Université de Montréal

Educating interior design & architecture clients about sustainable design: Issues, perceptions, and expectations.

Sensibiliser les parties prenantes de design d'intérieur et d'architecture à propos de design durable : Questions, perceptions et attentes.

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Educating Interior Design & Architecture Clients About Sustainable Design: Issues, Perception, and Expectations.

Sensibiliser les parties prenantes de design d'intérieur et d'architecture à propos de design durable : Questions, perceptions et attentes.

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A été évalué par un jury composé des personnes suivantes :

Tiiu Poldma, directrice de recherche

Jean Therrien, président rapporteur

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Résumé

Cette recherche explore les obstacles qui interdisent le succès des projets de conception durable. L'étude explore les problèmes qui empêchent la mise en œuvre durable des projets à partir des perspectives d'éducateurs et de professionnels expérimentés. L'examen de certifications privées et de systèmes visant à certifier la durabilité dans l'industrie du design a été présenté dans cette recherche. La collecte de données comprenait des études de cas en général, des entretiens avec des éducateurs expérimentés et des professionnels et deux études de cas détaillées qui servaient d'exemples réussis d'adaptation dans un procès pour une meilleure mise en œuvre de projets durables, à Beyrouth et à Montréal. Les études des cas situés à Montréal, Canada et Beyrouth, Liban sont mises en avant. L'approche méthodologique interprétative a été utilisée pour analyser les données fournies par les participants à l'entrevue et deux études de cas réussies. L'éducation du client d'architecture a été la cible principale de cette recherche en reconnaissant l'importance du contexte social lors de la planification d'un projet durable. La discussion finale a présenté une nouvelle évaluation du processus de design qui permettra de mieux évaluer le processus de design environnemental.

Les résultats sont présentés dans une discussion qui a réévalué le processus de design pour former une idée précise des potentiels durables trouvés à la fois à Beyrouth, Liban et à Montréal, au Canada. La discussion finale présente de la perspective émergente de la façon dont un processus de design durable peut conduire à une meilleure évaluation du processus de design environnemental.

Mots-clés : Design environnementale, Design durable, Éducation de client, Barrières de design durable, Approche interprétative, Processus de design intégré.

Abstract

This research explores the barriers that prohibit the success of a sustainable design project. The study explores what issues prevent sustainable project implementation from the perspectives of experienced educators and professionals. Different approaches are examined in the implementation phase. The literature review included the examination of private certifications and systems that provide sustainable certifications in the design industry. Data collection included case studies as a general view, interviews with experienced educators and professionals, and the examination of two detailed case studies. Case studies are examined in Beirut, Lebanon and Montreal, Canada, along with other practices found with a better implementation of sustainable projects. The methodological approach includes exploratory interviews and interpretive analytic methods to analyze the data provided by the interview participants, as well as a comparison between two case studies in sustainable development. Educating the client was the primary target of this research alongside acknowledging the importance of social context when approaching a sustainable design project. Findings are presented in a discussion considering a re-evaluation of the design process to form a precise idea of the sustainable potential that might be found in Beirut, Lebanon and Montreal, Canada. The final discussion presents emergent perspectives of how a sustainable design process can lead to a better evaluation of environmental design.

Keywords: Environmental Design, Client Education, sustainable design barriers, Interpretive approach, Integrated Design Process.

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To my lovely wife
for her patience
and encouragement
throughout my career

To my dad Rachid,
for his advice
and inspiration

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1. Introduction

1.1. Overview of the study

The U.S. energy consumption statistics of the year 2012 state that the building sector consumes approximately 47.6% of the energy used in the United States and 74.9% of the U.S. electricity consumption in operating buildings. (U.S. Energy Information Administration-EIA, 2013). In terms of interiors, people occupy interior environments over 90% of their day (EPA, 2009). As a person recently living in Montreal, I discovered that Montreal is an interior environment oriented city, and my aim is to understand what an environmental interior design approach is in terms of sustainability. As a researcher, I want to examine perspectives of interior sustainable design approaches, by understanding Montreal's specific issues regarding sustainability in architecture and interior design specifically. Since sustainable interior design approaches tend to target indoor air quality, Montreal, being a city with many interior environments, I was interested in exploring how sustainable approaches respond to these needs. The World Health Organization report 1995 highlights that 40% of the buildings with chronic indoor air quality have problems. (World Health Organization, 1995). Although this is an old statistic, things have not changed. The need to attain a better indoor quality is a must to improve our daily life at work and home. Indoor air quality, energy consumption and building constructions are all issues that concern the sustainability of our indoor environments.

This research will target the major barriers prohibiting environmental interior design and architecture sustainable approaches from being implemented, and present some successful case studies from Montreal, Canada. As the interest is to inform designers, the author examines how these ideas might be carried out in two cities: Beirut, Lebanon and in other projects in Montreal, Canada. The research study proceeds with reviewing the issues by looking at interviews with both educators and professionals in Canada and Lebanon, and by understanding the major barriers and the sustainable potential for each of these two countries. Following an analysis of these issues and case studies, possible durable solutions will be presented at the end of this research, to be used as an appropriate way to research, design, prepare, build, and potentially even renovate some projects.

1.1.1. Research questions

The research questions are as follows:

1. What are the barriers found in both Lebanon and Canada that are prohibiting architects and interior designers from achieving a better environmental design in the research, design, and construction phases?
    a. What possible opportunities and solutions might be useful in both countries?
2. In the context of sustainable development, how could architects and designers educate the client to be able to make sustainable solution choices?
    a. What are the solutions being proposed by designers and architects for sustainable design projects?
    b. What tools can be used to aid and sensitize citizens in cities who are in urgent need of these approaches?

The perspective of this study is one of how a "sustainable environmental interior design" approach is, and is not, implemented in the design of both interior design and architectural projects from the perspectives of Canada and Lebanon, specifically the cities of Montreal and Beirut.

1.2. The context

There are different barriers to the implementation of sustainable design solutions in various countries. In this study, the focus will be on the obstacles found in Beirut, Lebanon and Montreal, Canada. With experience as an interior architect in Lebanon, this perspective includes understanding the barriers that are prohibiting sustainable approaches of environmental interior design to be implemented.

One of the main obstacles that prevent sustainable interior design in Lebanon is the cost. The cost of the sustainable project containing environmental construction materials and mechanisms would be higher than the non-environmental one, and this is the main concern for the client who is always searching to pay less. Hankinson, M. (2012) suggests that a sustainable project is 20% more expensive than other projects, thus prohibiting clients from adopting the sustainable project. (Hankinson et al, 2012).

Related to cost is the issue of time. Clients are impatient, and when design production is time-consuming, this becomes an issue. Studies are needed to understand why clients have no ability to be patient and pay more. As Hankinson suggests, “If it requires research, it will be more expensive, and the client will go for the cheapest option nine times out of ten” (Hankinson et al, 2012).

Another barrier implied has been the limited selection of sustainable materials that can be part of the construction phase in the design of interior environments. For example, in Lebanon, one difficulty is that most of the sustainable materials are imported from outside the country, and this contradicts with the idea of sustainability and increase relative costs. In a recent survey, more than 70% of interior designers said that the barrier cited for undergoing environmental interior design was the difficult nature in encouraging clients to adopt sustainable design thinking. (Hankinson et al, 2012). The gap occurs through the lack of sustainable education specifically for interior design clients since the client has the power but lacks the knowledge.

The client lacks sustainable education and knowledge, so educating the client should be a major concern. While the current certification systems in North America, LEED and USGBC, aim to certify both architect and designers work, their purpose is to educate professionals and not the client directly. The available sustainable knowledge targets professionals, and yet we need to provide the client with similar knowledge. Even new design graduates lack both sustainable knowledge and sustainable experiences in their work. New graduates must continue to follow professional development (CPD) after graduation. As Hankinson (2012) mentions that 80 % of interior designers who lack CPD expressed an interest in conferences, courses, and design seminars but time and location were the main issues not to attend, while 20% did not have the interest in attending. (Hankinson et al, 2012).

Another problematic has been surrounding the design thinking is “object-image” and the nature of design itself today. As El-daccache notes, “Design in our society, irrespective of its civil function, has, therefore, become an object-image, devoid of any provocative feeling, exactly like plastic surgery.” (El-daccache M., 2014). The image of the project is dominating the content with an emphasis on visual effects rather than sustainable substance. As El-daccache says, “the obsession with the image complying with the needs of the market.” (El-daccache M., 2014). He notes that theories and social values are becoming a part of today’s

architecture, and yet in contradiction, design is, in part, being replaced with the design of the "image" (El-daccache M., 2014). The design market today, emphasizes elements of publicity and image regardless of what design of function can present to our social values and needs. El-daccache M. states that public and social housing; in Lebanon in particular, are considered the old-fashioned aspects of architecture nowadays, and conversely that today's trend for architects is private housing and luxury. Design clients are targeting business market and luxury, and this adds to a misunderstanding of the interior design thinking that convolutes the entire process for all users.

In general, the problematic is that, in part, interior designers are following what clients are choosing for them to consider in interior design. Interior design trends have not always been a design for luxury. The power of design clients is reforming the industry in a way that is not helping with the image of what interior designers do, and what interior design should be. "In the past, Principles of sustainable development existed as well as skills." (El-khoury N. 2014). Looking back to understand sustainable development in historic cities would be a good example to show the sustainable potentials through simplicity.

1.2.1. The choices of Lebanon and Canada

In Lebanon, interior design as a discipline is very young, and as such, there is no professional association and there are no policies concerning environmental interior design for obliging interior designers to reach well-structured environmental design using sustainable approaches. Moreover, while architects do have an association, the association of architects has no policies related to sustainability. Some designers and architects are following the LEED system as a personal initiative to apply sustainability, but LEED is considered as a good system for new buildings and not usually considered for renovation. As Beirut, Lebanon lacks the means for sustainable policies, achieving a minimal sustainable awareness through the client's perspective will be the way to understand issues and provides a smaller scale place to compare with Montreal, Canada. In Montreal, more sustainable resources and thinking are already in place. Lebanon lacks long-term planning due to its general instability, so understanding sustainability from different approaches and engaging the client's point of view would be a more realistic starting point there. By presenting the LEED system and how it

might be adapted, a comparison between Montreal, Canada and Beirut, Lebanon is possible, to show how the LEED model is not always the right solution and that there are more solutions that can be implemented to adapt sustainable design.

In Canada, the latest federal policy for a sustainable future was issued in October 2010. In the past five years, there has been little proactive action toward updating sustainable strategies. The last report included general strategies for cities and the country as one entity. The main purpose was to minimize the environmental footprint of government operations, and this could be a very slow process. Reviewing the by-laws for interior designers in Canada showed the lack of specific sustainable policies and strategies. (BY-LAW NO.1: Borrowing, 2012) & (BY-LAW NO.1: Governance and Operations, 2012). Nothing was found about specific policy for interior designers as a member of the professional association, itself a member of the Interior Designers of Canada.

In Montreal, there is a lack of clear policy initiative about sustainability at the writing of this study. However, there are individual initiatives that are taken by certain architects and designers to achieve sustainability in the design process and in solution implementation. Some examples can be stated to support the issue; however, for a major city in Canada, Montreal's individual initiatives are not enough and more efforts should be taken into consideration to apply sustainable solutions in design. Canadian initiatives by government provide a good example of how a sustainable design approach might be implemented as an educative approach that can be followed in Lebanon.

After reviewing the LEED GA v.4 and LEED for commercial interiors, it was difficult to find specific criteria about renovating old structures or for interiors (LEED v4 for INTERIOR DESIGN AND CONSTRUCTION, 2014). LEED mainly targets new structures and states general ideas of sustainability as the range that one can get materials from, the location of the site and other elements that are more related to urban sustainability or external elements. LEED reconsidered their policies to start including a more extensive review of major interior renovated spaces (LEED CANADA FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS, 2009). Challenges are similar in both countries but in different scale. Investors are targeted wherever they are, to try to convince them to apply an ethical approach of environmental design with more solid evidence to support this view.

1.1.1. "Sustainability" definitions

"Sustainable development" is defined as the general view of sustainable design given by Brundtland Commission, as stated in the 1987 report to the United Nations: "Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs." (Krygiel E. et al, 2008, P: 12). Most interior design professionals use the term sustainable design. Referring to NCIDQ website (2016), the definition of sustainability in interior design is stated as *"The use of resources in such a way that they are not depleted; a method of practice or use of materials that is capable of being continued with minimal long-term effect on the environment."* (NCIDQ, 2016).

However, as part of the interviews conducted, a renowned architect, Daniel Pearl, suggests that

> Sustainability means a sustainable lifestyle – not just designing ecologically sensitive buildings. We need to design a building within a lifestyle, within a community, within a context. (Daniel Pearl, 2017).

The actual definition also includes the social aspect that we need to build as a society. According to Pearl (2017),

> Sustainability is ensuring social cohesion, ensuring a renewed environment that supports our biodiversity, food production, air quality, water quality. It is trying to sustain and even regenerate when we destroy parts of our city. Sustainability has been more traditionally defined by energy efficiency or water efficiency or material qualities – which are are basic, metabolic components of ecological design but alone they do not comprise a sustainable building or infrastructure, because it is can only exist when we succeed in sustainaing a holistic lifestyle. (Daniel Pearl, 2017).

1.1.2. "Environmental design" (NCIDQ)

"Environmental interior design" has been a term used to describe the relation of interior design with environmental issues that target sustainability. In the past, environmental design was also understood as the design of the environment as a complete and cohesive system, and of which interior design is a component (Poldma, 2003). It is the aspect of interior design that adapts the environment as the main issue requiring change. The building industry is the major contributor to the environmental problems such as global warming, heat island effect, and air and water pollution. Improving the health and wellness of building's occupants is the major target of environmental interior design. Interior design's primary concern has been shifted to provide a health full and sustainable environment for individuals to live, work, and play. According to the NCIDQ (National Council for Interior Design Qualification) website, the Environmental Design definition is "the aggregate of the physical conditions of the interior environment that affects the health and safety of the occupants, including air quality and circulation, temperature control, ergonomic layout, physical circulation plan and related matters." (National Council for Interior Design Qualification, 2016)

"Environmental interior design" branches into two aspects that are 1) the macro aspect known as sustainable design; and 2) the micro aspect, known as green design. LEED certification aims to achieve green design, and most of their definitions and goals are using the term "Green Design." "Green Design is the response of utilizing ecological principles in design. A substantive dilemma arises if green buildings do not provide improved environmental performances in their operations." (Hyde, R. et al, 2007, p: 59)

1.1.3. Materials as a key element

Materials are a major issue when discussing sustainable design. Sustainability through material's solutions exist since the dawn of mankind. As an example, the Romans did well by having sustainable historic cities that reused materials to rebuild different structures. Other examples can be found in Rodwell's book "Conservation and Sustainability in Historic Cities." (Rodwell, D., 2007) Understanding history and what were the simple steps that were taken in the past, help us understand how we might achieve sustainable cities today.

Summarizing all the above, as Stieg notes “These phrases cannot be taught to practitioners, it has to be developed from within the designers through their personal drive to protect the natural environment" (Stieg, C., 2006).

There is an urgent need to create change through our work as interior designers. Education is needed of both non-experienced interior designers and society. Away from non-practiced theories, we need to implement solutions that bring benefits to our profession and society.

1.3. Research objectives

1.3.1. Major objectives

The primary purpose of this study is to investigate how informing and educating interior design clients about the best practices of sustainability might contribute to improving the way we design our spaces. First steps include understanding the nature of sustainable environment interior design. Second, it is important to investigate various educator’s and professional’s points of view. How could this research have an impact on improving the behavior of the clients to adopt environmental interior design? What types of environmental regulations for interior designers should be implemented? Creating more systematic concepts that might allow designers to work using all the aspects and the process of design. The opportunity of achieving sustainable and environmental interior spaces might be implemented in different stages within a general approach to the design process. Other possible ideas include integrating a sustainable way of thinking in the creative process of design, by introducing a new ideology of understanding materials. Researching good practices and historic examples of sustainable designs is another possible way. Gathering research that connects the available databases and other sustainable tools can create a more accurate system for interior designers. Possible ways to implement ideas include developing guidelines for the design process and providing information to clients. Current materials databases are not enough to help environmental interior designers to proceed more with sustainability. How can smart technologies act as a tool to aid our design?

1.3.2. Considering the contexts

Educating the client by developing sustainable system approaches with the help of the design professionals and educators is a need. As Aouad mentioned, "Gaining identity in the public's opinion should be the next step after gaining identity in the workplace and the legal arena" (Aouad, D. 2013, p: 60). Aouad states that interior design has become a hybrid and public recognition and the understanding of the profession by others is key to its development, shaping public perception of our value and strengthening our image as a profession, seems of utmost importance. (Aouad, D. 2013, p: 60). As interior designers, our duty is to shape the environmental interior design profession by designing our space's needs, and reaching the client by changing attitudes, to reshape the core elements of designing sustainable spaces. For example, in a broader sense, sustainable approaches mean understanding how cultural identity and social inclusion are vital for a sustainable approach. Using case studies and work experience, Tiiu Poldma has presented functional design solutions by studying people's experiences in the context of the interior environment and social issues. She states:

> The sustainable issues that emerge include reusing and adapting existing spaces for the new needs, and understanding how integrating everyone into social life builds sustainable practices within society for longer time. (Poldma T., 2013)

1.3.3. Development of the research questions and objectives

Developing the research questions and objectives includes developing the problematic. In the study, this means understanding the client's behavior, attitude, knowledge, and motivations about sustainable design, and how they are exposed to sustainable solutions. From the perspective of this study, we as designers need to understand what the basic needs the client asks for (or not) when developing a project concept, understanding the client's point of view and also their knowledge of sustainable approaches in particular. The research questions and objectives were developed to understand these perspectives and how clients might be better educated and served by architects and designers in the creation of sustainable projects.

In our current societies, specifically in our interior spaces, we spend the majority of our time while at work, home, restaurants, and other places. Sustainable interiors are important specifically in light of the advanced level in technology that we are reaching today.

The major objective of this research is to educate the client about the appropriate ways to implement and to adapt sustainable design in their projects by presenting different approaches on how to accomplish a successful environmental design. These will be understood by the various studies researched and the interviews with educators and professionals from architecture and interior design. It is anticipated that new findings will re-modify the questions and the objectives of the research and offer ways to achieve understanding the issues studied. The results of the study could be different from the preliminary solutions presented. Various points of views may redirect the study in a variety of ways. Forming a checklist that covers most of the environmental elements only can not be sufficient to achieve a better understanding of sustainable design in a complex context of larger social and local issues.

1.3.4. Issues that can emerge from this study

Linking different elements of our society and culture should highlight other aspects to be part of the sustainable design. For example, targeting social issues will allow the appropriate implementation of better sustainable solutions for design as the community is invited to be a part of the solution in a social context.

Change of the client's attitude towards the space design thinking should be considered as important. Interior designers and interior architects are responsible for creating this new social attitude toward design. The diversity of practices is required to achieve the most out of space design. The impact of our work has a huge result toward other disciplines. Hoping to attain the thinking of "To design our needs" not "The need to design." As Rodgers states:

> *The changes that design faces at the moment can be witnessed on a professional, economic and technological level, by the blurring of traditional design disciplines, the transformation of funding and employment patterns and the introduction of new techniques* (Rodgers, P., 2008).

