path coefficients explaining the relation between the different variables. Using the bootstrap method in SmartPLS, we will be able to test the significance of these coefficients as detailed in Table 26.

Table 26. Path Coefficients

Path	Path Coefficient	T-Value	Significance
F1RC ⟶ MAN	0.229	2.563	**
F2RC ⟶ MAN	0.189	1.658	*
F3RC ⟶ MAN	0.391	3.600	****
F1RC ⟶ EM	0.334	3.975	****
F2RC ⟶ EM	0.048	0.554	
F3RC ⟶ EM	0.176	1.649	*
MAN ⟶ EM	0.411	3.63	****
SIZE ⟶ MAN	0.301	2.679	***
SIZE ⟶ EM	-0.209	1.748	*

Note: ****, ***, ** and * respectively significant at 99.9%, 99%, 95% and 90%;
The critical z-values are respectively 3.310, 2.587, 1.964, and 1.645.

All the numbers detailed above are shown on Figure 6 below.

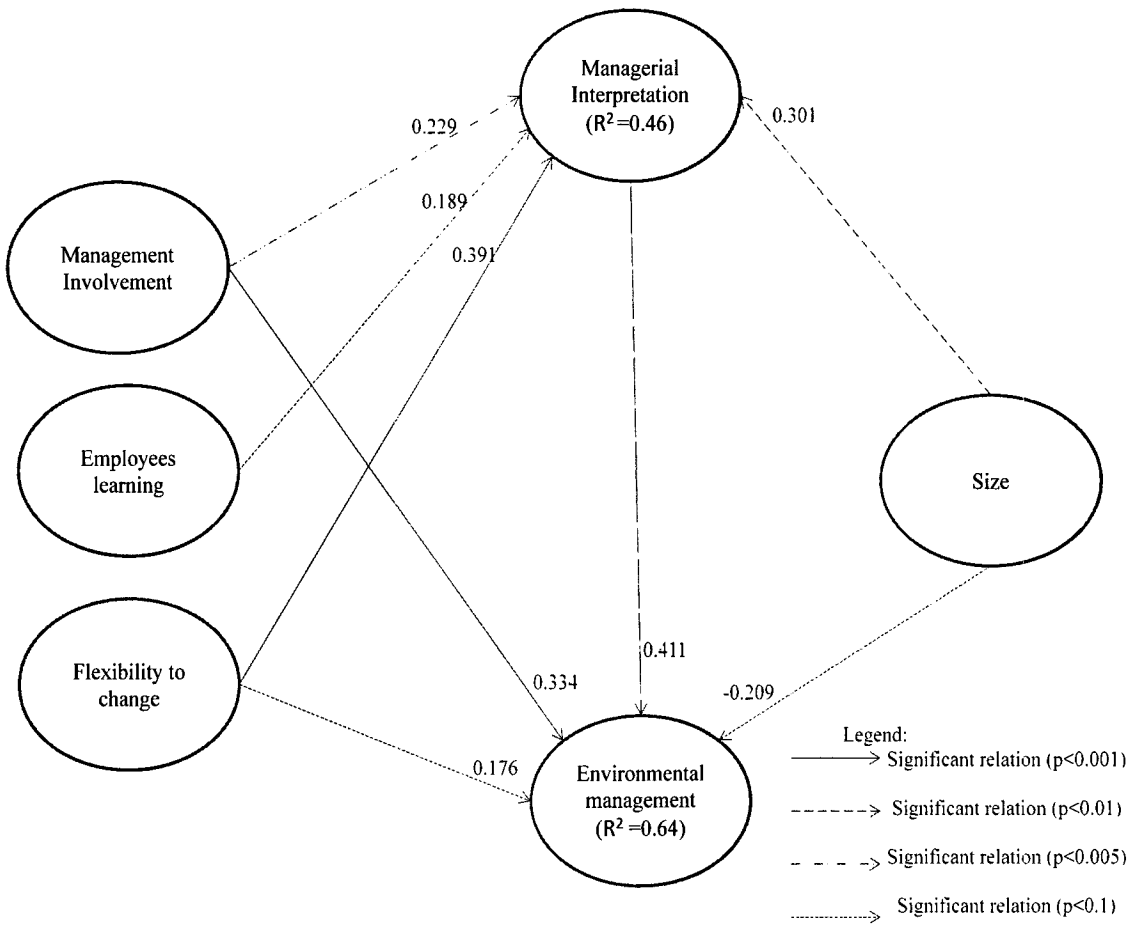

Figure 6. Path Coefficients, Significance, and R square of the latent variables.