Mary Knackstedt (1995), in her book "Interior design & beyond" states:

"Interior design can make it possible for people to do better at whatever they attempt, with the right environments. This is power, and within it comes great responsibility, because interior design can direct behavior". (Knackstedt M. et al, 1995, P: 1). Our goal as interior designers has been proved to be a response to everyday life changes that demonstrate environmental responsibilities. Many responsibilities are set to be our obligations since we have the power to design and translate our ideas into the interior design. *"Our work has the potential to affect the way people live for generations."* (Knackstedt M. et al, 1995, P: 1).

Linking a complete and sustainable design approach to what professionals can provide is essential in helping to educate clients in what are the best practices. Simplifying sustainable design thinking to reach most of the clients might be as easy as presenting the basics of environmental interior design to both win over clients and then by extension, to attain a sucessful project. By giving clients the option to choose their sustainable priorities and solutions to their projects; databases of the available sustainable materials including client's ratings, research to save the client's time and some feasibility studies, would show them that sustainable design does not necessarily mean having to pay more.

Interior designers, as Hankinson (2012) says, have social and moral obligations toward sustainable design approaches. We have a duty to educate both our society and emerging interior designers to make sustainable interior design a priority.

Approaching sustainability from different scale perspectives, such as cities and interiors, might facilitate the understanding of the process, cities being the macro scale and interiors as the mini scale. Germany is a major example of this approach. It is considered "Europe's Green Leader" by Solutions Journal in October 2011. On a bigger scale, Ralph Buehler (2011) mentions that Germany has delivered four decades of sustainable policymaking reaching today's classification between leaders of sustainable country policies. (Buehler et al, 2011)

> *"Lebanon is in need of better resources management and energy efficiency. The amount of wasted energy in Lebanon is huge, and efforts must be made to find ways to use energy efficient technologies and renewable energy resources".* (El-khoury N., 2014)

Canada and Lebanon were chosen for this study to gain a better understanding of the issues and solutions presented in both countries. For example, in the book “Mobility and Design” (El-khoury & DePaoli, 2013) the collaboration between the “Lebanese American University” & “University of Montreal” included the presentation of several views. Aouad states: “Knowledge and practice can only merge in an environment where social, economic, political, technological and sustainable issues are debated” (Aouad, D. 2013, P: 56). Our design process should translate into “To design our needs” to highlight the society issues. Aouad mentions that we should incorporate a more defined and conclusive research methodology in the design process can only enrich the process (Aouad, D. 2013). The design process becomes a research process and “the action of designing is the same as the moment of synthesis that occurs in all forms of research, when the various parts of the data and analysis begin to make sense” (Swann C., 2002)

1.4. Proposed research study result

By presenting the research study and its components, this study seeks to reach a better understanding of the issues prohibiting sustainable design from being implemented and present some solutions. The literature review will reveal the issues and organize the key elements that will be investigated, in the hopes of facilitating the subject and understanding what priorities of sustainable design are necessary. Presenting some case studies will give us the ability to show examples of the ordeals facing environmental design and some suggested solutions in both countries Lebanon and Canada.

After performing the literature review, the research study conducted includes interviews, to better understand the problematic from different educational and professional points of view. A qualitative methodological analysis will be used to interpret the interviews performed and extract the key elements to present and facilitate the understanding of sustainable design. Research study results will be supported by successful case studies to show the ability of how to implement the sustainable design with the appropriate sustainable potentials found in both countries.

1.5 Study chapters

In this section, the components of the master's thesis are presented. Chapter One introduces the main elements of the study and the need for a better sustainable design implementation. In this research, questions will be raised in an attempt to find appropriate answers. Defining sustainability and environmental design will be efficient to better understand the scientific definitions from trusted references in interior design and the sustainable domain. What are the research objectives? Moreover, how can we develop these objectives throughout the study? A brief of the context will be presented to show the current status of sustainable design in both Lebanon and Canada by proving the necessary transformation that should be done to facilitate environmental interior design issues and to present appropriate solutions. Starting with the general view of sustainability, to facilitating sustainable elements and terms for the public and with concluding the research with some proposed solutions and priorities for the society and industry to begin with.

Chapter Two presents the literature review and explores the various aspects that will help a better comprehension of the research elements. The literature review develops several themes related to sustainable design, design practice, design education, and social aspects of sustainable design.

Through the literature review, preliminary barriers found in the design process along with the educational approach are discussed. Specific issues include understanding durable materials performance and properties, sustainable construction issues and other sustainable technical problems. The review includes analysing the assessment of certifications such as LEED, Cradle to Cradle certification, and BREEAM. This analysis of the barriers will allow the formation of guidelines that summarize the key elements of sustainable design for the interior environment. In addition to the guidelines checklists offered, a sustainable indicators system will be presented and will be used in choosing the case studies. Two or three successful case studies will be chosen to show an overview of how sustainable solutions have been developed and implemented.

Chapter Three explains the overall study approach, the qualitative methodology chosen, and the methodological approach presented to explain the data collection and the analysis phases. There will also be a section dedicated to clarifying the validity strategy of this research. The theoretical premise will introduce EBD and IDP as two strategies that are considered. The two salient issues "Time" and "Cost" will be explored throughout the study with the interviewed experts to highlight the major issues. An interpretive analysis strategy will be used (Denzin et al, 2000) to explain the interviews and case studies developed in this research. Study components include the study description that branches into different phases for the two chosen locations of Beirut, Lebanon and Montreal, Canada. The sampling part of the research will show the indicators by which case studies will be selected. The criteria for the interview choices and the analysis will be explained as an element of the methodology. The last part of Chapter Three will be to present the ethical procedures that will be followed for assuring ethics, trustworthiness, and transparency of the study.

Chapter Four will be presenting and analyzing the results reached by the study. "*Data collection I*" will present the briefed first analysis of the interviews performed in a coded comparative analysis. The second comparative analysis will show the emerging issues and solutions found throughout the interviews in Montreal, Canada and Beirut, Lebanon, and presented in two tables (Table 1 & Table 2). Sustainable design practice and education will be the second part of the *"Analysis II"* to present, explain, and highlight the current status in both countries with the different general case studies. *"Data collection II"* will present the two detailed case studies of the Benny-Farm and Rosemont projects, adopted after new findings have been analyzed during the interviews.

Chapter Five explores the final analysis of the precedents, issues, and industry problems to sum up the findings and presents the major problems and potential solutions. Preliminary conclusions will be presented from the previous analysis. The final discussion will show how we might benefit from the issues and findings in this research, in an attempt to present a better understanding of the sustainable research, design, and implementation in both countries. How will we be able to adopt assistance from successful sustainable case studies to follow and implement in other projects in Montreal, Canada and Beirut, Lebanon? These

solutions will be presented as a re-evaluation of the design process to include sustainability in five phases; research, conceptual design, design development, construction, and finally, maintenance and management of implemented projects.

Chapter Six offers the conclusion, where limitations will be presented along with the contributions. Finally, at the end, there are proposed future considerations to promote and support this research. A preliminary suggested platform diagram is proposed as a first means to facilitating sustainable understanding for architecture and design clients in the future. The platform proposed can be part of the groundwork of providing environmental and sustainable design tools specifically for design clients.

2. Literature review

The literature review is comprised of understanding the elements of environmental design and sustainable approaches and having a look at how the sustainable thinking is presented in interior design and other industries. The study includes a literature review of issues related to the two categories of design profession & education of environmental design. The literature review includes subjects such as interior design and its history of development, sustainable thinking in different industries, several educators & professionals points of view, and what barriers prohibit appropriate implementation. The issues examined include debates about how to choose construction materials, how to improve indoor air quality, and the process to reach sustainable certification. This review provides the basis for developing the major issues and themes that will be asked in the interview process later on. In particular, Pelsmakers' book "*The environmental design pocketbook*" (Pelsmakers S., 2015) and Gesimondo and Postell's "*Materiality and Interior Construction*." (Gesimondo N. et al, 2011), help form the major sustainable indicators and guidelines by understanding the characteristics of materials that are used in construction today. These reviews help to highlight various sustainable indicators, systems and elements to reach a better understanding of how to evaluate sustainable projects. Specifically case studies will then be examined from both Beirut, Lebanon and Montreal, Canada, in light of the reviews done here.

2.1. History of design practice development

Slotkis (2012) presents sustainable concerns and emphasizes its role in interior design practice and education. She questions the satisfaction and knowledge level of clients by taking into consideration functionality of the space, sustainability approach and design. This requires introducing other disciplines into interior design while knowing the important role of interdisciplinary in achieving sustainable design profession and education. Possible ways include targeting interior design practitioners and students as convincing them to believe in the power of change in interior design practice and its effects on social behavior and attitude. Improving indoor quality is one of the targeted issues throughout the research. How can we re-

evaluate interior design industry and influence industry practitioners? Two new points of view were presented on how to re-structure and develop the interior design profession. How to influence people and how the future of interior design is meant to be part of our social history. Introducing different roles found in different disciplines in interior design and how it can aid interior designers practicing their work. Slotkis discusses various guidelines on how interior designers can educate themselves and thrive by using design thinking and highlighting the importance of how interior design choices make an impact, by using the interior designer's power to change society and prepare for future issues through socially sustainable design choices.

Slotkis (2012) speaks about the process of building up the design components in a way that shows how every component accumulates to inform the other and presents some examples of design firms to show how the business theories have been implemented. As an introduction to the design components, she talks about the design industry and its trends. While she presents that some communication skills were found to discuss the relationship between the designer, design firm, and their client, she emphasizes that elements of the design process can influence this mission as well. She offers a general view of sustainable concerns and its effect on resources, such as what are the elements to target while aiming to achieve environmental interior design including management of air quality and contaminants. She discusses interior health quality and how the use of natural light more often into interior spaces is a simple and easy way to improve the indoor air quality, as well as how to determine the appropriate choice of materials that can be much healthier for the interior space usage as a whole (Slotkis, S., 2012). The choice of safe materials in the construction process of interior space and taking into consideration these added elements could improve the interior air quality and productivity of the space that she suggests can improve sustainable approaches.

Furthermore, Slotkis (2012) discusses education and how students and design graduates can benefit from understanding how applying environmental interior design as sustainable design becomes important for industry today. With this general view of sustainable concerns and its effect on natural resources, we can identify the targeted elements contributing to environmental interior design.

2.1.1. Eco-effectiveness and sustainable design practices

Everyday products and ways to reduce our chemical use, energy consumption and non-useful daily products are needed. However too often we, as a society, lack the appropriate knowledge. McDonough & Braungart (2002), in their seminal book "Cradle to Cradle", speak to the need to consider approaches of sustainability. They argue that by implementing sustainability, industries can still be productive and efficient. They present ideas about sustainable thinking with no limitations to be applied in urban environments, buildings, and economic and social systems. "Why being "less bad" is no good" (Mcdonough W. et al, 2002, p: 45). Having the obligations to do something is a must, while Mcdonough & Braungart have used an impressive line to show the importance of acting. Approaches they suggest, such as Eco-effectiveness, re-evaluate the way we perceive design thinking with simple behaviours. Mcdonough & Braungart state that going with the extreme process of recycling actually results from the use of fewer resources with the least natural impact. (Mcdonough W. et al, 2002, P. 68- 91.)

Mcdonough & Braungart highlight different ways to lead the design industry to achieve progress. They provide ideas about educating people on various points of view, and how professionals and educators evaluate sustainable interior design and architecture today. Work examples, case studies, and prototypes were implemented and discussed to support their theories and opinions. This sums up the importance of changing our daily life style and acting towards a sustainable life, assuring a successful approach for implementing sustainable design. These generic life-style ideas could be a start point for Lebanon to act towards sustainable approaches.

2.1.2. The case of Lebanon

Discussing some major problems in implementing sustainability in design specifically in Canada & Lebanon is important to understand the contexts of this study. The issues in Lebanon are evident, as El-Khoury notes:

> *Lebanon is in need of better resources management and energy efficiency. The amount of wasted energy in Lebanon is huge, and efforts must be made to find ways to use*

> *energy efficient technologies and renewable energy sources, such as solar, wind and geothermal energy.* (EL-Khoury N., 2013, P: 131).

El-Khoury presents the potential of adapting sustainability as a path to design spaces by highlighting the sustainable development potential found in Lebanon. For example, some universities, such as Lebanese American University (L.A.U.) have started being an example to help in the Lebanese sustainable development process. L.A.U has adopted "Green" curricula, as Dr. El-Khoury states:

> *Sustainable architecture and design have to be taught in educational institutions such as L.A.U., L.A.U is committed to introduce "Green" curricula in relevant fields and adopt a university that contributes to environmental sustainability.* (EL-Khoury N., 2013, P: 132).

Sustainable education begins from the surrounding environments such as the university and educational institutions. Learning about sustainable barriers could be a major shift for the youth to start taking action to change the environmental status in general.

2.2. Sustainable design barriers & issues

The obstacles to achieve environmental design involved clients, official authorities, industry, and interior designers as well. The literature review has highlighted some general barriers that can be used to tackle the issues.

2.2.1. Preliminary barriers

As Hankinson et al (2012) mentioned that time and cost are two major issues that prohibit the client from achieving sustainable solutions. Time and cost have been identified in the literature as two major common obstacles found throughout the study of the client and interior design approaches. Targeting these two elements will allow us to understand the appropriate solutions that can be presented as tools. Adapting these tools to improve the environmental aspects targeted to educate the interior design client will be one of the major goals of this study.

Figure 1 presents some of the preliminary barriers as found in both Lebanon and Montreal, Canada. These are shown in terms of the major stakeholders, including interior designers, clients and offcial authorities.

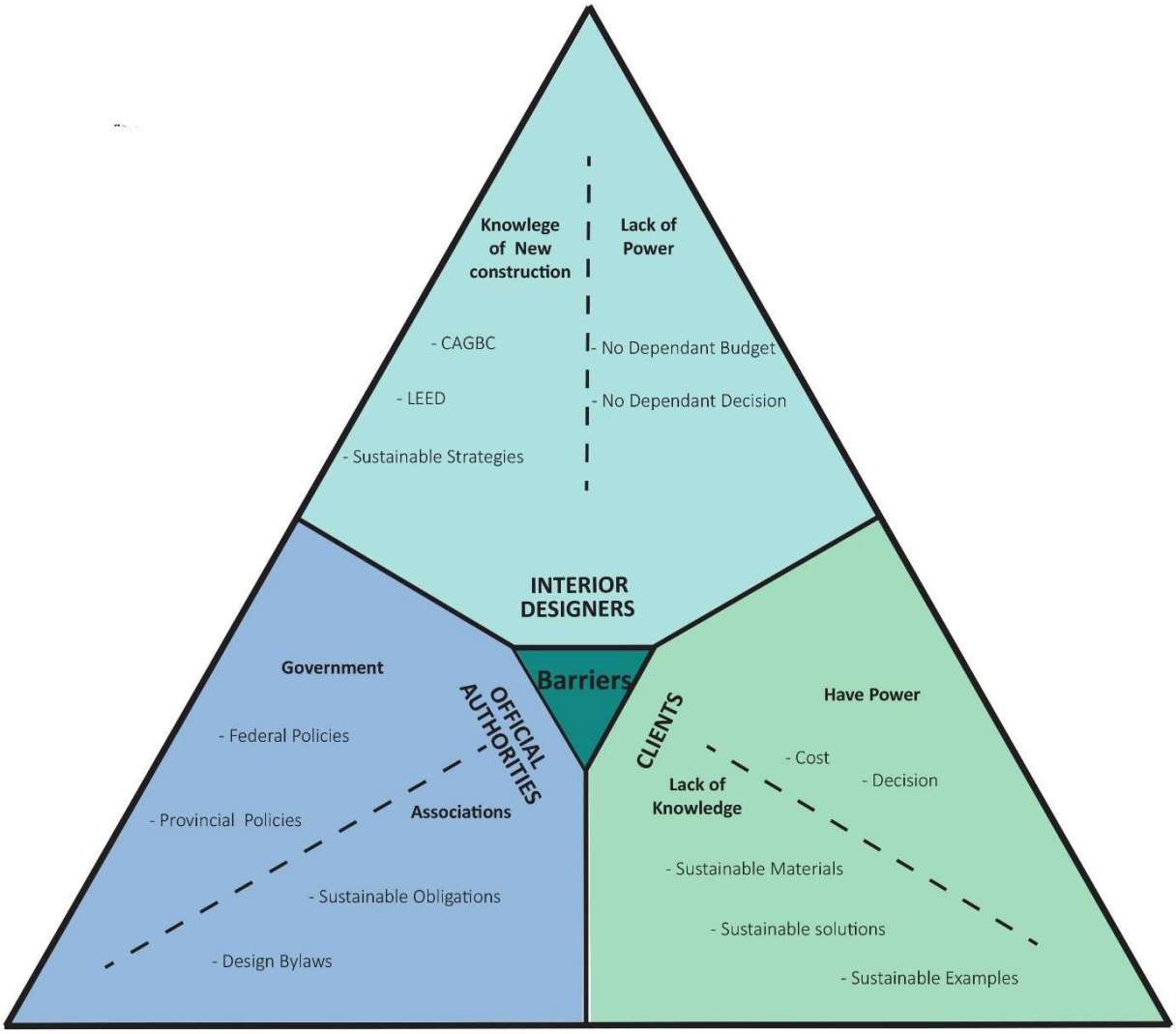

FIGURE 1 - Barriers prohibit achieving environmental interior design in Lebanon and Canada (Source: A. El-Khatib)

2.2.2. Industry issues

Considering Lebanon, and in his article “The Dilemma between Architecture and Design in our society,” El-Daccache M. (2013) speaks about issues within the industry today, from a

Lebanese perspective. He suggests that the design industry today has taken the wrong path, tackling the "image" approach while ignoring the functionality and the content of architecture and space elements. *"Design in our society, irrespective of its civil function, has, therefore, become an object-image, devoid of any provocative feeling, exactly like plastic surgery." (*EL-Daccache M., 2013, P: 25). El-Daccache mentions, *"The image of the project prevails over its content."* (EL-Daccache M., 2013, P: 25). Social values have been neglected in today's architecture & design, leaving behind what El-Daccache has named as the design of the "image" which can only be employed for the visual layer of design leaving behind a little number of highlighted solutions regardless of their values. As he states:

> *It is therefore very difficult to talk about architecture and what it is today, because of the design of the "image," a part of its theoretic and social value, offers countless solutions.* (EL-Daccache M., 2013, P: 25).

El-Daccache laments how today's architecture & design have been transformed into targeting luxury, and avoiding previously held core social and public values. Architects and designer are diving into the world of publicity and leaving behind designer's duty to improve society. Society has become the reflection of design, and vice versa which shows the interactive approach. As he states:

> *Surely the authors and investors on the territory have changed; they require more publicity and image and less architecture and design. Architecture today means publicity. The architect who speaks of the problems of public and social housing is considered old-fashioned, whereas the one who speaks of a private house as a Porsche in order to meet the client's requirements is considered up-to-date.* (EL-Daccache M., 2013. P: 27).

Architecture & design practices are key elements to consider in tackling the critical problems of design today and by considering environment factors within "society." One potential way is to understand the value of Evidence-based Design (EBD) and preparing the

appropriate research elements from the beginning of the project that will be the key for design thinking that considers sustainable solutions.

Discussing that sustainability does not require a lot of effort & technology, El-Khoury (2013) mentions how ancient civilizations used sustainable development in their construction techniques: ***"****In the past, principles of sustainable development existed as well as skills and know-how in ecological construction techniques."* (EL-Khoury N., 2013, P: 129). Taking Byblos city, Lebanon as an example, she discusses how Romans used sustainable development in building their theaters as one of their ancient construction techniques. Technology can help achieve sustainability but it is not a must, simple techniques are enough to at least start the sustainable thinking.

After reviewing the general and the industry barriers that prohibit designers and the public from achieving sustainable design, it is a must to facilitate the educational approach that will allow us to put the change into act.

2.3. Education approach

In considering design thinking for interior designers from a broad foundational perspective, it is by understanding the lived experience of people using the spaces that students can best design supportive environments. To illustrate this view, two case studies are presented to show the ability of how to improve the design process through educational activities. Poldma (2013) explains two case studies that she examined with university students, as a "Living Lab" workshop, that present an understanding of the relation between cultural values and technology. Poldma (2013) shows effective findings resulted from this workshop that improved the connection understanding between the society and the spaces that people occupy. These are *"Case Study #1: The lighting workshop as cultural and technological contexts" & "Case Study #2: The design studio co-designing within a living lab"* (Poldma T., 2013, p: 147). Two case studies were examined through the "lived experience" to reach an understanding of the relation between cultural values and technology through the lighting workshop and living lab. Understanding the connection of developing the project and student work would lead to the concept of identity through the "Lived experience" concept, which

would explain the process of reaching functional design solutions. *"The concept of culture and identity through lived experience are manifested through both the student work and the design concept development itself"* (Poldma T., 2013, p: 150). Examining different approaches of how to improve the process of design can be a means to understanding all the contexts of a design problem and can also lead to a better understanding of the appropriate sustainable design solutions. As Poldma states:

> *The sustainable issues that emerge include reusing and adapting existing spaces for new needs, and understanding how integrating everyone into social life builds sustainable practices within society for the longer time.* (Poldma T., 2013, p: 153).

This approach suggests that sustainable thinking begins within the design process itself, when adapted to cultural and social issues as much as physical choices of sustainable materials. Scientific research strategies such as trial and error in exploring applications in practice are ways for students to see design thinking in action, and are also necessary for designers and researchers to examine repeatedly issues, to reach the right relation of human perceptions for new design problems. In another example describing the human-digital-technological interface, Poldma suggests that *"Using critical design thinking as a major component of structuring how space works within human-digital-technological interface."* (Poldma T., 2013, p: 153). Responding immediately to the "lived experience" also allows for the spaces to be designed with the people who will use the space in a dynamic way. As Poldma suggests, we can then interact much easier with the designed spaces around us: *"We can embrace these ideas as we create better places to moderate new experiences for everyone."* (Poldma T., 2013, p:153). The fast evolvement of societies and cultures means that designers need to be faster in responding to community needs, while actually currently design thinking has been slow in reacting in comparison to the increasingly fast pace of change in society. As Poldma states:

> *In the world, we live space is no longer a separate experienced aesthetic place, but either an immediate environment flexible enough to change according to immediate*

needs activated by the activity being done in the moment in time when this occurs. (Poldma T., 2013, p: 153).

Our daily needs should allow us to adapt faster to the environments around us. The evolving communities and changing needs will be a major cause to transform our design to allow it to be more flexible as part of the sustainable design element.

2.4. "Community" as a design element

The community has been a core influence for many disciplines for multiple reasons. Our response towards the community, and as a community, defines the essential need and the present obstacles that sustainable design is facing. Understanding the relationship between society and designing spaces is a must, to better understand the issues facing design in general, and specifically, sustainable design.

Poldma mentions that we should find the intersection between the understanding of how people use spaces and to put it in effect which leads to the acquirement of knowledge and the understanding through thoughts, experiences and examination of the senses, from the perspective of educating for *"Problem-solving using cognitive and affective skills."* (Poldma T., 2013, p: 143-144). In terms of education, learning about the first stages of design thinking helps improve our ability to implement ideas in designing: *"Cognitive skills might involve understanding how people use spaces, what specific ends and how functional needs & activities intersect."* (Poldma T., 2013, p: 143-144).

Many references were consulted to understand how ethical responsibility that we as designers have, to improve the communication between designing spaces and surrounding societies. Dunne & Raby discuss the power of design: *"A design is not just a tool but also a form of communication that embodies particular political and moral meanings."* (Dunne & Raby, 1999 in Melles, p: 144). The introduction of technology into all disciplines with no exceptions made professions in need to adaptation: *"Spaces are increasingly constructed by mediators such as culture, technology and social constructions of space as a place."* (Poldma T., 2013, p: 145). Furthermore, we need to be attentive not to allow technology to control our sustainable goal but instead facilitate it. *"With all these technologies available, spaces are*

transforming the very nature of what constitutes "space" and our use of space." (Poldma T., 2013, p: 146). We should be aware of how to adopt and introduce technology in designing our spaces knowing that cultural and social values should be our priorities.

Understanding the presented issues will be by targeting the relationships between society and the physical space. As Poldma (2013) notes, *"Physical space is the setting in which social relations are not only played out, and they are more often than not also determinants of social relations."* (Poldma T., 2013, p: 146). The primary element that frames the physical perception of the space is the critical relation between technology and social values. Poldma presents the ideas of Shirley Ardener who speaks to the social perception of the world: *"The appreciation of the physical world is in turn dependent upon social perception of it"* (Ardener S., 1981, p: 146). Dependency on how society interacts with physical spaces differs from time to time, highlighting the element of social perception toward physical spaces. *"This would explain the relative popularity of one place one moment and then its rejection the next."* (Poldma T., 2013, p: 146). According to Poldma (2013), the physical experience varies among different elements that form its environments such as time, physical interaction, and different settings around. *"Specific experience in specific time."* (Poldma T., 2013, p: 146).

Educational approach alongside the community are the elements that create the social values. Changing the needs of society is the major key element that allows us to experience the daily physical spaces around us. Physical spaces are converted to be the construction phase in design, which shows the need to shift towards sustainability.

2.5. Sustainable design construction

McDonough & Braungart coined the term "Remaking the way we make things" (Mcdonough W. et al, 2002) and their seminal book, "Cradle to Cradle" has its aim to re-make & re-think our sustainable design strategies, to tackle and achieve a daily sustainability lifestyle. They discuss how simple strategies can allow us to understand the sustainable thinking in our everyday life activities. This can be achieved by understanding materials and their effectiveness in our daily life. The need to re-consider our everyday products is necessary, as these have been mostly found to be poisonous for our health and our environment. "Cradle to Cradle" has been a certification organization supporting the LEED

system that would provide points for its use. Cradle to Cradle certification gives us a huge database of sustainable construction materials that are previously examined and certified to show their efficiency and innovation in sustainable design. The materials certified by “Cradle to Cradle” team are trusted to be sustainable and providing zero VOC’s as one of its characteristics. Net-zero waste and many other eco-effective specifications are the certification target to provide the health and wellness through certified materials. The objective to achieve the industry change was by using the shock strategy to show the serious daily risks. Some examples were stated to show the right intentions of large enterprises that adopted sustainable solutions for their businesses. These cases were reported to prove a point that transforming into sustainable solutions can be found and applied, but the industry’s obligations should be re-considered. (Mcdonough W. et al, 2002, P.157-187).

Gesimondo, as discussed in his book, "*Materiality and Interior Construction*" (Gesimondo N. et al, 2011), discusses interior design construction and the use of each material within the building industry. What to consider when trying to implement sustainable and environmental design? The major idea was to highlight the materials characteristics and their significant properties. *"Why Materials Matter?"* (Gesimondo N. et al, 2011, p: 1), a major question to be answered in their book was how materials and their properties do matter in the design construction process and design intentions. Adding to that, the design concept, human factors, health, safety, and welfare as general guidelines to maintain the sustainable approach of today's construction process. "*Materiality and Interior Construction*" indicates how to consider a sustainable design with general elements and went further into materials specific properties to preserve the sustainability property of construction in most of the design environments. In summary, “Environmental sustainable design considerations” branches into thirteen major elements.

Under the title “Environmentally sustainable design considerations”, biomimicry is the first element Gesimondo discussed in his book.

> *Biomimicry (a combination of the Latin words bios, meaning “way of living.” And mimesis, meaning “to imitate”) refers to the concept of using nature as the ideal*

inspiration for creating products and emulating natural methods of production. (Gesimondo N. et al, 2011, p: 22).

Interior designers should profit from everything around us to employ into our environmental design world, in an ideal case scenario there should not be any waste of elements concerning the world we develop. Imitating the nature is an option for us to recognize, to enrich our environmental design ideas, concepts, and implementations by trying not to waste anything. As an example, construction waste is known to be one of the biggest problems we need to change. Here comes the concept of recycling, upcycling, and downcycling of construction materials. The idea of re-using materials specifically when renovating projects is essential to avoid the use of new materials that is a portion of natural resources.

2.5.1. Understanding and applying sustainable construction

The use of recycled materials in the design process is a significant contribution to the environment, and as Gesimondo states: *"Building products made with recycled content are less harmful to the environment."* (Gesimondo N. et al, 2011, p: 27). These construction materials might include acoustic ceiling tiles, carpet, composite boards, composite floor tiles, concrete, glass, gypsum, insulation, masonry, metals, and terrazzo. As they state: *"Ecologically conscious manufacturers are directing architects and designers to online resources for product literature in an effort to reduce the use of paper used for cut sheets."* (Gesimondo N. et al, 2011, p: 27). Manufacturers are putting their efforts into responding to client demands and are in the market trying to improve and accommodate the industry with better sustainable solutions.

They coin the terms downcycling and upcycling. Here are the definitions according to Gesimondo:

About upcycling,

It refers to a material that has either been recycled into a material of lower grade, as in the case of some plastics, or the reuse of a product that has diminished performance characteristics for an alternate purpose, such as the reuse of batteries for lower-power appliances. (Gesimondo N. et al, 2011, p: 22).

"Downcycling also describes the reuse of a material that has outlived its peak performance to serve another intended purpose" (Gesimondo N. et al, 2011, p: 23). Upcycling definition is *"Upcycling is the other half of the recycling process, which aims to reduce the consumption of natural resources and divert used products from a landfill."* (Gesimondo N. et al, 2011, p: 27). Upcycling relies on the use of used materials and developing them into a new phase of use. *"Upcycling is popular because of its economic advantage, especially in developing countries, where the purchase of raw materials is cost prohibitive."* (Gesimondo N. et al, 2011, p: 27).

Carbon-Neutral Design has been a larger concept of reducing building's carbon emissions and is one of the global targets used to attain a better environmental design. As Gesimondo states:

> *Carbon is expended in the extraction of materials that we use to create products, in the transportation of these products to the site, in their construction and fabrication, in the operation of buildings, and through the people who occupy interior spaces.*
> (Gesimondo N. et al, 2011, p: 22).

The neutralizing carbon concept includes the design process as a means to provide better interior spaces for individuals dwelling the space. The use of carbon-free or carbon reduced materials is necessary along with the preparation of the space for dwellers to allow them to reduce their carbon consumption in interior spaces. One example would be the alternative technologies used in preparing and the casting process of concrete that is considered one of the most materials that produce carbon and is largely consumed in the construction industry. *"The process of making concrete accounts for more than 5 percent of human-caused, carbon dioxide emissions produced annually."* (Gesimondo N. et al, 2011, p: 22).

2.5.2 LEED certification system

Certifications can be one of the elements to identify environmental design that have been found to aid sustainable design to be attained correctly. Private initiatives are responsible for the verification of these certificates. *"These watchdog organizations oversee the processing of*

materials to ensure that the balance and biodiversity of the ecosystem that some materials come from are maintained and protected." (Gesimondo N. et al, 2011, p: 22). Individuals seek environmental design certification processes that can monitor the appropriate implementation of environmental design. These private organizations are doing their best to improve the industry, but they lack the potential to regulate these environmental standards to reach federal policies to best implement these standards. Some of these certifications are being carried out in the wrong way and used for the sole purpose of luxury; example LEED in Lebanon. These certifications include Cradle to Cradle certification, FloorScore, Greenguard, and Leadership in Energy and Environmental Design (LEED).

Local materials play a significant role as many researchers determine the importance of using local materials to contribute to the reduction of fossil fuel use. LEED certified projects adapt a well-structured system that identifies this problem.

> *The intent of crediting points to projects that use materials extracted and manufactured regionally is to support regional economies and minimize the environmental impacts resulting from transportation.* (Gesimondo N. et al, 2011, p: 24).

VOCs (Volatile Organic Compounds) are a major concern for indoor air quality in most of the environmental design discussions. *"The sources of VOCs emitted from material fabrication and installation processes, and their effect on indoor air quality, are outlined in the "Health, Safety, and Welfare" section at the beginning of this chapter."* (Gesimondo N. et al, 2011, p: 28). This element mainly targets the long-range health impact of the materials installed in the indoor environment, and these materials are primarily found in the paint category. *"The accumulation of VOCs in the atmosphere blankets the earth with greenhouse gasses that absorb and emit infrared radiation."* (Gesimondo N. et al, 2011, p: 28). These gasses are one of the contributors to global warming, and the excessive use of these gasses disturbs the environment, raising the earth's temperature.

Other elements can be included such as embodied energy, life-cycle assessment, natural and synthetic materials and their components, rapidly renewable materials, and reclaimed or repurposed materials.

Montoya explains the process to follow in obtaining certifications and specifically LEED certification. Montoya (2011), has put an outline with a title of "Improving a building's indoor environment quality" targeting the following details in his book:

> *Reusing existing building stock, selecting building materials, building materials that have recycled content, materials transportation impacts, building materials that are made from rapidly renewable resources, recycling construction waste, and references and resources for further study.*
>
> *Ventilation systems for improved indoor air quality by Measuring indoor air quality, Mechanical ventilation systems, Passive ventilation systems: - Cross ventilation, Stack ventilation, and Hybrid integrated ventilation systems, Methods for improving indoor air quality during construction by Construction air quality plan, and Improving air quality during construction, References and resources for further study.* (Montoya M., 2011, P: 99-104)

These are some major elements to target to achieve sustainable ventilation systems for a better building indoor environment quality.

2.5.3. Material properties and performance characteristics

> *Considering a material's attributes along with the environmental and structural conditions of the space in which it will be installed allows one to better understand how the selection of materials in integral to the design process.* (Gesimondo N. et al, 2011, p: 29).

Understanding and studying the properties of the materials used in the environmental design process allows us to better implement appropriate choices. They suggest several physical properties that might be considered, such as the ability of a material to expand or contract, stability & structural qualities, wear & age, odor absorption, moisture, warmth or comfort, and many other properties and they state: *"As an applied art, material selection and*

composition can contribute to or take away from a project's success." (Gesimondo N. et al, 2011, p: 29). Gesimondo explains about different physical properties of materials in detail. The list of detailed physical properties includes: absorption coefficient, acoustics, aging and weathering, cellular structure, compressive and tensile strength, density, dimensional movement (creep, deflection, expandability, shrinkage, swelling), ductility, durability, elasticity, emissivity, flame and smoke rating (class A, B, or C), moisture resistance, stability, surface attributes, thermal conductivity, thermal transmittance, and workability & joinery (Gesimondo N. et al, 2011, p: 30-31). This list could be a good example of the specific properties that might be targeted when trying to implement an environmental design construction materials. Without diving into the details of each material property, a general view of these properties would allow us to have an idea of the vast number of physical features the materials industry includes.

2.5.4. Applying sustainable design and the BREEAM system

BREEAM building certification is adopted as the environmental design evaluation system in the United Kingdom. Pelsmakers S. starts his debate with the broad aspects of environmental issues reaching in details the achieved environmental interior design in spaces. *"The internal environment: space, warmth, light and air"* (Pelsmakers S., 2015, *p: 149).*
As Pelsmakers states:

> *Two key drivers are making consideration of a building's internal environment ever more vital: the changing and the increased thermal performance of the fabric from which the building is built. (*Pelsmakers S., 2015*, p: 149).*

Targeting the interior environment of a building should be the way to attain a better space understanding by the improvements of warmth, light, and air along with the interior space which will lead to a better environmental design adaptation. To show the need for a better internal environment, Pelsmakers S. (2015) mentions that dealing with the internal environmental issues should be taken care of without compromising the quality.

> *Equally, increased airtightness standards, controlled background ventilation and even the impact of the building fabric on space standards all mean that a careful approach is required to avoid compromising the quality of the internal environment.* (Pelsmakers S., 2015*, p: 149).*

Having a checklist to facilitate the work of designers is an essential element to better implement an environmentally sustainable design approach. Pelsmakers (2015) provides a checklist for primarily residential development, that includes four principal components: space allowance, thermal comfort, flood protection, and interior air quality. (Pelsmakers S., 2015, p: 152-153). As Pelsmakers suggests, *"Dwelling space standards: minimum dwelling and room sizes" checklist to better understand the environmental internal space needs."* (Pelsmakers S., 2015, *p: 153).* Also, he states that *"Thermal mass combined with good summer night-cooling can help keep buildings passively cool in summer and balance winter space heating needs."* (Pelsmakers S., 2015*, p: 172).* Targeting thermal mass as a major issue that will improve the thermal adaptation of the internal space. Another element is the *"Pollutants and the indoor environment,"* (Pelsmakers S., 2015, p: 187). Minimizing pollutants found in most of the construction materials will be a thoughtful initiative to work on. These two aspects would go under the health and wellness of the dwellers that will not only improve the dwelling they are utilizing but also will have a significant impact on their health while using the other internal spaces. Pelsmakers suggests that

> *Making buildings more airtight whether newly built or retrofitted, means there is less unintended air infiltration to dilute pollutants and humidity, hence why well-designed building ventilation is crucial. Failure to do so may cause symptoms such as headaches, itchy eyes, blocked nose, loss of concentration, dizziness, exacerbated asthma and allergies. (*Pelsmakers S., 2015, p: 187).

This shows the importance of considering thermal mass, night cooling, pollutants, the indoor environment and many other elements to achieve a well internal space ventilation.