4.2.4 Main Findings

The measurement items prove to be reliable since the factor loadings of the manifest variables are higher than 0.5. As shown in Table 21, the factor loadings in the revised measurement model were all statistically significant.

Reliability of the indicators is proved since the composite reliability of all the items is higher than 0.7 as shown in Table 23.

Since the average variance extracted is higher than 50 percent, the model has acceptable convergent validity. Discriminant validity is shown in Table 24 since all latent variables are explained by their proper indicators, more than by the indicators of other variables. Hence, the measurement model shows that the manifest variables constitute reliable measurements of the LVs; there is convergence between the measures of each concept and divergence between the different concepts.

The model serves to perform a confirmatory factor analysis in order to validate the causal relationships proposed. The results will allow approving or rejecting the hypotheses formulated in chapter 3.

The path coefficients between endogenous and exogenous variables are shown in Table 26 and Figure 6. A significant positive relationship is shown between the three factors representing the complementary resources and capabilities, and managerial perception of the environment as a business opportunity. Two of these factors, namely management involvement and flexibility to change, affect the proactive environmental initiatives of the firm. Only employees' learning and knowledge does not have a significant relationship to the pro-activeness of environmental initiatives. Thus, hypotheses H1 and H2 are supported.

Managerial perception of the environment as an opportunity for the firm was found to have a significant relationship with the development of a proactive environmental management. Hence, H3 is supported.

Finally, the size of the firm has a significant relationship with the managerial perception of the environment, showing that in large firms, managers perceive the environment as an opportunity rather than a threat to the business. However, a negative significant relationship exists between the size of the firms and the proactive environmental management. This means that small firms are making early steps in integrating aspects of green construction.

On another perspective, R^2 for each latent variable is assessed. It has the value of 0.64 for the variable Environmental Management, and 0.46 for managerial perception. This means that 64 percent of the variance in the first variable is explained by the factors in the model. Factors in the model account for 46 percent of the variance of the other variable. These results show that other variables, not considered in the studied model, affect these two variables.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

In this chapter, a summary of the key findings and their managerial implications as well as the limitations to this research will be presented.

5.1 Summary of key findings

Descriptive statistics of chapter 4 highlighted some main findings. Managers' opinions on the additional cost of the environment vary between agreeing (42%), disagreeing (21%), and being neutral (23%). This means that Lebanese firms did not develop yet a clear figure about the cost of building green. In addition, most of the firms (61%) do not have yet procedures for environmentally related activities. Around 55% are not changing the structure of the organization structure to adapt to these new initiatives. Also, experimentation in the environmental field is not supported in around 55% of the firms yet. Finally, there are no emergency procedures to adapt to environmental problems in 61% of the firms. These results reflect the fact that building green is still recent in the construction companies in Lebanon.

Another issue highlighted by descriptive statistics is that almost half of the managers disagree or are neutral vis-à-vis the financial advantage of the incentives offered by the government and financial institutions. This highlights the necessity of developing these initiatives and making them available to all the firms working in the building sector.
A significant positive relationship exists between all complementary resources and capabilities, and managerial perception of the environment as a business opportunity. This means that the involvement of management in firms' activities, employees learning and knowledge, and rapidity of the firm to introduce change affect positively the managerial interpretation of the environment as a competitive advantage. Thus, hypothesis H1 is supported. This result is consistent with the findings of Lopez-Gamero et al (2008).