"The building fabric" is best described by its components, which are all related to the construction material's properties and methods used in the construction phase. *"Materials and*

construction methods may be chosen according to aesthetics, costs, availability robustness, and material performance, e.g. Acoustics and structural strength" (Pelsmakers S., 2015*, p: 193).* According to Pelsmakers (2015), these Components are general. When we specify sustainable fabric, other component's should be added and prioritized such as life-cycle assessment and embodied carbon of materials, including designing deconstruction and reuse. Another element would be thermal performance, air vapor, and water permeability, and impact on interior air quality. (Pelsmakers S., 2015, *p: 193*). *"The environmental impact of building materials,"* (Pelsmakers S., 2015*, p: 196)*, is the first element that comes to mind when talking about the building fabric and he presents a *"Material specification overview"* list to help designers prioritize between components in achieving sustainable design. For example, he has shown the advantages and disadvantages of some of the most used materials such as concrete, (Pelsmakers S., 2015, *p: 225*), that can be valuable for information related to storage on site, design, during construction, and in-use aspects. Highlighting the importance of these properties to be known, researched, and studied in the early stages of the design phase with the presence of some checklists can be used for each stage of the design. He continues to suggest checklists as follows:

> *Airtightness: design Stage" and "Vapour-open construction: design stage,"* (Pelsmakers S., 2015, *p: 256-259). "Yes, so far, less than 1% of solid walled dwellings have been insulated, and no UK regulations deal with the refurbishment of existing housing stock.* (Pelsmakers S., 2015, p: 277).

This is an example of what the renovation industry is suffering in the UK, and many examples can be held in other countries. Again, Pelsmakers suggests

> *By simply refurbishing to much higher insulation and airtightness standards, carbon reduction of at least 40% can be achieved. This would reduce the operational energy required just to heat our buildings by at least 80%.* (Pelsmakers S., 2015, p: 277).

This example shows the important role environmental design can play while in renovation process to improve the environmental approach in the industry. To better tackle environmental design, some technical elements were found in this book:

> *Recommended retrofit measure checklist" that can help in improving roofs, draught-proofing/airtightness, walls, background ventilation, materials finishes, solar shading, heating controls, boiler, floors, windows, doors & shutters, whole building retrofit, water, and energy provision.* (Pelsmakers S., 2015*, p: 282-283).*

These technical elements facilitate the way we target the building fabric in details when it comes to renovating buildings during the construction phase. He proposes another check-list as follows:

> *The green deal and eco" is another checklist that covers fabric improvements, heating, and heating controls, and micro-generation and renewables to show what elements can be targeted to improve an existing building through environmental design renovation process.* (Pelsmakers S., 2015, *p: 290-291).*

Pelsmakers (2015) presents the mechanisms that will improve the design and construction phases when targeting environmental design. *"This chapter contains key details to illustrate good practice concerning insulation placement, airtightness zones and minimizing thermal bridging."* (Pelsmakers S., 2015*, p: 299*). Mechanisms are shown in diagrams to explain the technical properties in design and construction stages. These illustrations include *"foundations, floors and wall junctions,"* (Pelsmakers S., 2015, *p: 302),* as an example to consider. Other elements are, "design, advantages, disadvantages, type of suitable insulation element, thermal mass and vapor permeable properties and description." (Pelsmakers S., 2015, *p: 302).*

> *Types of green roofs, including brown and biodiverse roofs" to targeting its aspects and details such as "soil depth, cost. Wet weight, suitable for food growing,*

compatibility with renewables, advantages, and disadvantages. (Pelsmakers S., 2015, *p: 321).*

These are just some of the many other detailed diagrams and checklists presented by Pelsmakers (2015) that can be important to look at before proceeding with the design process. Showing the successful sustainable projects is important to prove that sustainable construction is achievable and realistic. Sustainable design implementation around the world has been highlighted in the below section with further explanation of successful case studies around the world.

2.6. Case studies around the world

Several case studies were presented in Sayegh (2014) book "*Sustainability, Energy, and Architecture: Case Studies in Realizing Green Buildings."* The book indicates the sustainable efforts of several countries and successful examples of learned lessons in sustainable design. I will now outline the salient issues by country in the next section of the literature review.

2.6.1. Netherlands

The book starts narrating the history of how the Netherlands has reached a better implementation of sustainable built environment *"Dutch efforts towards a sustainable built environment"* (Zeiler W., 2014*, Chapter 1, p: 19).* The additional demand for energy use has developed in all countries; the issue lies behind how to limit our use or how to find better sources for our daily energy consumption. "Passive Houses" was one of the sustainable solutions for energy consumption. *"This leads to energy savings in heating of 80%, compared to conventional standards for new buildings."* (Zeiler W., 2014*, Chapter 1, p: 6).* Many statistics were presented to show the impact of shifting to passive houses as a sustainable solution example. *"Designing and building passive houses in a country is not a straightforward matter, as can be seen from experience of building such houses in Germany and Austria."* (Zeiler W., 2014, *Chapter 1, p: 6).* According to Zeiler, each country has its style of implementing passive houses depending on the country's building codes and

environment. *"Each country has its own building tradition, architecture, building technologies, climate, and culture."* (Zeiler W., 2014*, Chapter 1, p: 6).*

2.6.2. Halifax, Canada

The Canadian example is presented by Henderson debating the construction industry in Halifax, Canada trying to show us the appropriate way to deal with extremely cold conditions. "*Residential Deep Energy Retrofit in Cold Climates"* (Henderson S., 2014*,* Chapter 5*, p: 111)* was the title of this chapter. Henderson introduces how Canada was one of the first countries to introduce energy efficiency programs through the "National building code of Canada" in 2012 (Henderson S., 2014,Chapter 5, *p: 113).* He also explains how with the extreme cold weather comes a number of problems; *"horizontal driving rain, repetitive freeze, high flood zones, permafrost, seismic loading, and other structural and safety concerns",* (Henderson S., 2014,Chapter 5, p*: 113),* while Canada has succeeded to improve its energy efficiency and decrease energy usage. Targeting materials as a major issue to be developed while implementing environmental design is a must. As Henderson S. (2014) mentions, targeting retrofit envelope is a necessity to achieve a better thermal efficiency. He suggests different solutions on how to improve the insulation in renovated buildings such as adding more insulation to the exterior of the building. "*In typical terms of energy efficiency, there is a 'law of diminishing returns' in play when increasing insulation levels."* (Henderson S., 2014*,* Chapter 5, p: 117*).* Henderson also introduces a better understanding of the cost of insulation for retrofit in which he includes under the title of *"The cost of insulation vs. the cost of fuel"* to show a comparison chart on how to implement a better envelope for the building. Pinpointing *"Ventilation and Air Movement"* as a major element to work on by improving the environmental retrofit process has been a concern for Henderson specifically in cold weather.*"Controlled (mechanical) ventilation is required in cold climates as building envelopes get tighter."* (Henderson S., 2014, Chapter 5, p: *119).* Mentioning that a ductwork heating system is an excellent option except in Quebec.

> *Happily, this is one of the most common heating systems in most of Canada, the notable exceptions being Quebec, with inexpensive hydroelectricity making electric*

furnaces and strip electric the heating systems of choice, and the maritime region, where low-cost natural gas is not available, and the traditional choice of heating system has been an oil-fired boiler or strip electric. (Henderson S., 2014*,* Chapter 5, *p: 119).*

Henderson (2014) presents in his book different case studies to show the importance of environmental retrofit projects in Canada. He targets mainly seven issues, comparing pre-retrofit and post-retrofit of projects, which are *"Attic insulation, Above-grade wall insulation, below grade wall insulation, basement floor insulation, windows, Air tightness (AC/H at 50Pa), and Peak heat loss(kW)."* (Henderson S., 2014, Chapter 5, *p: 121*). Regina, Saskatchewan and Halifax, Nova Scotia were two targeted areas to consider in his case studies from which they are known as two regions where the cold reach its extreme in Canada (Henderson S., 2014, Chapter 5, *p: 120 & 123).* These Canadian examples of the environmental retrofit process sum up the cold weather environmental design process as an example for extreme climates.

2.6.3. Middle East – Dubai, U.A.E.

The next part covers mainly the most developed country in the Middle-East specifically under the title of sustainable design in Dubai, the United Arab Emirates. Aboulnaga (2014) explains the content of his chapter on page 131, through the title which is *"Sustainable Building for a Green and an Efficient Built Environment: New and Existing Case Studies in Dubai".* Aboulnaga introduces a general view about cities & buildings with the effect of Climate Change. (Aboulnaga M., 2014*, Chapter 6, p: 132-137).*

Aboulnaga M. (2014) states:

1. Fifty percent of material resources taken from nature are building related.

2. Forty percent of the energy used in Europe is building related.

*3. Over 50% of the national waste production comes from the building sector. (*Aboulnaga M., 2014*, Chapter 6, p: 138).*

Presenting these statistics, Aboulnaga tries to express the importance of adapting environmental solution into the building sector. Aboulnaga mentions three general benefits categories that sustainable design will aid in building industry,

"Environmental benefits: - Enhance and protect diversity and ecosystems.

- Improve air and water quality.

- Reduce waste streams.

- Conserve natural resources

Economic benefits: - Reduce operating costs.

- Create and shape makes for green product and services.

- Improves occupant health and productivity.

- Optimize life-cycle economic performance.

Social benefits: - Enhance occupant comfort and health.

- Increase aesthetic qualities.

- Minimize strain on local infrastructure

- Improve overall quality life. "

(Aboulnaga M., 2014, Chapter 6, p: 140)

Showing the benefits would help in developing the idea of sustainable solutions and show the advantages that could be achieved if used, trying to convince and make a positive point.

Placing Dubai, U.A.E. in the category of the developing countries that has started to implement sustainable federal regulations and laws to reach carbon emission reduction. According to Aboulnaga, Dubai published DSP (Dubai Strategic Plan) in 2007 emphasized on

sustainable development: “economic development, social development, and the built environment." (Aboulnaga M., 2014, Chapter 6*, p: 141).*

The DSP was centered on six main sectors: - Public sector

- Economic development

- Social development.

- Infrastructure, Land, and Environment.

- Security, justice, and safety.

- Government Excellence. (Aboulnaga M., 2014, Chapter 6, *p: 141)*

According to Aboulnaga, “Dubai Green Building Policy” was first implemented in 2008 in both the electric and water sectors, and then in 2010 first phase of Dubai Green Building regulations was published (Aboulnaga M., 2014*,* Chapter 6, *p: 140).* In an attempt to excel in environmental innovation, Dubai regulations and sustainable solutions have started along with the construction process of Burj Khalifa which was completed in 2009. Some environmental issues were targeted while building Burj Khalifa, the iconic world structure and they were trying to implement sustainable development as it was at that point. Aboulnaga mentions 18 case studies that took place in Dubai (9 new buildings and 9 retrofitted buildings) to show the performance indicators and the energy efficiency that they tried to implement as phase 1 of the sustainable development regulations and laws as implemented in 2009. (Aboulnaga M., 2014, Chapter 6, *p: 151 - 156)*. To demonstrate the achievement of the retrofitted building, Aboulnaga (2014) presents a chart that describes the sustainable process each case study targeted.

Green Elements applied in the retrofitting process of the three case studies

(4, 5, and 6)

Energy-efficient techniques:

- *Daylighting and light fittings*
- *Automatic daylight dimming*

- *Occupancy controls sensors*
- *Efficient light bulb*
- *Passive techniques*
- *Solar water heating*
- *Sunlight ducts (light wells)*
- *Lifts capacities*
- *Cool roofs*

Health environment and comfort:

- *Lighting level*
- *Noise level*
- *Water quality*
- *Air quality control b**y** CO_2 sensors*
- *Mold and dust measurements*
- *Safety*
- *Waste segregation and recycling* (Aboulnaga M., 2014, Chapter 6, *p:156)*

To sum up the construction phase of sustainable design, an analysis is shaped to mainly target sustainable design and construction to best facilitate the significant points in achieving sustainable design.

2.7. Analysis: Indicators and guidelines perceived

In this section dividing and analyzing the emerging themes will provide preliminary means to assess sustainable guidelines & indicators coming from sustainable projects.

Referring to some systems for indicators will be the initial assessment process to evaluate sustainable projects. One of the general indicators will be the SMART system for indicators.

***SMART** system for indicators:*
***S**pecific: Clear and simple?*
***M**easurable: Scientifically sound and verifiable?*

***A**chievable**:** Doable?*

***R**elevant: Meets sustainability goals?*

***T**ime-Related: Timely? The potential for repetition?* (Shen, Ochoa, Shah, & Zhang, 2010).

The LEED certification category is one major certification system that indicates successful sustainable projects. As a preliminary overview, four themes emerge among the suggested emerging guidelines based on the LEED system to evaluate the sustainable potential of the project.

Guidelines :

A. According to LEED V.4 for BD+C: New construction and major renovation

(USGBC (2015). "BD+C: New Construction and Major Renovation." LEED V.4. Project Checklist.)

1. Water efficiency

- Water use reduction – 20% reduction
- Water efficient landscaping
- Innovative wastewater technologies
- Water use reduction

2. Energy & Atmosphere:

- Fundamental commissioning of building energy systems
- Minimum energy performance
- Optimize energy performance

3. Materials and Resources

- Storage and collection of recyclables
- Building reuse- maintain existing walls, floors, and roof
- Building re-use maintain 50% of interior non-structural elements

- Construction and demolition waste management planning
- Materials ingredients
- Recycled content
- Regional materials
- Rapidly renewable materials
- Certified wood

4. Indoor Environmental Quality

- Minimum indoor air quality performance
- Environmental tobacco smoke (ETS) control
- Outdoor air delivery monitoring
- Increased ventilation
- Construction management plan- during construction & before occupancy
- Low-emitting materials - adhesives and sealants
- Low-emitting materials - paints and coating
- Low-emitting materials - flooring systems
- Low-emitting materials - composite wood
- Indoor chemical and pollutant source control
- Controllability of systems - lighting and thermal comfort
- Thermal comfort - design and verification
- The material certification use such as Cradle to Cradle certification
- Interior lighting
- Daylight
- Quality views
- Acoustic performance

B. Guidelines assigned by some findings (Pelsmakers S., 2015) The environmental design pocketbook), (Pelsmakers S., 2015, p: 225). This is an adapted version of the guidelines by Pelsmakers:

1. **Materials and Resources**

- Materials reuse
- Cradle to Cradle certification
- Material databases

2. **Indoor Environmental Quality**

- Sustainable material databases used to choose and implement in an environmental design project.
- Daylight
- Home automation systems

3. **Innovation and Design Process**

- Interdisciplinary research methods used at the beginning of the project to consume less time.
- The use of EBD (evidence-based design) and shared design at the beginning of the project process.
- Sustainable solution planned at the beginning of the project phases.
- Client behavior and purpose to choose a sustainable project.
- Feasibility studies at the beginning of the design process that can lead to consuming less time.
- Strategies used to convince the client with sustainability.
- Professional aid available for clients to have a simplified view of sustainable projects.
- Budget used for each environmental design project.
- Information is available for clients.
- The role of the designer in educating the client.
- The technology used through design process such as virtual reality used as a prototype instead of models.

C. Materiality and interior construction (Gesimondo N. et al, 2011, *Materiality and Interior Construction*) suggestions for guidelines:

1- Design intentions

- The design concepts
- Health, safety & welfare

2- Environmentally sustainable design considerations

- Carbon - Neutral Design
- Local materials
- Natural and synthetic materials and components
- Rapidly renewable materials
- Recycled materials

3- Material properties and performance characteristics

- Absorption coefficient
- Acoustics
- Aging and weathering
- Durability
- Fire rate
- Thermal conductivity
- Thermal transmittance

D. Center for active design checklist: Building design elements include:

- Designing stairs for everyday use
- Building programming
- Appealing and supporting walking routes
- Building facilities that support exercise

E. The environmental design pocketbook (Pelsmakers S., 2015, *The Environmental Design Pocketbook. 2nd Edition. RIBA publishing.)* Suggestions include:

1- The internal environment: space, warmth, light and air

- Dwelling space standards: minimum dwelling and room sizes
- Ideal room orientations: recommended zoning
- The concept of thermal comfort
- Daylight, solar shading and designing for hotter summer
- Thermal mass and night cooling
- Natural ventilation, MEV & ventilation with heat recovery (VHR)

2- The building fabric

- The environmental impact of building materials
- Typical mainstream materials and construction methods
- Thermal performance: keeping the heat in (and out)

3- Retrofit of existing housing stock

- Demolish or Refurbish?
- Recommended retrofit measure checklist
- Which standards for retrofitting the existing housing stock?
- Will it be necessary to refurbish existing properties in a warming climate?
- The real cost of retrofitting the existing housing stock
- Reduced standards for a reduced cost

4- Key details

- Foundations, floors and wall junctions
- Wall and window junctions
- Roofs

Starting with the general abilities to transform our daily life-style into the sustainable aspect was a must to debut from the larger scale to prove that sustainability is valid. In the

case of Lebanon, was a part to show the need of sustainable design as an essential element in taking action. Describing and explaining the sustainable barriers found in the design industry, education, and community became a way to approach the sustainable status found today. Educational and community approaches were the methods that allowed us to be familiar with the obstacles in order to examine in detail. At the end, was a showcase of the details found in the sustainable construction industry and possible answers of the construction problematic in practice. With the adaptation of educational and community approaches as the methods to improve the sustainable design status, comes the priority of educating the client who is considered as the public aspect related to the sustainable design project.

3. Methodology and study components

3.1. Methodology

According to Mack (2005), qualitative research is a scientific type of research that seeks answers to specific questions to reach new findings that were not determined in advance and are applicable in the future. Qualitative research methods are an effective way to obtain information about opinions, behaviors and social context, in a non-statistical manner. A general framework of the qualitative methodology will be used to explore phenomena used in the research along with the use of in-depth interviews and experienced participant observations (Module 1: Qualitative Research Methods: A Data collector's field guide, 2005). The analytical objectives include explaining relationships, individual experiences, and group norms and behavior.

The approach in this study is to understand the phenomena of sustainable approaches using a methodology type that is both dialogic and dialectical, meaning, that the collected data is compared and contrasted to discover meanings. (Denzin, N.K., 1994). The purpose of the research is to raise awareness among interior design and architecture clients by guiding them to reach sustainable design with simple research strategies that mainly target time and cost such as Evidence-Based Design (EBD) and Integrated Design Process (IDP).

EBD (Evidence-based design) is an approach to understanding how the environment affects human behaviour. As Whitemyer (2010) mentions,

> *Traditionally associated with healthcare architecture, evidence-based design (EBD) is making inroads into being part of the process for designing schools, office spaces, hotels, restaurants, museums, prisons and even residences. In short, EBD is when decisions about physical space are based on research and data.* (Whitemyer, D., 2010).

EBD will be used at the beginning to better understand the potentials of the project. We should be using research skills not to mimic design, but to gather scientific evidence to support our designs. With the help of today's technologies, much time could be saved by gaining

scientific, professional, economic and technological based evidence to include in our design. CIDA professional standards for 2014 state the following as a part of the design process standards:

> *The exposure of students to a range of design research and problem solving methods" that should lead in terms of student's expectations to "gather, evaluate, and apply appropriate and necessary information and research findings to solve the problem (pre-design investigation).* (CIDA, 2014).

CIDA includes the advanced research through the educational programs of universities since it is essential for design education. Rodgers states that awareness should be available to prioritize knowledge over craft. (Dykes et al, 2009).