Two of the complementary resources and capabilities, namely management involvement and flexibility to change, affect the proactive environmental initiatives of the managers. Only employees' learning and knowledge does not have a significant relationship to the pro-activeness of environmental initiatives. Lopez-Gamero et al (2008) failed to prove the significance of management involvement but proved the significance of employees' learning and knowledge. In both models (Lopez-Gamero's and ours), two of the three factors were proved to affect pro-activeness of environmental management. Thus, H2 is supported.

Managerial perception of the environment as an opportunity for the firm was found to have a significant relationship with the development of a proactive environmental management. Hence, H3 is supported in consistency with Lopez-Gamero's model. Finally, the relation between the size of the company and its managers' perceptions show how managers of large firms are more inclined to think of the environment as a competitive advantage to the firm.

On another perspective, the factors in the model explain 64 percent of the variance of the variable environmental management and 46 percent of the managerial interpretation of the environment. In Lopez-Gamero's model, 72.5% of the variability in Environmental management is explained by the variables in the model for the hotel sector and 98.4% for the IPPC companies. For the variable managerial interpretation, 21% of the variability is explained by the variables in the hotel sector and 55.6% for IPPC companies.

5.2 Managerial Implications

It is evident from the relationship between the complementary resources and capabilities, and the managerial perception, that the construction firms in Lebanon have a significant number of R&Cs that influence the managers' perception of the

environment as a competitive advantage for their firms and the proactive environmental initiatives in the firm.

It is clear that managers are involved in the environmental initiatives and decisions made by the firm. This is evident since companies involved in green projects assign an engineer accredited with one of the international certificates to be responsible of environmental issues; they may have an environmental department or at least an environmental manager. So, environmental protection decisions are made at the managerial level. This integration of the environment at the managerial level enhances the perception of managers vis-à-vis the environment and consequently makes the firm more proactive in its environmental decisions. Thus, managers should be involved in environmental decisions and should share the environmental policy of the firm with all the employees making them more aware of the firms' decisions.

Managers working in the construction sector developed a flexibility to adapt to the changes in their environment. This is due to their interaction with customers and their aim of meeting customers' requirements. Accordingly, environmental initiatives are taken into consideration. They are also in interaction with suppliers and other companies working in the building sector. This flexibility in the construction sector has a significant effect on managerial interpretation and on the pro-activeness of firms. Thus, managers are invited to stay in contact with suppliers, customers, and other firms in order to stay updated with the latest technological products and processes. Since the technology used in green buildings is changing constantly, these managers should always be aware of these advances, which make them ahead of the competition in this sector.

Although we cannot see a significant relationship between employees' learning and knowledge and the pro-activeness of firms, still this factor affects positively and significantly the managerial perception of the environment as a business opportunity. This may be due to the fact that managers value their employees' skills but these employees deal only with technical issues and have no input in managerial decisions, specifically when they are related to the environment.

As for the size of the firms, the results show that large firms have an influence on their managers' perception of the environment as an opportunity. This may be due to the resources large firms have which in their turn influence managers.

We should emphasize here the role of the government and environmental NGOs to work with small-sized firms who lack the initial investment necessary to enter the green market. The lack of necessary skills, time, and resources are major factors resulting from the small size of the firm.

The managerial perception of the environment influences the environmental pro-activeness of firms. In fact, the more managers perceive the environment as a competitive opportunity, the more they are involved in proactive initiatives. This can be explained by the fact that managers profit from the "strategic window" where they can attract customers interested in the green products and constitute then a market niche. Second, managers caring for the environment, think also from the economic view. They know that the government and the Central Bank have been recently launching initiatives in the form of low interest rates for the development of green projects; the National Energy Efficiency and Renewable Energy Account, known as NEEREA initiative, as an example of these initiatives, was detailed in the literature review.

5.3 Limitations

The study has a number of limitations.
First of all, the number of firms working on green buildings in Lebanon is still small. We identified 62 firms of which 43 completed the questionnaire. Although we have no problems regarding the reliability of the results, which was proven by measuring the sample adequacy, but still the results of this study can be more generalized when the population is bigger. Hopefully, in the coming years we will see a larger number of companies working on green projects.

Second, we had to represent the variable Environmental Management by its five indicators in the model. For this purpose, we performed a factor analysis for the items representing each of the five factors. This process leads to a loss of information since the method used extracts factors that account for the larger part of the variance but not for all the variance as explained in the part relative to factor extraction in chapter 4.

Finally, the results show that the two dependent variables, proactive environmental management and managerial interpretation of the environment, were not fully explained by the factors developed in the model. More research should be done to identify the different factors that affect the managerial interpretation of the environment and the environmental initiatives taken by the firms. These issues may be the subject of other researches combining the resource-based view of the firm with other theories of the firm to cover all the factors affecting the concepts of "thinking green" and "building green".

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Appendix 1

Green Buildings in Lebanon:
Firm's Resources, Managerial Perceptions, and Environmental Decision-making

This questionnaire is designed to complete a thesis as a requirement for a Master degree in Business Administration.

Buildings have a huge impact on the environment: they generate GHG emissions, consume energy, water, and raw material. Nowadays, many firms working in the building sector are taking actions to minimize the effect of their design and operations. In this survey, we are trying to know more about:
(1) The effect of your companies' resources and capabilities on your perceptions of the environment as a business opportunity
(2) The effect of your view of the environment on the environmental proactiveness of your firms, and on the pioneering entry strategy into the green building world

Please read the following points before answering the questions:

- *It is very likely that the GHG emissions like Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) are responsible for the temperature increase in the world, and humans are responsible for the generation of theses gazes. Many sectors are contributing to these emissions: energy supply, transportation, buildings, industry, agriculture, forestry, and waste.*
- *Building Green has benefits on the environmental, social, and economic levels:*
  - *It helps reduce global warming, conserve water, and preserve biodiversity.*
  - *It decreases health problems, and increases productivity and well-being of workers.*
  - *It incurs operational and maintenance savings on the long run.*

This questionnaire should be answered by a senior manager responsible for the environmental decisions of the firm. It takes about 20 minutes to answer the questionnaire. This research provides a good way to know what drives the firms to be involved in the development of green projects.
Please be assured that we are only interested in your opinion and that your answers will be kept strictly confidential. By clicking on the following link, you will be able to open the online survey, and answer the questions.
http://www.eSurveysPro.com/Survey.aspx?id=b95fb07f-a84a-4bb0-b923-adf8ec795ad8
By clicking "Finished" after the last question, only your answers will be reported. We will be able to see only your answers. The questionnaire is anonymous.

Your contribution will be highly appreciated.

We would like first to know some useful information about the company.
Please highlight the answer that best describes your firm.

1- Role of the company in the building sector
   1- Contractors 2- Architects/Design engineers
   3- Owners/Developers

2- Number of Employees
   To specify

3- Does the firm take into consideration the environment when working on new buildings?
   1- Yes 2- No

4- What statement best describes the company?
   1- The company is not integrating any green features into the projects
   2- The company is integrating green features into the projects without aiming a certification
   3- The company is working mainly on green projects with the objective of getting low levels of certification (certified or silver)
   4- The company is working mainly on green projects with the objective of getting high levels of certification (gold or platinum)

5- When did the firm start working on green buildings?
   1- Before 2008
   2- After 2008
   3- Never

We would like to assess the **complementary resources and capabilities** that drive firms to adopt environmental strategies, among which building green projects. On a scale of 1 to 5, highlight the number that is closest to your view.

1=Strongly Disagree (SD) 2=Disagree (D) 3=Neutral (N)
4=Agree (A) 5=Strongly Agree (SA)

How important is each statement as a resource or capability in the firm?

	SD	D	N	A	SA
6- The behavior of top management inspires the acceptance of change by all other organization members	**1**	**2**	**3**	**4**	**5**
7- All the organization members know and share the firm's mission and objectives	**1**	**2**	**3**	**4**	**5**
8- We adapt to the new market conditions more rapidly and in better conditions than our competitors do	**1**	**2**	**3**	**4**	**5**
9- We identify the new consumer and market opportunities because we establish a watch and monitoring system	**1**	**2**	**3**	**4**	**5**