3.1.1. Integrating a view of the integrated design process

Pearl has developed the IDP process to integrate into his projects. Integrated design process as described by Pearl (2004):

> *In professional practice, IDP has a significant impact on the makeup and role-playing of the initial design team. The client takes a more active role than usual, the architect becomes the leader rather than the sole form-giver, and the structural, mechanical and electrical engineers take on active roles at the early design stages.* (Pearl D., 2004)**.**

These strategies can be implemented at the beginning of each project to facilitate later complications.

> *The IDP process is based on the well-proven observation that changes and improvements in the design process are relatively easy to make at the beginning of the process, but become increasingly difficult, expensive and even disruptive as the process unfolds.* (Pearl D., 2004)**.**

EBD & IDP are two key tools when considering a better project understanding. EDP provides a means to use evidence to support design thinking, while IDP as an advanced tool can be used for both renovation and newly built projects and meant to improve the environmental potential of the project. (Pearl D., 2004)**.**

Working step-by-step and linking each step to the other provides a framework for environmental interior design understanding that could answer the client's satisfaction. As Aouad states, "It is after all the quintessence of the interior design profession to provide the publics with a better quality of life" (Aouad D. 2013, P: 59). The comprehension of sustainability is the target of this research, without ignoring the client's attitude.

Grouping all mentioned disciplines could result in a sustainable process of extending research duties and reducing production time.

> *Through interdisciplinary approaches, the interaction between different disciplines will be stimulated; hybrid communities will emerge; thus, blurring the traditional design disciplines making way for more creative contemporary designs*. (Aouad, D. 2013, P: 59).

The above is considered as one element of the sustainable process in design, which will help achieve less time consumption and form standard indicators to facilitate the work for the next process phases.

The purpose of this methodology is to collect information then analyze it to create a clear understanding that will facilitate the client's understanding to reach a better choice of sustainable design projects. Highlighting successful and unsuccessful examples and analyzing the indicators and guidelines used to reach sustainability will allow us to acknowledge profound reviews of what could be appropriate to influence the client's choice.

The research phase performed at the beginning of the design process will help consume less time for the sustainable process, while the cost element could be accomplished by presenting different databases available for a better choice of sustainable material.

3.1.2. The theoretical premise

As this study is exploratory in nature, the study proceeds with the backdrop of the ideas about EBD and IDP to frame the exploration of the perspectives that occur within the data collection. The theoretical premise is that a holistic sustainable approach requires creating an understanding with the client of the integrated design processes (Pearl D., 2004), and also what constitutes an environmentally sustainable design approach for interiors. EBD and IDP will be the framework in approaching sustainability as preliminary stages of design to better plan and manage the sustainable project. EBD and IDP will attempt to consume less time in the implementation phase while being used as introductory stages. Time and cost are revealed as salient issues in the literature review and will be the main topics explored to see if these are prominent issues with the experts. Experts from both countries were interviewed to understand the communication tools used in their experience with sustainable education and profession with their students and clients, from both architecture and interior design perspectives. The gathered interviews will permit an understanding of what issues emerge in how to improve the client's understanding about sustainability.

3.2. Methodological approach

Due to the nature of the exploration of these ideas, there are 3 phases of data collection and analysis. Data collection proceeds using the interviews and case studies as described below. The interviews are open-ended, thus providing the means to construct the phenomenon as the experts describe their experiences. (Denzin et al, 2000)

This is followed by an interpretive analysis that culls emergent issues and themes in a constructive manner (Denzin et al, 2000). During the analysis, a comparative study is done between Beirut, Lebanon and Montreal, Canada.

The two case studies tackled were chosen according to the "SMART" indicators system (Shen, Ochoa, Shah, & Zhang, 2010). After finalizing the interviews analysis and performing a comparative analysis, two case studies are then examined in further detail, and as were suggested by Nancy Dunton (2017). The two social housing projects in Montreal that she

suggests were examined to be adopted as appropriate examples of how to research, plan, manage, and implement a sustainable project. The two successful sustainable projects were essential to be analyzed to explain all details and aspects of achieving a successful sustainable project. Adopting these case studies will allow the adaptation of the strategies followed into duplicating the success in Beirut, Lebanon and why not in other projects in Montreal, Canada.

3.2.1. Data collection and analysis

Part 1 – Choice of participants

The interview process includes choosing the participants, who are chosen with their experience with sustainable design education and practice in mind. Next will be the preparation of the questions and themes to target throughout the interview to their particular experience. The type of the questions will be open-ended, to have a flexible environment regarding the subject and the themes targeted. This approach will facilitate future analysis of the interviews. The two titles that will be targeted through data collection will be related to the concept of time and cost as the major barriers the client's faces and that restricts achieving sustainable design projects.

Part 2 - Interviews

The interviews are performed through a personal communication (face to face) interview or Skype video call. Video and audio recordings are carried out throughout the interviews to ensure the descriptive validity of some observations and to stimulate the recall and reflection.

Part 3 – Analysis of interviews and case studies

The final phase includes an analysis of the four interviews and the two successful projects presented in Montreal, Canada to better understand how to implement successful sustainable projects. The two case studies are used to examine in detail what can be learned when thinking, designing, and implementing the sustainable project. The final analysis is then done to glean the primary findings from the interviews and case studies. This analysis also is used to clarify the professional's point of view.

The analysis proceeds with a reading and proof reading of the texts of the literature review and the interviews, to glean the issues that emerge across all the texts. This is an interpretative approach (Denzin et al, 2000), where each analysis is done to interpret the presented elements of the study. The interpretative approach allows more flexibility with the analysis to integrate the social aspect of design into the study.

The data analysis follows different criteria in which the two drafts of sustainable indicators and sustainable guidelines (outlined previously) will play a prominent role. A preliminary analysis is performed after formulating an idea from the literature review. A second analysis is conducted after finalizing the interviews phase and getting new findings from the interviewees. The final analysis is carried out, after completing the two successful case studies that include some sustainable solutions to be implemented in different projects.

The argument for this approach is that in understanding both the existing conditions and the views of the designers and architects who use sustainable approaches, documenting their ideas in an analytical manner helps to provide guidelines for future sustainable projects that can inform stakeholders, such as clients.

3.3. Study components

The study components include the literature review, an examination of systems and issues of sustainability, and subsequent interviews from professionals and educators in Lebanon and Canada. The literature review will facilitate the understanding of the problematic by seeking some preliminary answers to the research questions. Explaining different points of view that will aid us to formulate the design research that sets up the general context of understanding the sustainable design industry in both Lebanon and Canada.

3.3.1. Study description

The goals of the research are to understand the general setting and context of the targeted area of research. In the case of this study, these are examined in light of the views of architects and experts. The study will manage to follow two research elements that have already been identified through the preliminary research phase, which would be education and professional

approaches to sustainable interior design. The study unfolds in the following phases as described below.

Phase 1

The first phase includes a review of some sustainable private organizations and certifications. The literature review includes sustainable solutions found in LEED, CaGBC, USGBC & interior design "By-Law 1&2". The issues were then analysed and indicators for various systems emerged as important to lay the groundwork for the data collection that follows.

Phase 2- Research presentation

The second phase is divided into two parts which will include 2A and 2B. Phase 2A is an analysis of case studies of certified or intended LEED certified buildings in different countries. In addition, evaluating current sustainable practices in various countries was done, and as was presented in Chapter 2. Netherland and Germany emerged as two of the expert countries that have been able to achieve durable solutions from all aspects examined. Looking at the general picture and then going further into the details will be the approach used to analyze the best practices in these examples, as a means to show successful examples of sustainable projects and document the sustainable indicators.

Analyzing these projects in both countries will help show the important role sustainable indicators and guidelines play in attaining sustainability. Presenting two successful examples from Montreal, Canada will be essential to highlight the difficulties the sustainable industry is facing and to show the sustainable potential found.

More than one project is being designed to have the intention to be LEED certified in Beirut, Lebanon. These projects are not finalized yet, which leaves us with more than one uncompleted examples to adopt for Beirut, Lebanon. Beirut-Terraces and District //S are two sustainable projects that might show the potential of reaching sustainable designs in Beirut, Lebanon.

Phase 2B- Interview participants and locations

Interviewing professionals and educators from Montreal, Canada & Beirut, Lebanon about their opinion of the client's behavior towards sustainable projects and highlighting the problems the client face according to the interviewed individual's experiences. This phase will include the group of interviewed individuals chosen among professionals and educators to highlight sustainable issues raised and how to solve them. Interview questions will be prepared for architects and interior designers, who had experienced sustainable approaches in their projects or had sustainable courses to teach in both Beirut, Lebanon and Montreal, Canada. The interviews will be with experts who are considered leaders in environmental and sustainable design in their practices. The chosen educators are selected from University of Montreal and Lebanese American University. The interview will include different questions that cover the client's behavior towards sustainable projects. In addition to answering some questions and having participant's point of view about the sustainable indicators and guidelines.

Interviews were conducted with two individuals from each of the two countries, Canada and Lebanon, with experience in sustainable education.

Question formats are open-ended to reach a better understanding of experienced individual's comments to be an element used to improve the findings. Data format is textual obtained from audiotapes, videotapes, and interview notes. Flexibility in study design is presented by adding and modifying the interview questions, since individual's responses could affect the questions asked next, and adjust data collection and research questions according to what is learned, observed, and found.

Locations were selected according to the need and availability of sustainable design in both countries. Lebanon has a severe need to change the design industry and benefit of sustainable approaches while sustainable design can be easily implemented knowing the geographic location and the social ability to accommodate sustainable approach. Montreal, Canada was another location to show the minimal successful sustainable projects implemented where the resources are much more available than Lebanon. These minimal successful projects were examples to be considered for future sustainable design implementation in Montreal as well.

3.3.2. Data collection

Analysis 1- Re-evaluating the design process

The first analysis was done to evaluate the private certification systems found to be successful. This analysis is drawn from the literature review including sustainable systems that shows detailed diagrams and lists of key issues. Sustainable indicators and guidelines will aid us in preparing the interview questions. After performing the research and analysis phases of some sustainable examples & case studies, a list of sustainable indicators should be available before proceeding to the next phases. Here in Figure 2 the emerging issues are grouped together:

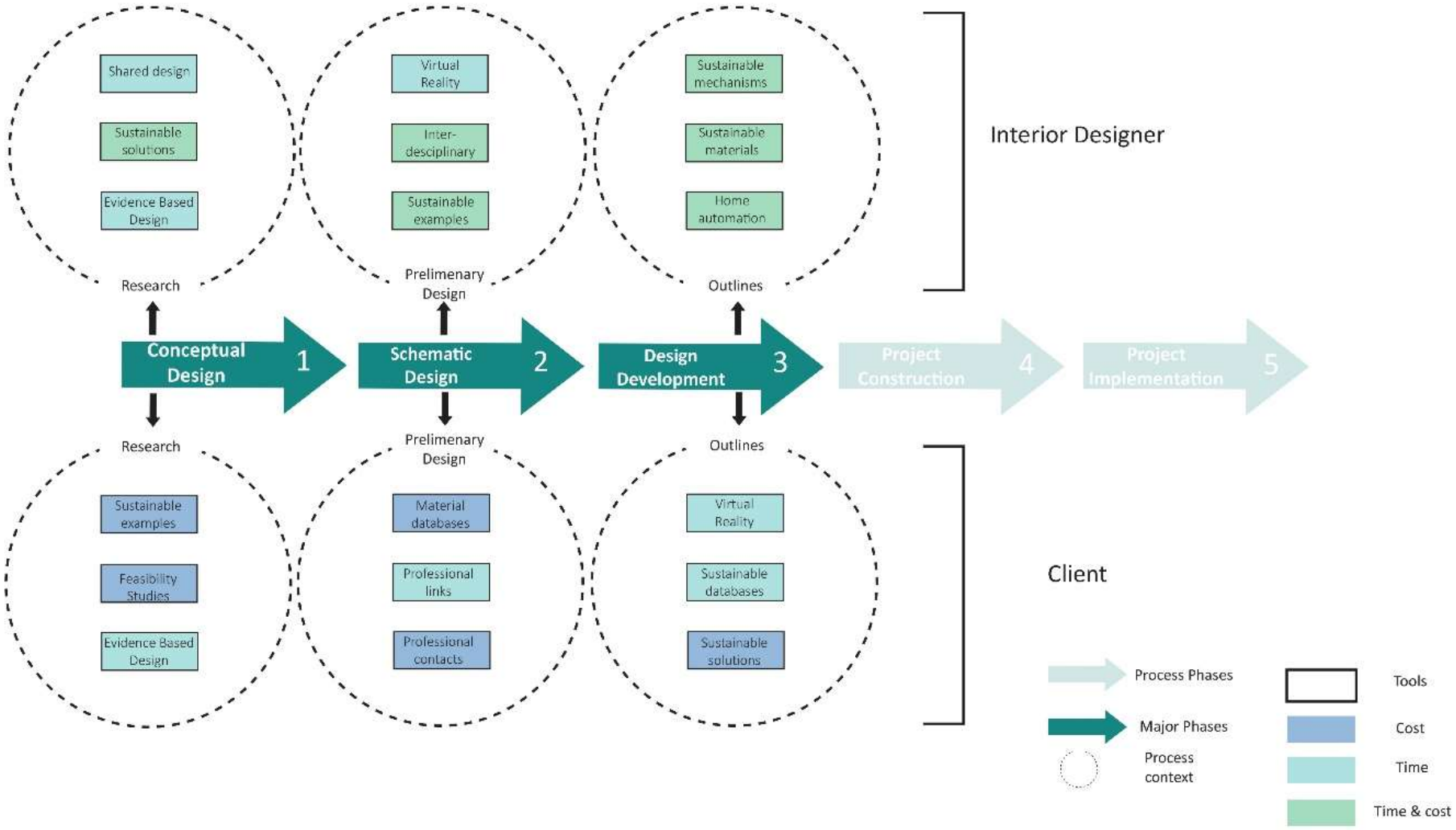

Figure. 2 -Re-evaluating design process to target the client

(Source: A. El-Khatib)

This Schematic model (Figure. 2) acts as an example that supports the research through the re-evaluation of the design process by adapting newly added tools to every major design process. With the assistance of many professionals and educational points of view, the design process was simplified to five major phases. The first phase is the conceptual design phase followed by the schematic design phase. The 3rd phase is the design development phase followed by project construction and implementation phases.

After having a draft of specific indicators & guidelines for sustainability, questions for each interview are prepared to start the next phase.

Analysis 2

After performing the interviews, an analysis is done and ideas are added to the specific indicators of sustainability. These are also confirmed by the experienced individuals. This list of indicators and guidelines is a checklist. These sustainable indicators & guidelines are used as a reference point for discussion.

3.3.3. Sampling

The interviews were chosen specifically to cover both education and professional perspectives. The sample consists of four interviews, two each professional and educational, and one from each country, Lebanon and Canada.

Interviews

The individuals interviewed will be chosen according to their educational and professional experience in the field of architecture, interior design, sustainability or their experience dealing with sustainable approaches. Four interviews are performed to formulate the academic and professional point of view.

The first individual interviewed is Nada El-Khoury. She is a researcher in sustainable design and a professor at Lebanese American University, and where she has performed some research in sustainable development.

The second individual interviewed is with Ghassan Abu Haydar, a researcher, professional, and a professor at the Lebanese University. He is an experienced architect with a variety of projects and client behavior experiences. His academic experience at the Lebanese University goes back 10 years when he and his colleague introduced and taught sustainable architecture workshops.

The third individual interviewed is Daniel Pearl, considered one of the leading architects and educators in sustainable and environmental design projects in Montreal. He is a professor at University of Montreal and is past Director of education and research at CAGBC (Canadian Green Building Council).

The fourth individual interviewed is Nancy Dunton, a professor at the University of Montreal. She was recommended by Daniel Pearl on behalf of her contributions in Benny-Farm & Rosemont Projects that were leaders in sustainable social housing in Montreal, Canada. Dunton was one of the committee members who had put her experience in environmental design and sustainable solutions to better implement these projects.

Case studies

Preliminary case studies are chosen in reference to the "SMART" indicators system that is already presented in the literature review in Chapter 2. Extracted from the literature review, three case studies were taken to show a preliminary view and case studies in some countries. After performing the interviews, new findings have arisen to allow us to investigate two examples of sustainable social housing implemented in Montreal, Canada. These two examples are Benny-Farm and Rosemont projects. Further research and analysis were performed to understand the process of formulating a sustainable project in Montreal, Canada.

3.4. Assuring ethics and transparency

3.4.1. Ethical procedure

The ethics certificate was obtained for this study, accompanied by an information form and consent forms in both English and French, as well as the interview issues & themes (Appendix III). All documents were submitted to the ethics committee of the Université de Montréal

multi-faculty research ethics committee (CPER) to get “Certificat d’approbation éthique.” The ethics certificate (Certificat d’approbation éthique) was received to proceed and perform the interviews from June 2, 2016 till June 1, 2017.

3.4.2. Trustworthiness and transparency

Several efforts were made to assure that this study is transparent and trustworthy. From the beginning, the literature review was extensive, highlighting the issues or barriers about sustainability and environmental design industries from many sources. The choice of interviews and the data collection proceeded with trusted sources such as LEED, BREEAM, and Cradle to Cradle. Case studies were chosen based on the recommendations of several sources. Getting the information on these private certifications and systems was meant to be through literature readings. The interviews participants aided the research to guarantee the rigorous of the information adopted to assure the accuracy of sampling, data collection, and data analysis. Interview participants helped make sure that the analysis referred to trusted sources and was accurate according to their point of view.

The building of indicators and comparing the two case studies were aspects of internal trustworthiness. The case studies that were recommended of the social housing sites were further support to the findings and their analysis supported the interview content.

4. Presentation and analysis of the results

The following description is the analysis of the results of the interviews that were conducted. The data collection will present the interviews done with Nada El-Khoury, Ghassan Abu Haydar, Daniel Pearl, and Nancy Dunton. Afterwards a comparison will be done showing the differences of the findings between Beirut, Lebanon and Montreal, Canada interview participants. Interviewees from Lebanon are two professors who have previously taught sustainable design and sustainable architecture in Lebanese universities alongside with their professional experience in the design and architecture industry in Lebanon. Interviewees from Montreal, Canada had experienced and worked in actual successful sustainable projects implemented in Montreal, Canada and they best present the method and sustainable thinking to achieve a successful sustainable project.

The analysis proceeds with a coded method to extract the major elements that emerge from the interviews. This preliminary analysis presents the major points extracted from the four interviews by presenting each data collection, and then with a presentation of six different categories.

4.1. Data collection I

Under the title of "data collection I' are the main elements taken from the interviews performed. At the end of the presentation of these elements, what is significant about issues, findings, and solutions that will benefit the research analysis is presented. Six broad categories organize the salient information from the interviews performed. These categories are: General barriers, client attitude, government barriers, educational issues, social barriers, and private certifications and systems. These categories also facilitate the later comparison between the two case studies, Beirut and Montreal, in terms of salient issues that arise within each category.