10- Employees are aware of the progress made in their work areas (new knowledge, new practice development)	**1**	**2**	**3**	**4**	**5**
11- The knowledge owned by individuals is transmitted and readily accessible to all their workmates	**1**	**2**	**3**	**4**	**5**
12- Employees are able to take initiatives and decisions on their own thanks to the encouragement of authority delegation	**1**	**2**	**3**	**4**	**5**
13- Our close relationships with suppliers and consumers allowed us to know at first hand and before the rest of firms the existence of new products or services, needs, new technologies or machinery	**1**	**2**	**3**	**4**	**5**
14- On some occasions, other firms are consulted in order to improve in some specific aspects	**1**	**2**	**3**	**4**	**5**
15- We are able to make rapid changes in building design	**1**	**2**	**3**	**4**	**5**
16- We act in accordance with quality management principles and practices	**1**	**2**	**3**	**4**	**5**

Now, we would like to assess **the managerial perceptions of environmental issues** in business strategies. On a scale of 1 to 5, highlight the number that is closest to your view.

1=Strongly Disagree (SD) 2=Disagree (D) 3=Neutral (N)
4=Agree (A) 5=Strongly Agree (SA)

How much each statement reflects your perceptions of environmental issues?

	SD	**D**	**N**	**A**	**SA**
17- Environmental initiatives slow down growth	**1**	**2**	**3**	**4**	**5**
18- The environment represents an opportunity for the firm	**1**	**2**	**3**	**4**	**5**
19- The environment entails an additional cost	**1**	**2**	**3**	**4**	**5**
20- Reasonable environmental management is not an option, but a necessity	**1**	**2**	**3**	**4**	**5**
21- Environmental issues can only be attended during periods of economic prosperity, since they do not generate profit for the firm	**1**	**2**	**3**	**4**	**5**
22- The solution to technological problems depends on new technologies, not on the actions that the firm may perform	**1**	**2**	**3**	**4**	**5**
23- Concern for the environment is a passing trend	**1**	**2**	**3**	**4**	**5**

Now, we would like to assess the **environmental management initiatives** of the firm. On a scale of 1 to 5, highlight the number that is closest to your view.

1=Strongly Disagree (SD) 2=Disagree (D) 3=Neutral (N)
4=Agree (A) 5=Strongly Agree (SA)

How much each statement describes the organizational environmental management?

	SD	D	N	A	SA
24- The firm communicates its environmental policy and strategy to all its employees	1	2	3	4	5
25- The management team encourages and participates in environmental management initiatives	1	2	3	4	5
26- Procedures are defined and documented for all the activities, products and processes which have a significant direct or indirect impact on the environment	1	2	3	4	5
27- The organizational structures (the organizational chart and the description of roles within the firm) are adapted or modified, if necessary, with the purpose of facilitating environmental management	1	2	3	4	5
28- Barriers to environmental communications are removed, including the encouragement for employees to communicate directly with their managers or with other firm employees	1	2	3	4	5
29- The employees have the environmental competencies required to develop their professional activity	1	2	3	4	5
30- When there is a wish to improve in some environmental aspect, collaboration is established with other firms so that they can help to achieve the improvement	1	2	3	4	5
31- Support is given to experimentation with new methods with the aim of identifying possible environmental improvement areas	1	2	3	4	5
32- Emergency procedures are established in order to respond to environmental problems and accidents	1	2	3	4	5
33- The elaboration of financial and operational plans and indicators is carried out taking into account the environmental policy	1	2	3	4	5
34- Environmental savings and costs are quantified in the budget	1	2	3	4	5
35- Priority is given to the purchase of less harmful components and /or products	1	2	3	4	5
36- The suppliers' environmental record is evaluated	1	2	3	4	5
37- A standardized system is used for the treatment of consumer complaints	1	2	3	4	5
38- An environmental report is evaluated	1	2	3	4	5
39- Information about environmental management, such as data related to costs and procedures of building green, is regularly provided to suppliers, consumers, and institutions	1	2	3	4	5
40- Our strategy addressing the issue of building green improves our cost position relative to our competitors by beneficiating from incentives offered by the government	1	2	3	4	5

41- Environmental activities enhance revenues through the emerging market of customers who go for eco-friendly buildings	**1**	**2**	**3**	**4**	**5**
42- The company reduces liabilities and environmental risk by using less energy and sustainable products	**1**	**2**	**3**	**4**	**5**

Finally, we would like to assess the **technical environmental management initiatives** of the firm. On a scale of 1 to 5, highlight the number that is closest to your view.

1=Strongly Disagree (SD) 2=Disagree (D) 3=Neutral (N)
4=Agree (A) 5=Strongly Agree (SA) 6=Not Applicable (NA)

How much each statement describes the technical environmental management of the projects performed by the firms?

	SD	**D**	**N**	**A**	**SA**
43- The firm encourages the use of water- conserving toilets, urinals, and plumbing fixtures	**1**	**2**	**3**	**4**	**5**
44- The firm encourages the use of water efficient techniques for landscaping	**1**	**2**	**3**	**4**	**5**
45- The firm goes for energy efficient material, uses renewable energy, and heating and cooling systems with low refrigerants	**1**	**2**	**3**	**4**	**5**
46- The firm encourages material reuse and recycling	**1**	**2**	**3**	**4**	**5**
47- The firm prefers regional materials to imported materials	**1**	**2**	**3**	**4**	**5**
48- The firm uses low emitting material generating less harm to the environment	**1**	**2**	**3**	**4**	**5**
49- The firm encourages controllable lighting and controllable thermal system	**1**	**2**	**3**	**4**	**5**
50- The firm encourages sustainable site selection, storm water management, and light pollution reduction	**1**	**2**	**3**	**4**	**5**
51- The firm is innovative in its projects and operations	**1**	**2**	**3**	**4**	**5**

Appendix 2

Credits required by LEED, BREEAM and ARZ

BREEAM Credits

Management

- Man 01: Sustainable procurement
- Man 02: Responsible construction practices
- Man 03: Construction site impacts
- Man 04: Stakeholder participation
- Man 05: Service life planning and costing

Health and Wellbeing

- Hea 01: Visual comfort
- Hea 02: Indoor air quality
- Hea 03: Thermal comfort
- Hea 04: Water quality
- Hea 05: Acoustic performance
- Hea 06: Safety and security

Energy

- Ene 01: Reduction of CO_2 emissions
- Ene 02: Energy monitoring
- Ene 03: Energy efficient external lighting
- Ene 04: Low or zero carbon technologies
- Ene 05: Energy efficient cold storage systems
- Ene 06: Energy efficient transportation systems
- Ene 07: Energy efficient laboratory systems
- Ene 08: Energy efficient equipment (process)
- Ene 09: Drying Space

Transport

- Tra 01: Public transport accessibility
- Tra 02: Proximity to amenities
- Tra 03: Cyclist facilities
- Tra 04: Maximum car parking capacity
- Tra 05: Travel plan

Water

- Wat 01: Water consumption
- Wat 02: Water monitoring
- Wat 03: Water leak detection and prevention
- Wat 04: Water efficient equipment (process)

Materials

- Mat 01: Life Cycle Impacts
- Mat 02: Hard landscaping and boundary protection
- Mat 03: Responsible sourcing of materials
- Mat 04: Insulation
- Mat 05: Designing for robustness

Waste

- Wst 01: Construction waste management
- Wst 02: Recycled aggregates
- Wst 03: Operational waste
- Wst 04: Speculative Floor Finishes

Land Use and Ecology

- LE 01: Site selection
- LE 02: Ecological value of site and protection of ecological features

- LE 03 : Mitigating ecological impact
- LE 04 : Enhancing site ecology
- LE 05: Long term impact on biodiversity

Pollution

- Pol 01: Impact of refrigerants
- Pol 02: NOx emissions from heating source
- Pol 03: Surface water run-off
- Pol 04: Reduction of night time light pollution
- Pol 05: Noise attenuation