4.1.1 Analysis I- Brief coded comparative analysis

The following categories were developed as the overarching themes:

1- General Barriers

2- Client Attitude

3- Government Barriers

4- Education issues

5- Social Barriers

6- Private certifications (LEED, DGNB, ARZ, FSC…)

Several elements emerge in reading the interviews.

In this analysis, the considerations of each element are documented by city and by overarching topic. Here is an overview of the elements that emerge under each category from the perspective of interviews in Beirut and Montreal:

1) **General barriers**

Beirut:

a. People who make a difference should be given some financial support of discounts or raise property taxes.

b. Introduce comprehensive design process.

Montreal:

a. Sustainability is trying to sustain and even regenerate.

b. Sustainability is "What tools and processes are wanted in which context."

c. Time is a real problem, in that sustainable approaches take longer than the need from the industry.

d. Regarding sustainable education, it's better to start early.

e. According to a recent statistic, 30% of the landfill waste is from construction.

2) **Client attitude**

Beirut:

a. The main issue for client is the cost and the percentage of what the project could be when over the budget.

b. Budget is the main issue for client.

Montreal:

a. Sustainability is both ethical and subjective. As it also is an intersubjective position when understanding the whole context, the issue is complex.
b. Questioning the client goals is a process of co-education with the client.
c. Understand the potential that the client has in terms of engagement.
d. Co-learning may take a long time.
e. Green financing solutions can aid as a tool.
f. Attitudes are still changing and yet it is still a challenging topic.

3) Government barriers

Beirut:

a. Government barriers are an issue.
b. Lack of governmental intervention is a challenge.
c. Work on federal policies would assist.
d. Lebanon is 4th or 5th on the sustainability projects list with 150 sustainable buildings and 25 LEED certified buildings.

Montreal:

a. Planning an offgrid neighborhood will not be accepted by the government since taxpayers are needed for the roads, services and others.
b. Political problems continue to be difficult in the social context.
c. Some minimal government policies such as tax credits are helpful, such as replacing windows.
d. Until the government recognizes the need to encourage owners, things will progress very slowly.

4) Education issues

Beirut:

a. Educational awareness is necessary.
b. Need to educate designers as to what are the best sustainable solutions.

Montreal:

a. Negotiated dialogue is necessary and questions include: What is the social cohesion of the neighborhood and how is it going to be affected? What are affordability and diversity? Are we going to be inclusive, or exclusive?
b. What is cultural diversity, economic diversity, mixed use diversity, and complexity in the context of sustainable options?
c. Architects and interior designers can be proactive by creating teams with vision.
d. Need for both context and stakeholder's awareness.
e. Stakeholders include owners, eventual users, the community, bureaucrats & politicians, academics, and experts outside the neighborhood who see that this is a wonderful opportunity to get involved.
f. "Loose fit" philosophy as a solution for now and a means to plan for the future.
g. Energy solutions include saving energy and it costs nothing to save.
h. Educating stakeholders is difficult.
i. Major renovation problematic in Montreal is in the building envelope. While most clients try to ignore this element since it is the hardest and priciest element of the building when it comes to renovation and when there is the presence of strict conservation rules.
j. Biggest problems of renovation are air quality, the envelope, and wasteful heating systems.
k. Education can help in terms of understanding both the initial systems construction and then long-term monitoring. This needs the professional education of architects and designers.
l. An issue is mandating proper diagnosis.
m. It is essential to consider the factors of real diagnosis and understand what we have and how to do it.
n. Pressure comes from the kids in current generations, such as recycling in Montreal (blue boxes).
o. When schools teach children to recycle, they in turn, push their parents to do the same.
p. Education of homeowners, architects, and designers is an ongoing process.

q. Toolkit for teachers to teach about awareness of built heritage is a current initiative for primary & secondary school kids in Montreal.

5) Social barriers

Beirut:

a. Community awareness
b. Social awareness for designers and public and the public is a large issue.
c. Educate society by introducing sustainability in early education would be important.
d. Beirut can be a leader, in terms of the massive resources available, in terms of sustainability.
e. Community awareness is essential, and one way to encourage is to give prizes to all successful projects.
f. Need for social awareness for both designers and the public.
g. Involve the community more.
h. Collaboration
i. Shared design

Montreal:

a. Part of current education is that the project must give back to the community as much as it takes.
b. Each scale has different needs and different approaches.
c. A ethical question in Quebec is the role that hydro generated electricity plays.
d. Involvement & implication of the community is important.
e. The community must continue to pressure municipalities to make things more efficient.
f. People's ambitions are advanced but perhaps the construction industry is not keeping up with the demand for change.
g. Lack of education of the industry.

h. Current generation architects & designers have the right attitude and desire but the lack of resources persists.
i. Community pressure only works with increased awareness by industry about sustainability.
j. When industry requires sustainability, the community will follow.
k. "Chez-Soi" community education was tested when the "Grey water system" was introduced. This is an example of how sustainable solutions were provided for residents and how community education takes place.
l. Sustainable management can increase when both industry & the community become educated.

6) Private certifications (LEED, DGNB, ARZ, FSC…)

Beirut:

a. Now ARZ certification is trying to implement sustainable issues and trying to get involved with the government since 2011.
b. Improve the follow-up process with certification.

Montreal:

a. LEED is not enough as a certification standard.
b. While there are checklists and rating systems that are tailor-made, problems continue to persist.
c. LEED is not enough to target sustainability (Dunton)
d. LEED is a checklist.
e. LEED is an important beginning but we are at a moment of change.

4.1.2. Analysis II- Emerging issues

The previous list of barriers was presented as between Montreal, Canada and Beirut, Lebanon. This was essential to facilitate the comparison between both countries. Here we see how these issues are compared. In table 1, both countries barriers are presented, to show the how many barriers are found in each country. This step will simplify the overview for

directing the issues later. Lebanon has the higher number of barriers (17), while in Montreal, Canada there is a lower number of barriers (5). This comparison shows that there benefits on learning about what works in Montreal, Canada, and what might be useful for Lebanon in terms of understanding how these barriers might be reduced.

Categories	Montreal, Canada	Beirut, Lebanon
1- General	- 30% of the landfill waste is from construction debris	- Minimal individual initiatives
2- Client Attitude	- "Cost" is a major issue for client - Minimal ethical position	- "Cost" is a major issue - No ethical position - Lack of resources - "Time" is a major issue
3- Government		- No federal policies - No association policies
4- Education	- Lack of industry awareness - Minimal stakeholder's awareness	- Lack of education awareness - Lack of designer's awareness - Lack of industry awareness
5- Social	- Community will follow	- No community awareness - No social involvement - No Social collaboration
6- Professional	- LEED is a generic checklist and not enough. - In terms of the industry, we are far behind	- Lack of sustainable solutions competition. - No follow up especially for LEED certifications - ARZ Certification part of LGBC since 2008 and no actions taken - Minimal LEED projects

Table. 1 – Comparative Analysis of the barriers - (Source: A. El-Khatib)

Table 2 presents the available sustainable solutions found in Beirut, Lebanon and Montreal, Canada. Table 2 shows that the number of available solutions in Montreal, Canada is higher than that found in Beirut, Lebanon. Precisely, in Lebanon there are no attempts observed or noted for successful sustainable solutions implemented. Montreal, Canada showed 12 points regarding sustainable solutions found.

Categories	Montréal, Canada	Beirut, Lebanon
1- General	- In terms of sustainable education, it's better to start younger.	
2- Client Attitude	- Process of co-education with clients may take months and months.	- Minimal willingness but faced by a lot of barriers so clients are stepping back.
3- Government	- Minimal federal policies such as tax credit for replacing windows. - Green financing solutions are available.	
4- Education	- Better implement context awareness for stakeholder's awareness. - "Lose fit" philosophy. - Tool kit for teachers to teach about awareness of Montreal built heritage to primary & secondary school kids. - School recycling awareness pushed parents (public) & government to implement recycling in Montreal.	
5- Social	- Involvement & implication of the community. - Community must continue to pressure municipalities to make things more efficient. - Current generation of architects & designers have the right attitude & desire but companies mislead them.	
6- Professional	- LEED started improving their systems beyond the mere ideas of bike's stand to be a box to check.	

Table. 2 – Comparative Analysis of the solutions - (Source: A. El-Khatib)

4.1.3. Sustainable design practice in Lebanon

With the emergence of new markets in Lebanon, the rise of sustainability has been based mainly on the LEED certification system implementation to date. However, sustainability in Lebanon has been in a very slow progress pattern. In my interview with El-Khoury, we speak about these issues. As El-Khoury states: *"Some clients are starting to be aware of sustainable issues when they ask us to design their projects"* (El-Khoury N., 2016). El-Khoury talked about her experience with a client that wanted to renovate a building. He was considering sustainable solutions such as solar panels and rainwater collection as a major part of his project. However, there were many restrictions from the government to have the permit as clients are not allowed to put a certain number of solar panels on the roof because they need to have 20% of the property's electricity provided by the government. Having federal restrictions hamper individual initiatives, such as being off the power grid, and this is a major issue needing new solutions. As El-Khoury states:

> *This client lived in France and Dubai, and he asked for sustainable solutions for his project, so it was his initiative to implement sustainable solutions but now he is regretting going into all of this chaos especially after knowing the cost of sustainable solutions in Lebanon which lack the sustainable industry competition, and it's obliging him to invest more money into his project.* (El-Khoury N., 2016).

El-Khoury has been introducing minimal sustainable solutions to clients, such as the choice of materials to have better healthy products to improve productivity, health, and wellness used in designing spaces. Regarding some of the natural ventilation solutions, according to El-Khoury (2016), the public mentality needs to change. For example, they will not accept some simple solutions, such as having a balcony with some plants instead of having curtain glass all over the exterior residential spaces.

> *I once tried to convince a client not to have curtain glass and instead to have an exterior space on the balcony with some plants to improve the air quality and to have a*

transitional space between interior and exterior spaces, but the response was no because plants will bring insects. (El-Khoury N., 2016).

Educating public awareness in Lebanon is essential, as the public attitude toward sustainable solutions and sustainability, in general, lacks long-term thinking. *"People are living in aquariums they want to isolate themselves from all exterior spaces"* (El-Khoury N., 2016). As El-Khoury continues:

The main issue is the resistance from clients to change, because they don't want to look at their investment in a new angle that will mainly affect the profit, the cost is the highest scoring barrier for the transition to sustainability that affects the capabilities of the project. (Abu Haydar G., 2016).

Abu Haydar (2016), speaks of the 15-20% additional cost achieved when implementing sustainable solutions into design construction process, is a significant margin for the client when considering his investment. According to Abu Haydar (2016), this kind of resistance that the client shows might be reduced if we work on raising awareness and educating the public. This means educating the client in a way that would make them feel comfortable and have some knowledge to work with sustainable projects. The lack of knowledge is what makes the client worried to proceed with sustainable projects. As Abu Haydar states:

Clients have heard of sustainability as a trendy process for design projects while they do not know what sustainability in design means" (Ghassan Abu Haydar, 2016). He added, *"I think the lack of awareness, the lack of enthusiasm by the client, and the lack of exposure of knowledge in sustainability were the barriers against integrating sustainability into our any future design proposal.* (Abu Haydar G., 2016).

According to Abu Haydar (2016), *"Lebanon is the 4th or 5th in MENA area in sustainability"* (Ghassan Abu Haydar, 2016). Lebanon has good progress on sustainabilty and placed 4th or 5th after U.A.E, K.S.A, and Qatar in the Middle East. According to Abu Haydar (2016), over 1200 projects have been LEED certified in the MENA area with U.A.E having

over 800 LEED certified projects and that U.A.E is being the leader in sustainability in the MENA area. 25 LEED certified projects are established in Lebanon along with other 115 projects that are not certified by LEED, but are considered sustainable projects depending on other sustainability evaluation systems and certifications. After ten years, Lebanon has launched a pure Lebanese sustainable certification and is called "ARZ" building rating system.

The ARZ certification system was officially launched in 2011. It is an individual initiative done by a group of architects who also have established the Lebanese Green Building Council (LGBC) in 2008 according to the LGBC website. *"The LGBC aims to become a leading non-profit organization working to promote the sustainable building industry of an international level."* (ARZ Building Rating System, 2011).
Furthermore, *"LGBC works in collaboration with governmental organizations, municipalities, the Order of Engineers and Architects, LIBNOR, universities and other key organizations"* (ARZ Building Rating System, 2011).

In Lebanon, "G building" is the first green building NGO in Lebanon founded by Nader Al-Nakib an eco-entrepreneur who has earned his bachelor degree from the American University of Beirut and his MBA from Boston University. (Environmental and Sustainable Development Forum, 2011). According to Mr. Nader Al-Nakib (2010), Lebanon is placed in the 7th ranking among other Arab countries in MENA area regarding LEED projects, with 10 LEED registered projects and only one certified LEED project (A presentation done by G building in 2010). Some of these sustainable buildings are District//S as LEED Neighborhood Development, Beirut Terraces as LEED new residential construction, Verdun Heights as LEED Core and Shell, Audi Plaza as Platinum LEED operation & maintenance for banks, Town Quay which is Audi plaza as LEED Core & Shell for mixed use, and for offices Beirut Harbor as LEED Core and Shell and Palladium as LEED commercial interiors. (G building presentation, 2010).

However, according to the Lebanese green building council's website and ARZ building rating system's website, no projects are registered or certified by these councils. Therefore, efforts are still minimal to improve sustainability in Lebanon. According to LGBC, their vision is to work along with government to improve green buildings in Lebanon. However, unfortunately, since 2008, there are no obvious results of the council nor of the ARZ building

rating system. (ARZ Building Rating System, 2011). As Abu Haydar suggests “My suggestion is to have some laws from the government suggesting any financial reward encourage the client and the designer innovation” (Abu Haydar G., 2016). The government may provide incentives for architects and designers and to implement precise laws with the architect’s association, with rewards to designers implementing sustainable solutions. According to Abu Haydar (2016), a successful sustainable project should be replicated. As he states: “Other is to promote design process that is comprehensive and collaboration as well so stimulate demand by end-user to improve availability” (Abu Haydar G., 2016).

According to the USGBC website, Beirut-Terraces (Figure 3) was one of the LEED certified projects in Lebanon. Beirut Terraces has earned LEED BD+C: Core and Shell certification from USGBC.

This project was an example that Abu Haydar (2016) has mentioned in his interview (Abu Haydar G., 2016).

Figure 3 – Beirut Terraces in Downtown of Beirut, Lebanon

(Source: R. El-Khatib)

4.1.4. Sustainable design education status in Lebanon

After performing two interviews with two different institutional professors, it is valuable to review the status of sustainability education in Lebanon. These two interviews were performed via Skype and both interviews mainly targeted the university educational status about sustainability for architecture and design. The two interviews were with Ghassan Abu Haydar at Lebanese University and Nada El-Khoury at Lebanese American University.

As El-Khoury states, “In the case of Lebanon, the main problem is that our students have no idea what sustainable design is and this is a big problem that needs to be solved” (El-Khoury N., 2016). She values the importance of integrating sustainable design into the university

curriculum for design and architecture programs. El-Khoury insists that sustainable education start at the early education levels in schools as an attitude to be adopted as part of a lifestyle. Sustainable education at the Lebanese American University is considered as part of each course that El-Khoury teaches. There have been efforts to have a core course about sustainable design included in architecture and design curriculum at Lebanese American University. However, this has not succeeded, due to an objection to having a core course, and instead an elective sustainable design course has been suggested. As El-Khoury suggests:

> In order to achieve sustainable education maybe we should introduce a core course at the early stages of design and architecture programs which is considered the foundation year to give a general idea for students and to start embedding it in their minds and later can be part of every course provided to them. (El-Khoury N., 2016).

Abu Haydar mentioned in his interview that "education" is one of the major elements to be tackled, to improve the level of awareness and training background about sustainability. According to Haydar, "Education is divided into two end users who are university students and project clients because of the client lack sustainable education and look at us as educators to solve their project's issues" (Abu Haydar G., 2016). According to Abu Haydar, he and a colleague have developed a sustainable architecture workshop and successfully introduced it into the Lebanese University and specifically into the bachelor of architecture ten years ago. Abu Haydar has highlighted the challenges of teaching about sustainability since misinformation surrounds the new topic introduced into architecture and design at that time. This workshop is branched into two parts; the theoretical and practical part. What both professors tried to mention is that sustainable education should start at schools first to be introduced as a lifestyle to highlight the importance of sustainability, in general, to be as a need and not as an option. "Interior design and architecture programs across the Lebanese universities have to step up their responsibilities to teach their students and public as well about the importance of sustainability in every aspect and not as an option in order to adopt sustainability as a lifestyle since education is the most vital part of sustainability" (Abu Haydar G., 2016). Abu Haydar also mentioned,

The importance of including sustainability in design programs and not to limit sustainability education in design programs with materials because what we are talking about is much wider that should involve more approaches. (Abu Haydar G., 2016).

Another project mentioned by Abu Haydar (2016), was the International College (IC) project that is Gold LEED certified by the USGBC. (Abu Haydar G., 2016). Certified school building can be a good example for students as part of the sustainable education provided to them.

4.1.5. Sustainable design practice in Montreal, Canada

Two interviews were conducted with experts in Montreal, Canada. I interviewed Daniel Pearl, a leading architect on sustainability Montreal, Canada. The following section is a summary of our interview and Daniel's ideas about sustainable design.

Pearl begins by discussing the issues. First, barriers impede the realization of environmentally sensitive design projects that approach sustainable solutions differ from country to country, depending on the physical, social, economic, and cultural contexts, and their environmental values and approaches. Environmental design in Montreal, often goes beyond the checklists that LEED certification require. While environmentally sensitive designs have been built in Canada, there are still some significant barriers that slow down environmental design practices from spreading environmental awareness throughout the construction field.

According to Pearl, a second issue is that the "client" has been one of the major determinants for how far/successful architects & interior designers have become vis-à-vis achieving environmental design and sustainable solutions. According to Pearl (2017), *"Often it is our clients who determine how far we can go, so moving towards sustainable solutions is dependent on the level of the client's education and thirst to learn, and the level of support or difficulty in the political context."* (Pearl D., 2017). He states that clients can benefit from being better educated on the importance and benefits of environmental design and sustainable solutions. The challenge lies in figuring out how to broaden their clients' understanding of the complex issues. Community awareness is as critical as client awareness. Most of the private

ownership projects have been purely about maximizing profitability via investments, so when the client's target is limited to short term profit, then sensitivity to "doing the right thing for the planet" is very challenging. Pearl states that, every neighbourhood context consists of multiple stakeholders who can include the owner, the eventual users, the immediate and neighbouring community, the local and central municipal politicians, the academic community, and various experts and consultants who got involved (Pearl D., 2017). It is a massive effort to try and educate and encourage co-learning amongst these varied (and at times divergent) stakeholders, but to effectively co-invest to develop a neighbourhood, success is wholly dependent on these interrelationships.

Third, according to Pearl, the lack of time is a real problem, especially when clients, for example, ask to design and build a renovation project in as little as 6 months.

> *So in that context, we push clients to adopt a philosophy called "loose fit" where knowing that 6 months is not enough time and so we design in a way where the client and their consultants can easily add components in the future.* (Pearl D., 2017).

Fourth, another problem found in Quebec is the low-cost of hydroelectricity compared to other provinces in Canada or around the world. The ethical question related to energy savings is poorly understood, *"There is an ethical question in Quebec – every hydroelectric kW that we save here can actually displace a coal or nuclear energy kW used in Ontario or Vermont or New York state."* (Pearl D., 2017). The lack of current sustainable federal policies is also one of the major barriers to economic ecological measures moving forward at a much faster pace. Pearl states, one of the major barriers to completing well-designed and built renovation projects is the lack of proper diagnoses of the hidden challenges within the buildings and infrastructure – how we jump to formulaic conclusions withour taking the proper amount of time to evaluate the best actions.

> *How many people do you know that have equipment to go measure electromagnetic radiation,, how many look at air quality, how many designers look at the toxicity inside the walls and within the paint that are invisible to the human eye, how many people truly evaluate a building's air leakage and energy loss, how many look at how flexible*

is this building is to respond to an earthquake, how many people look at whether the building can easily to be designed or upgraded to meet barrier-free design standards. (Pearl D., 2017).

Finally, As Pearl suggests. the need for better diagnoses is a must when the renovation is taking place. Referring to Pearl; it is important to have the dedication of all project participants toward environmental solutions to better implement sustainable projects. (Pearl D., 2017).

4.1.6. Sustainable issues in education and its status in Montreal, Canada

In the following interview, I spoke to Nancy Dunton, a foremost expert about sustainable aspects of education and built heritage. One of the major issues has been the LEED system. LEED certification is not always the right choice. It is a very generic system that most architects and contractors adopt in sustainable projects. In the interview with Dunton (2017), she states

*In a curious way I have argued for a long time that LEED is a program that although it had value in an earlier time perhaps, it's a false thing in many ways. It is now used by contractors and by developers to say' "Look my program is sustainable, I have ticked all of these boxes," but that's what it is ─ it's a set of boxes, a checklist only. (*Dunton N., 2017*).*

Sustainable design depends on various factors related to social, urban, and environmental approaches to be applied in building, rather than one context system such as LEED. LEED certification is a general checklist to work with and a way for credibility to be achieved. According to Dunton (2017), "LEED is a false thing in many ways" (Dunton N., 2017).

During our interview, Dunton gave a general example of how sustainable education occurs:

Do you know where the pressure for that comes from? It comes from the kids. The kids who are in school now and have been in school for the last ten years ─ they are the ones who were taught about recycling and they pushed their parents to do it. (Dunton N., 2017).

This example shows the importance of sustainable education in early education such as elementary school and its imapct on youth and their attitudes toward sustainability. A social attitude towards sustainable design begins with educating the early generations about sustainability. Dunton is a member of the Board of Directors of Heritage Montreal, and she mentions that the not-for-profit foundation has just created an online tool for teachers to teach about awareness of built heritage to secondary students. This step toward educating a younger generation about built heritage in Montreal will raise awareness with younger generations. *"Yes, you can be talking to adults, and yes, you can be talking to university students, but the reality is that if you want a change of attitude, you should start earlier."* (Dunton N., 2017).

Another important part of social education has been lack of industry knowledge. Lack of industry knowledge about sustainability as a holistic approach, in general, and about integrating sustainable issues into design education, has been a major reason for some unsuccessful examples of implementing sustainable design. Dunton mentiones that one of the major reasons for the choice of the geothermal system at Benny Farm (Energie verte Benny Farm and the issues of installing a geothermal system to be connected to three buildings) was due to the lack of industry knowledge.

> *There was not much knowledge connected to commissioning those systems and about people who are the owners (and not engineers) running those systems, so that was a difficulty."* (Dunton N., 2017).

The lack of industry development in implementing truly sustainable solutions has been a major issue, and in part, due to the lack of industry education about sustainability. As Dunton notes, *"People's ambitions are maybe advanced, but the construction industry is behind."* (Dunton N., 2017).

Dunton gives another statistic, stating that more than 30% of the landfill waste in Canadian provinces is from construction debris. *"We have such a long way to go for current construction practices*." (Dunton N., 2017). Dunton suggests that rather than educating the client, the urgent need is to start educating industry, and as she states here, with pressure on industry:

> *I do. I think that for the community to be able to apply pressure there have to be the choices available to them. Community pressure is not going to last long when there are no results they can get from it.* (Dunton N., 2017).

On another issue, Dunton (2017), mentions that we need to pay attention about how to build and maintain sustainable projects, by educating building operators on how to better manage these buildings over the long run.

From Dunton's perspective, Benny-Farm is an example of community education, especially for the residents of Benny-Farm. The community willingness to save Benny-Farm for its heritage and memory value played a huge role in terms of educating the community on how to be proactive. Dunton was a member of the Energie verte Benny Farm community organization. She spoke about the group worked hard to explain to the residents how these buildings work and especially at "Chez-Soi", the affordable housing for seniors at the complex. Dunton states,

> *It was intended from the beginning to put into place a greywater program. That can be difficult to communicate to people who are in their 80's and 90's and so that was a lesson that was learnt, although they might even be intellectually all for it, the reality is that's not what they've known most of their lives, so it was hard for them to accept…it took them time to understand.* (Dunton N., 2017).

The challenge was educating seniors about how sustainability is implemented, and of course, this would not be the case with younger generations. However, is was a success and achievable for seniors, and this is also an example to show those who are not convinced in younger generations, how sustainability is achievable through education.

4.2. Data collection II - Case studies

In the previous sections, the analysis was done to show the education and professional aspects of sustainable design in Beirut, Lebanon and Montreal, Canada. These reveal new findings, in

particular related to sustainable approaches within the architecture profession in Montreal, Canada. In the interviews with Daniel Pearl and Nancy Dunton, two case studies emerge as salient and valuable for further study. The interviews reveal two social housing projects that emerge as successful examples of implemented sustainable projects in Montreal, Canada. These two projects are Benny-Farm and Rosemount, in Montreal, Canada. These two examples are relevant to show the demonstration of successful sustainable projects that are far beyond the LEED system. Both projects show the barriers as well as the strategies for appropriate solutions. Furthermore, future considerations can be considered when discussing all phases of the project. The two projects can be an appropriate model to be repeated regarding the strategies and sustainable elements to better adapt sustainability in other projects.

4.2.1. Benny-Farm

The Benny Farm project begins with great historical memory of this social housing project that was initiated and built in 1947. According to Pearl D. & Wentz D. (2014) in their book *"Community-inspired housing in Canada" (Benny Farm and Rosemont): "In 1947 a new neighborhood named Benny Farm was built for World War II veterans and their families."* (Pearl D. & Wentz D., 2014, p: 25). It was important for Pearl and Wentz to try several options when considering how to preserve Benny Farm:

> *Preserving the buildings at Benny Farm was seen as a fundamental premise because the complex is social, socioeconomically, historically, symbolically, urbanistically, and environmentally significant.* (Pearl D. & Wentz D., 2014, p: 25).

According to Pearl & Wentz (2014), Pearl and partners are L'OEUF architecture started following this project in 1994 and proposed several master plans, including a mix of new buildings, renovations, and additions. L'OEUF knew how to appreciate the historical & social value of Benny Farm and how to transform it into a moral sustainable example. proposal always included a large margin of conservation as part of the solution, rather than complete demolition. As the authors state

> *A timeline of masterplan proposals for Benny Farm from the original plan through today. L'OEUF's proposals of 2001 and 2002 illustrate maximum conservation and a high degree of diversity of typology and clientele as well as infill while keeping most if not all the housing in the public and non-profit domain. Although neither of these plans was adopted, they did influence the programming and degree of conservation incorporated in the 2003 masterplan by Saïa Barbarese Topouzanov Architects, which was ultimately realized for the redevelopment.* (Pearl D. & Wentz D., 2014, p: 56-57).

The decision was made to try to conserve most of this community's project after several proposals were made that influenced the originally implemented plan. According to Pearl (2014), L'OEUF was responsible for four building of Benny Farm project. (Pearl D. & Wentz D., 2014, p: 61).

> *L'OEUF was the architect of record for four building projects at Benny Farm, which comprise a total of 190 residential units: Chez Soi, short for "O.B.N.L. Chez-soi Notre-Dame-de-Grâce," seniors' housing (new construction of 91 units), Coopérative habitation ZOO, affordable housing (new construction of 16 units and renovation of 30 units), CHBF (Coopérative habitation Benny Farm), affordable housing (renovation of 24 units), and Maisons Transitionnelles, affordable housing for young mothers (new construction of 29 units)…. L'OEUF provided the preliminary design of two further projects: AHOI 1 (renovation of 24 units) and AHOI II (new construction of 20 units and renovation of 30 units), both affordable housing for ownership. With approximately 800 residential units on the site, many old buildings in which introducing barrier-free accessibility would be impractical, accessibility was a challenge.* (Pearl D. & Wentz D., 2014, p: 61).

Figure. 4 – *Chez Soi*: A senior housing at Benny Farm.
(Source: A. El-Khatib)

L'OEUF also provided some solutions for existing buildings in terms of how to best adapt to the accessibility element at the senior housing tract, known as Chez Soi: *"L'OEUF's solution was to provide a reasonable number of new accessible units. About 100 units are fully barrier free, as is the entire senior's tract, Chez Soi."* (Pearl D. & Wentz D., 2014, p: 61).

They continue:

> *The renovation project at Benny Farm was similar to many conventional residential rehab projects, except that ZOO is connected to a district geothermal heating system and that some other green technologies and strategies were integrated. The envelope was upgraded to meet stringent energy standards, interior finishes refurbished, kitchens and dining areas enlarged, bathrooms updated, and electrical and plumbing systems replaced.* (Pearl D. & Wentz D., 2014, p: 61).

"Coopérative habitation ZOO" is a good example for teamwork initiative. Reducing waste was a major target in this project by the re-use of the existing bricks after performing several

testing's that showed that the old brick is better than the newly manufactured ones. *"The brick from many of the demolished buildings on the site was salvaged for reuse in both the renovation and construction of new buildings."* (Pearl D. & Wentz D., 2014, p: 63). Improving the efficiency of the building envelope using "effective R insulation values" along with taking thermal bridging into account, as elements in achieving sustainable solutions. (Pearl D. & Wentz D., 2014, p: 62). The glass windows were replaced to meet the new standards and improve natural ventilation.

> *At Benny Farm, we were lucky because the buildings are narrow and we were allowed to make window changes, so we enlarged windows in some key areas that were too dark, as in the kitchens and dinettes. We were able to achieve some amazing natural daylighting.* (Pearl D. & Wentz D., 2014, p: 63).

Another important element of the Benny Farm design was reducing the construction debris. As they state:

> *The construction process incorporated recuperation and renovation as waste management strategies to significantly reduce the volume of demolition rubble sent to landfills.*
>
> *Reusable cast iron radiators were salvaged from the buildings being renovated or demolished. They were checked, flushed, treated, and repainted.*
>
> *The original hardwood floorboards were removed and the salvageable planks reinstalled in some of the new buildings.* (Pearl D. & Wentz D., 2014, p: 64).

A strategy to treat drain water has been implemented, as Pearl & Wentz note:

> *Drain water heat recovery (DWHR) is a relatively straightforward technology whereby a heat exchanger is placed on shower drains. This recuperates heat in the waste water to preheat cold water being fed into the domestic hot water system.* (Pearl D. & Wentz D., 2014, p: 65).

"Chez Soi" was the second building that targets senior housing at Benny Farm project. According to Pearl & Wentz, "Chez Soi provides affordable subsidized rental housing and services for seniors."

It is a newly structured building, which allows the freedom of implementing sustainable solutions and is considered less competitive than the renovated one. Pearl and Wentz describe some of the features:

> *Balconies are strategically located above the larger openings to maximize solar gain in winter and minimize it in summer. Insulation is placed outside the steel-framed curtain wall and air barrier.*
>
> *Indoor air quality is enhanced by the use of low -VOC emitting materials.*
>
> *40 percent of the waste generated on site during construction was separated and recycled.* (Pearl D. & Wentz D., 2014, p: 66).

Figure. 5 – The difference between re-used bricks and newly installed bricks.
(Source: A. El-Khatib)

"A 58 m2 solar wall, in two sections, was installed by GEB F at Chez Soi." (Pearl D. & Wentz D., 2014, p: 67).

> *The solar DHW heating system installed on the roofs (solar water heating array of 72 collectors) was designed exclusively to preheat domestic hot water.*
> *The energy savings of the make-up air system can each 92%, even at an outside temperature of -10°C. Much of the system is maintenance free.*
> *Chez Soi features a 30 m2 intensive rooftop vegetable garden established through a joint initiative with GEBF in which a small intensive garden was established on the second-floor terrace of Chez Soi's northwest wing.* (Pearl D. & Wentz D., 2014, p: 68).

"A gray water/rainwater treatment and recycling system were installed at Chez Soi. The system collected gray water from the showers and bathroom sinks throughout the building." (Pearl D. & Wentz D., 2014, p: 69).

4.2.2. Rosemont

A second project was constructed after Benny Farm that integrated sustainable elements and the way of implementing them. Rosemont was built applying the lessons learned at Benny Farm and as Pearl mentions, "adjusting and retooling," and monitoring building performance: *"Rosemont is an affordable housing development very closely related to Benny Farm. It was L'OEUF's second large social housing project in Montreal."* (Pearl D. & Wentz D., 2014). One of the major research elements that was followed by Pearl at Rosemont project was the integrated design process (IDP). *"Rosemont the resident group was highly present and fully represented from the beginning of the project in the very first charrette, which allowed L'OEUF to conduct a comprehensive integrated design process."* (Pearl D. & Wentz D., 2014, p: 82).

> *More than half the units in Coteau Vert are larger than two bedrooms, ranging all the way up to five-bedroom units. Trying to get such large subsidized units in the city center is a formidable challenge.* (Pearl D. & Wentz D., 2014, p: 92).

Mark Poddubiuk says many of the project goals were achieved by passive design:

> *The buildings are ten meters deep. Conventionally, we have 18- to 20-meter deep buildings with double-loaded corridors. A ten-meter building with southern orientation solves 80 percent of our environmental design.*
> *Heating buildings in winter accounts for an enormous energy demand in Quebec, as average indoor temperatures of 20°C must be maintained while outdoor temperatures drop to minus 30°C.* (Pearl D. & Wentz D., 2014, p: 95-96).

The final choice was a geothermal heating system with centralized heat recovery ventilators. *"The energy system, designed to pre-treat 100 percent of the fresh air for all of the units, is oversized both in duct capacity and preheating capacity."* (Pearl D. & Wentz D., 2014, p: 96).

> *To increase the effectiveness of mechanical ventilation, the filters for the centralized HRVs have a MERV rating of 13, which is the highest in this class of use. Besides cross ventilation being part of every unit of CV, significant research went into choosing materials and finishes with minimum toxicity or VOC off-gassing.* (Pearl D. & Wentz D., 2014, p: 97).

Water management was a major environmental theme at Rosemont, as at Benny Farm. Civil Engineer Mario Gendron worked on both projects and states:

> *At Benny Farm we looked at water management, especially on-site management of stormwater and wastewater with on-site retention with flow control. We looked at how to use rainwater to recharge the water table and how to treat sanitary water on site with constructed marshlands. Unfortunately, this was not fully implemented, primarily because the city sewer system already has a large capacity. But we do have roof water being percolated into the soil through perforated pipes to recharge the local water table.* (Pearl D. & Wentz D., 2014, p: 98).

Figure. 6 – Interior courtyard at Rosemont that is rarely found in social housing (Source: A. El-Khatib)

A hindrance to advancing energy efficiency measures in affordable housing projects is that virtually all grant programs available for "greening housing units" support measures that deliver immediate or short-term economic or energy benefits. However, these initiatives do not support measures that enable the gradual inclusion of additional green strategies that provide for long-term resilience, flexibility, and growth. This issue was tackled directly at Rosemont, as Pearl states:

> *We fought for and received ten percent extra funding for Rosemont from the SHQ. It took about three percent of the extra monies to reach our stated airtightness goals, four percent for immediate technical installations such as the geothermal system, and about three percent to prep the buildings with the infrastructure to easily enable additional future installations. The Quebec government now allows any social housing to go after this ten percent, so we've changed the government's mentality and convinced them to raise their standards.* (Pearl D. & Wentz D., 2014, p: 100-101).

> *Risk management is not limited to the construction phase of a project; it begins in the design stage and lasts at least one year after occupancy. One of the major lessons*

learned from Benny Farm was the need to somehow include additional measures to limit the risk inherent in a public bidding process, especially given compulsory selection of the lowest bidder, regardless of his reputation or track record. The overall cooperation of the general contractor and his subcontractors was also a key element in successfully building Rosemont. (Pearl D. & Wentz D., 2014, p: 102-103).

Figure. 7 – Garden surrounded by buildings at Rosemont
(Source: A. El-Khatib)

Construction progressed largely according to schedule, delayed only by a fire on site. 155 units were built within 18 months, completed at the end of 2010. Commissioning, or putting the systems into operation and working out all the bugs, is usually done before occupants move into a building, but commissioning and performance monitoring are nonexistent in social housing in Montreal. Pearl explains the challenge:

Given that so few green affordable projects are built, it was important to not simply commission the projects but to monitor the performance for at least one year after full occupancy. The keyword here is "persistence." This is where measurement and verification come in; it requires a strategy, not waiting until a building is delivered and

then finding contractors who can handle maintenance of the systems. Training and education must be an integral part of the process. (Pearl D. & Wentz D., 2014, p: 104-106).

The residents of Rosemont can now decide themselves which improvements they will make, and when. They have a certain autonomy, including some control of whether there will be bigger or smaller rent increases. Giving the residents control of their own future means they must understand their building and their options. Anne-Marie Pelletier tells specifically what is shared: Rosemont is a work in progress. Living at Rosemont is an adventure in urban lifestyle change. (Pearl D. & Wentz D., 2014, p: 106-108).

Considering that Rosemont was, in part, an exercise in applying the lessons learned at Benny Farm, the question arises: Is Rosemont simple enough? Mark Poddubiuk sees potential as he discusses further:

Integrated design, with interconnected multiple systems, offers benefits, but it also creates a balance that is very fragile. If one thing goes wrong, all of a sudden a series of other things that you based on that one assumption all f all apart. That's the most significant improvement we made as we applied the lessons we learned from Benny Farm – that is, introducing redundancy. In nature, redundancy is a part of sustainable systems. Simplicity is another principle. The systems at Benny Farm and Rosemont are still too complex for the users. Clients don't have the knowledge, time, or experience. We need to find simple, passive solutions that are easy for the residents to use. Restrictions of building codes and subsidy programs don't permit many types of these solutions, yet sophisticated systems are inappropriate for the context of community housing. Can a plumber do something in that mechanical room? The systems need an operation manual. The buildings do too. The more complicated the system, the more resources you need for operation. There needs to be full-time maintenance and a budget for maintenance. (Pearl D. & Wentz D., 2014, p: 108-109).