LEED Credits

Sustainable Sites

- SSp1: Construction Activity Pollution Prevention
- SSc1: Site Selection
- SSc2: Development Density and Community Connectivity
- SSc3: Brownfield Redevelopment
- SSc4.1: Alternative Transportation—Public Transportation Access
- SSc4.2: Alternative Transportation—Bicycle Storage and Changing Rooms
- SSc4.3: Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles
- SSc4.4: Alternative Transportation—Parking Capacity
- SSc5.1: Site Development—Protect or Restore Habitat
- SSc5.2: Site Development—Maximize Open Space
- SSc6.1: Stormwater Design—Quantity Control
- SSc6.2: Stormwater Design—Quality Control
- SSc7.1: Heat Island Effect—Non-Roof
- SSc7.2: Heat Island Effect—Roof
- SSc8: Light Pollution Reduction

Water Efficiency

- WEp1: Water Use Reduction—20% Reduction
- WEc1: Water Efficient Landscaping
- WEc2: Innovative Wastewater Technologies
- WEc3: Water Use Reduction

Energy and Atmosphere

- EAp1: Fundamental Commissioning of Building Energy Systems
- EAp2: Minimum Energy Performance
- EAp3: Fundamental Refrigerant Management
- EAc1: Optimize Energy Performance
- EAc2: On-Site Renewable Energy
- EAc3: Enhanced Commissioning
- EAc4: Enhanced Refrigerant Management
- EAc5: Measurement and Verification
- EAc6: Green Power

Materials and Resources

- MRp1: Storage and Collection of Recyclables
- MRc1.1: Building Reuse—Maintain Existing Walls, Floors and Roof
- MRc1.2: Building Reuse—Maintain Existing Interior Nonstructural Elements
- MRc2: Construction Waste Management
- MRc3: Materials Reuse
- MRc4: Recycled Content
- MRc5: Regional Materials
- MRc6: Rapidly Renewable Materials
- MRc7: Certified Wood

Indoor Environmental Quality

- IEQp1: Minimum IAQ Performance
- IEQp2: Environmental Tobacco Smoke (ETS) Control
- IEQc1: Outdoor Air Delivery Monitoring
- IEQc2: Increased Ventilation
- IEQc3.1: Construction IAQ Management Plan—During Construction
- IEQc3.2: Construction IAQ Management Plan—Before Occupancy
- IEQc4.1: Low-Emitting Materials—Adhesives and Sealants
- IEQc4.2: Low-Emitting Materials—Paints and Coatings
- IEQc4.3: Low-Emitting Materials—Flooring Systems
- IEQc4.4: Low-Emitting Materials—Composite Wood and Agrifiber Products
- IEQc5: Indoor Chemical and Pollutant Source Control
- IEQc6.1: Controllability of Systems—Lighting
- IEQc6.2: Controllability of Systems—Thermal Comfort
- IEQc7.1: Thermal Comfort—Design
- IEQc7.2: Thermal Comfort—Verification
- IEQc8.1: Daylight and Views—Daylight
- IEQc8.2: Daylight and Views—Views

Innovation in Design

- IDc1: Innovation in Design
- IDc2: LEED Accredited Professional

Regional Priority

- RPc1: Regional Priority

ARZ Modules

M1: Energy Performance

Assessors take account of both the quantified energy use and size of the building. Energy Performance is also impacted by other modules like Thermal Energy, Electrical Energy and Building Envelope.

M2: Thermal Energy

Heating, Ventilation and Air Conditioning (HVAC) and Domestic Hot Water (DHW) systems are assessed.

M3: Electrical Energy

Lighting, power and other energy uses, like office equipment are addressed by the Electrical Energy component.

M4: Building Envelope

Assessors examine the building envelope, taking into account material types, extent of glazing, type, color and texture of the external finish. The orientation of each face of the building relative to the sun's position is recorded, as this affects energy use for cooling and heating. Cracks and mold on the building envelope can be significant in Lebanon and these are measured by the assessor during the site visit.

M5: Materials

The material module focuses on recyclability, geographic origin, maintenance requirements, embodied energy and environmental impact.

M6: Indoor Environmental Quality

The elements that are assessed during the site visit are bio-chemical and particulate emitters, noise, illumination, indoor cleanliness, cleaning chemicals, vibration, mold, odors, ventilation, access to a view of the outdoors and provision of drinking water.