These findings were to be possible opportunities and solutions to best replicate the successful aspects of these two sustainable projects that can be used in other projects in Montreal, Canada as well as Lebanon. It includes the research, design, and construction phases implemented in practice. This will facilitate sustainable design approach when educating the client about available solutions and to prove it by presenting successful implemented projects found in Montreal, Canada. The analysis will explain in details the issues perceived in these two projects and how to solve them, alongside identifying the possible solutions that can be implemented to better prevent such issues from emerging in other sustainable projects.

5. Discussion of findings

5.1. Analysis

5.1.1. Precedents

Benny Farm was the key project that initiated the success of what community housing might look like from a sustainable perspective. Most of the main elements were re-used as is, or modified to improve their performance in Rosemont project. These projects, Benny Farm & Rosemont, were designed to adapt to future changes and modification, with considerations such as reducing construction debris and, the re-use of building materials in renovation phases as essential components of sustainability.

According to Pearl & Wentz, re-use of existing bricks & re-use of cast iron radiators was important as a means to retrofit existing usage. Tackling the building envelope is essential to improve its efficiency and specifically the building's technical insulation strategy. As part of the building envelope, window glass is re-considered with better insulation and in terms of bringing the most natural light possible into the living spaces. Improvements to the heat and water systems were done. Drain water heat recovery was re-used as a strategy to preheat cold water being fed into the hot water system. Improving the solar gain and insulation were meant to design strategical balconies. Minimizing VOC emitting materials were meant to improve indoor air quality. Recycling 40% of the generated construction waste was available. Implementing solar wall systems to help water heating process. Geothermal heating and high-efficiency gas boilers systems were major reasons to reach 92% of energy savings. Roof vegetation was initiated to adapt vegetable garden through a joint initiative with GEBF. A gray water system was installed to reduce water loss. All these findings were considered as a good opportunity to re-apply in future projects.

The Rosemont Social housing project was a project that gained from the Benny Farm experience. The lessons learned from the Benny Farm project contributed to better implementation at Rosemont. The first key strategy used in Rosemont project was using the Integrated Design Process (IDP). Improving the building spaces by improving the unit size to reach a range of five-bedrooms and adapting 18-20-meter-deep building with double-loaded corridors with a southern orientation that have solved 80% of the environmental design.

Maintaining constant heat level in the building with the presence of the extreme weather in Montreal was achieved by using the geothermal heating system with centralized heat recovery ventilators. Improving the indoor quality was applied in addition to adding mechanical ventilation and cross ventilation. Maintaining indoor health and wellness quality was achieved by the choice of low VOC emitting materials and finishes. Water management was a key element to achieving a better water consumption through the Gray water system installed along with rainwater recharge. Sparing 3% of the budget was a good strategy to prepare the buildings for future additions in the future. Convincing the government by adding 10% to the budget for airtightness, technical installations such as geothermal system, and building infrastructure for future installations. *"The Quebec government now allows any social housing to go after this ten percent, so we've changed the government's mentality and convinced them to raise their standards."* (Pearl D. & Wentz D., 2014, p: 101). Improving risk management skills was essential to take off boundaries made to choose the bidding companies without adapting to the lowest price automatically. Pearl (2014) explains the challenge they faced,

> *We wanted a maintenance contract in place before the buildings were handed over. We decided to develop a strategy for who is going to maintain the systems."*
> *"The keyword here is "persistence," this is where measurement and verification come in; it requires a strategy, not waiting until a building is delivered and then finding contractors who can handle maintenance of the systems. Training and education must be an integral part of the process.* (Pearl D. & Wentz D., 2014, p: 106).

As TRG agent Yann Omer-Kassin states,

> *Rosemont is a very good example of what social housing can and should be. For the last 25 years, social housing has been housing f or poor people. That's the view we have. Under the old programs, we have our typical square buildings with residents who might know one another, but there's no sense of community. The cooperative model advantage is that there is a possibility of community-building.* (Pearl D. & Wentz D., 2014, p: 112).

The community that Rosemont has built is a great example of what a project vision could be. Alongside the community gain, there are some energy consumption savings which are the result of the strong sustainable vision.

> *Monitoring of energy consumption and indoor environmental quality at Coteau Vert began in March 2014. The preliminary results for the first three months show a total energy use of 80 to 100 kWh/m2/y, of which heating energy use accounts for about 50 kWH/m2/y. The large energy savings are primarily due to the preconditioning of make-up fresh air by the geothermal system, the general airtightness of the project, passive solar gain, and strategically sized glazed openings. This impressive performance is confirmed by the very low heating bills of many of the tenants. The upper floors use significantly less energy than the grade-level units during the heating season, whereas the lower garden units remain very comfortable throughout the hot summer months.* (Pearl D. & Wentz D., 2014, p: 114-115).

5.1.2. Issues

Most of the issues found in this section were experienced at the Benny-Farm project. Benny Farm was the first sustainable social housing implemented in Montreal, so issues that arose occurred as the project was realized. With experience, issues can be solved and targeted for better future implementation, such as was done with the Rosemont project. As Pearl and Wentz have suggested in this example: *"The main technical problems encountered involved the heating system, which broke down and left the seniors in Chez Soi without heat for several days the first winter of operation."* (Pearl D. & Wentz D., 2014, p: 71). Here they explain:

> *Combining a geothermal system with a solar collector system with solar walls with a central control system with ERVs into affordable housing makes for an ambitious project. In retrospect, one can say that the overall budget for this type of project perhaps failed to address this level of complexity, which affects every step of the process.* (Pearl D. & Wentz D., 2014, p: 72).

Combining two technologies made the heating system more complex. The complexity of the technical systems made the project harder to manage, again as they state:

> *The diagnostics, finding the problem, ended up in many cases being quite a trial. So there's something to be said about making these special mechanical systems not so opaque and building in the instruments and monitoring tools to ascertain whether they are working properly and how well they perform.* (Pearl D. & Wentz D., 2014, p: 72).

The industry has the responsibility to provide better solutions as well. However, the lack of industry experience means that these technical systems cost more time and money on initial implementation. Pearl warns against too large steps in applying advanced technologies.

> *Another gap was that the industry couldn't respond to the design criteria at a reasonable cost. So the gaps were on many levels: on a political level, a technical level, on an industry readiness level, on a client being able to handle the uniqueness level – so the potential for error was large.* (Pearl D. & Wentz D., 2014, p: 72).

Another issue faced is the lack of experience in such different technologies with complex techniques. *"Design projects to grow in complexity over time"* (Pearl D. & Wentz D., 2014, p: 73). Placing a future financial plan for maintenance and additional installation systems to permit additional sustainable solutions over time, along with passing sustainable maintenance knowledge to fit any individual replacement in the future. Applying Integrated Design Process in every project to keep clients, users, and the management team understanding of the design and construction process since every player in the project is critical. (Pearl D. & Wentz D., 2014, p: 74). Improving government role is vital and initiatives can include adding a sustainable management role, as has been done in Europe. This role is a key element to manage and connect all the project players. Since GEBF was closed in 2011, the industry has lost a key player in management and operation. GEBF was responsible for managing and operating Benny Farm project. As Pearl & Wentz note:

> *The ultimate consequence was that GEBF had to be closed down in August 2011. Regrettably, a pioneering sustainable local energy organization with a promising future was prevented from ever achieving stable operation and reaching maturity.* (Pearl D. & Wentz D., 2014, p: 77).

As seen, most of the issues found at Benny Farm project were part of the learning curve, and were lessons learned when planning and implementing the Rosemont social housing project.

5.1.3. Industry issues

Most of the complications faced at Benny Farm were the result of a lack of industry experience and knowledge. Operation and maintenance services cost more time and money because industry is still behind when it comes to sustainable solutions. Industry might step up to improve the competition and better implement sustainable solutions. Through experience architects and their teams will be able to avoid and solve these problems, but if the industry is not willing to improve and work toward sustainable solutions than these technical issues will act as an obstacle that will not allow the implementation and development of sustainable solutions.

Positive initiatives include those by the Holcim Foundation for sustainable construction. They have developed a five-point definition which was implemented in Benny Farm & Rosemont Projects. The five-point definition can be followed in the construction industry to be a preliminary strategy to implement sustainable construction.

> *Three of the five target issues align with the primary goals of the Rio Agenda: balanced environmental, social, and economic performance. A further target issue applies specifically to building – the creation of appropriate buildings, neighborhoods, towns, and cities. The final target issue recognizes the need for significant advancements that can be applied on a broad scale.* (Pearl D. & Wentz D., 2014, p: 11).

The first criteria would be "innovation and transferability." As Pearl D. & Wentz D. (2014) mentioned, Benny Farm is considered the first government-subsidized, large scale, community driven neighborhood renewal project that combined affordability, green building technologies, rehabilitation, and new construction. This is a pioneer project that has changed our perspective towards social housing.

> *Benny Farm and Rosemont have made an important first step in Montreal toward a change in attitudes and wider adoption of sustainable approaches. The overall strategy and the technologies proposed have advanced the local construction industry, public policy, and general expectations toward affordable construction.* (Pearl D. & Wentz D., 2014, p: 13).

Both projects were the first of their kind in Montreal, Canada and demonstrate what can be done with successful sustainable projects. Although the government's role was not enough, the courage found in these two projects facilitate future government role specifically after recognizing the success that occurred at Benny Farm and Rosemont Projects.

The second criteria are "Ethical standards and social equity." Sustainable construction has provided fair social equity through design, construction, use, and recycling of buildings and infrastructure. (Pearl D. & Wentz D., 2014, p: 14). In an attempt for social diversity, Benny Farm held a mix of social housing, first-time home owners, single mothers and other. As Pearl & Wentz mention, Benny Farm tried to preserve the social mission-affordability, social equity, and green public spaces of the original development, incorporation of many stakeholder groups throughout the design process, and establishment of non-profit, community-run utility company. (Pearl D. & Wentz D., 2014, p: 15). Benny Farm had another social target, which was to educate residents and visitors about sustainable development using an educational program provided by GEBF. Giving the control of future sustainable development to the residents was important and they have already been educated for future sustainable solutions in which were provided in Benny Farm and Rosemont projects through ready-to-implement plans. Applying the integrated design process in Rosemont project allowed the collaboration between residents and all the project players from the earliest stages of the project.

The third criteria were “Environmental quality and resource efficiency.” The re-use of previous materials in the renovation process at Benny Farm was one of the key elements to implement construction waste reduction strategy.

> *The new construction and rehab projects at Benny Farm incorporate extensive green strategies: material reuse, waste minimization, durable and energy-efficient envelopes, passive preheating of fresh air, a geothermal heating system, hybrid glycol/solar water heating, radiant heating and partial cooling, air and water-based heat recovery, water conservation, and on-site stormwater retention.”*
> *“Rosemont incorporates a full array of passive and active environmental strategies: cross ventilation, high-efficiency envelopes, waste-heat recuperation, a central geothermal system, storm water retention, permeable outdoor surfaces, trees as buffers, clotheslines instead of electric dryers, and more. The water and energy savings are significantly higher than code and standard housing projects.* (Pearl D. & Wentz D., 2014, p: 17).

Both projects have adopted high standards of environmental quality and resource efficiency to be relevant examples of being repeated in future projects in Montreal, Canada.

The fourth Criteria were “Economic performance and compatibility.” The economic performance and compatibility are two major elements the client would first consider when planning on doing a sustainable project. Benny Farm was the first large-scale sustainable project that included new and renovated buildings and this shows the client how affordable and feasible these projects can be when well managed.

> *Both projects apply to use the cooperative and non-profit organization as an ownership model, where community benefits above private interests are seen as an urban resource rather than a commodity. This approach builds long-term value for the community instead of yielding short-term gain for a few individuals.* (Pearl D. & Wentz D., 2014, p: 19).

Pearl & Wentz mention an example, *"The solar preheater for make-up air at Benny Farm is a one-time investment in free energy for the lifetime of the building."* (Pearl D. & Wentz D., 2014, p: 19).

The fifth and last criteria were "Contextual and aesthetic impact." Both projects included shared community spaces between the buildings.

> *Benny Farm and Rosemont both exemplify the essential mechanism of greening and densification of urban contexts. The correspondence between buildings and outdoor space is carefully planned to achieve optimal land-use density while providing well-proportioned private, semi-private, and public outdoor green spaces.* (Pearl D. & Wentz D., 2014, p: 21).

This criterion has been followed in both projects to improve their success rate. Benny Farm and Rosemont are two successful examples to learn from and repeat. The minimal government role aided these projects in many aspects to better achieve the target. If the government role was much more efficient, many things would be accessible and affordable to many future projects. The major ordeal that has been faced by these two projects was the lack of industry knowledge, experience, and competition. Something should be done to start improving the industry role in sustainable construction.

5.2. Final discussion

The overview of this research permits us to consider alternatives about how to design and implement a successful sustainable design project. The architecture or interior design project process can be branched into three categories to best understand the design process. Figure 2 shows an example of a preliminary diagram of re-evaluating the design process. Three major phases might identify a design project process, and these phases are the design research phase, design concept & development, and design implementation which is the construction phase. However, to have a successful sustainable design project, one more phase should be added,

and it is the final (and ongoing) phase that consists of the maintenance and management phase that will help manage the sustainable project over time. According to the findings of this research, this re-evaluation might not be the ideal process to achieve a successful sustainable project, but it can be an appropriate way to start thinking in an environmental design lifestyle. These sustainable solutions are implemented in Montreal, Canada and show a successful path to achieve the sustainable projects. Lebanon lacks most of these potential solution approaches, so adopting them can be a major strategy to improve sustainable understanding of design projects, but would be challenging.

The first phase of the design process is the research phase. After meeting with the client and highlighting the important points and knowing his willingness to collaborate to attain a successful sustainable project, comes the research phase of the project, without neglecting the two principal elements of time and cost. These two major elements will be found in every phase to be considered. The research phase will be the most critical part that would identify the project's path. This phase was always neglected in design project until two successful case studies, and interviewed professionals showed the important role the first phase can play. Three elements can be added to this process which are EBD, IDP, and client education. The evidence-based design could lead the first step of the process by referring to evidence-based research to implement. Integrated design process will be the second element that will allow architects or designers to manage a team of professionals including electrical, mechanical, design educators, social group, and the client. IDP will allow all the team to be in a continuous collaboration and aware of all the project phases that follow and help each with his own profession and social input. The third element would be educating the client and knowing the sustainable potential and dedication he would offer.

The second phase of the design process is the conceptual design and design development phase. Planning the project elements is included in this phase along with the team that is lead by the architect or interior designer. Issues found in this process are mainly revolving around time and cost, which allows the client to be in control. With the presence of the professional team, a better understanding will be found regarding the concern of cost concern. Time can also be a key issue, but more than one approach can be used to solve this problem. One of the strategies could be the "loose-fit philosophy" that Pearl (2017) has mentioned in his interview.

“Loose-fit philosophy” allows the client to achieve the project on time, but with the help of the professional team that provides , strategies.

One of the elements in this research has been the sustainable guidelines perceived from different references and mainly from LEED and BREEAM systems. At times guidelines can be perceived as problematic or incomplete when designing a sustainable project. These guidelines can come from LEED or BREEAM systems, which at times, are generic checklists. According to Pearl (2017) interview, he considers context to be vital, and that it is not possible to have tailored checklists that can work on all projects. Depending on each context, sustainable strategies and solutions can be found in specific fundamentals. The choice of materials and technical mechanisms can be achieved with the help of the professional team. The integration of the professionals would act as a tool to achieve a better understanding of material’s properties and characteristics to identify the materials choice. Renovation case scenario can be found, so one of the appropriate targets would be the construction waste reduction. According to Dunton (2017), one of the major issues to tackle in the building industry is the construction debris. In reference to the Benny-Farm project, more than one element in renovating the buildings was re-used. Re-using materials and other mechanical components is possible in most of the renovated projects.

The third phase of the design process is the construction phase. Here comes the industry’s role in helping achieve successful sustainable construction. Mechanical, electrical, and other mechanisms are set to be chosen in the design development process. Integrating the industry while designing a sustainable project is important. The industry has a serious issue with following up and providing sustainable solutions to the client. With more sustainable projects to be implemented, the industry will improve their experience to provide sustainable solutions. The industry should step up and improve their sustainable approach to better provide clients with sustainable solutions that will allow choices.

The final phase of ongoing maintenance and management is also considered vital. Along with having a sustainable project, comes the responsibility to employ more time in following up and maintaining the sustainable mechanisms and solutions with the appropriate diagnosis. According to Dunton (2017), one of the major issues encountered at Benny-Farm was the lack of industry’s experience in maintaining and installing sustainable mechanisms such as the

geothermal heating system. The lack of industry experience led to complications. Industry education in terms of appropriate building maintenance and management is a vital phase of a successful project implementation.

The re-evaluation of the design process should summarize the research issues, sustainable solution provided by professional's point of view, and successful case studies to be re-implemented in other projects in Montreal, Canada and in Lebanon.

Highlighting the barriers found in Lebanon and Canada were presented in this research. This explains the reasons leading not to achieve environmental interior design in both countries. With the detailed analysis and discussions presented above, an evident proof has been presented to show the important role interior designers have to play in an attempt to better implement sustainable design in research, design, construction, and management phases of the design process. As seen in previous discussions, the sustainable role that interior designers have to offer seems to be totally neglected. Sustainable design has always been an issue for architects to solve through sustainable management and thinking, while ignoring the major role interior designers can play regarding sustainable solutions found. Prioritizing the interior design role by having interior designers work on interior environments is a must for sustainable thinking. Joining the forces to fit among others in the processes and especially the IDP and EBD.

6. Conclusion

The research study presented an overview of the barriers prohibiting architecture clients from achieving sustainable projects. Different points of view were provided by trusted resources, educators, and professionals. Time and cost were the two most important elements that emerged as salient issues in this research. Targeting these two major elements, the core of the problematic, was essential and confirmed in interviews with sustainable design educators and professionals.

The research targeted Montreal, Canada, and Beirut, Lebanon where the integration of sustainable practices was studied. Starting with the definitions of "Sustainability" and "Environmental design" materials selection were also examined as key elements needed to formulate mechanisms to educate architecture clients to achieve sustainable projects.

The literature review clarified the problematic and the issues faced by architects and designers when trying to achieve a successful sustainable project. With an understanding LEED, BREEAM, and Cradle to Cradle, different aspects were explained to show the need for further actions since these certifications act as a preliminary solution. Adopting an example of materials as a key element, allowed us to explain how critical every sustainable element could be. Time and cost also were important issues that would guide the data collection. The data collection proceeded with an exploratory perspective, beginning with an examination of different case studies that were studied as an example of successful countries and projects to present general sustainable solutions that can be adopted in the future. The second part of the data collection consisted of four interviews, two each done with representatives of the two countries studied.

The analysis of the interviews revealed issues about relative success of sustainable issues in each country. This allowed for further investigation regarding sustainable projects, in particular in Montreal, the interviews led to the further study of two successful case studies implemented in Montreal, Canada. Analyzing these successful sustainable social housing projects provided a detailed awareness of how sustainable projects can be researched, designed, and implemented. These two projects, Benny-Farm and Rosemont are typical examples that can be used when planning to achieve sustainable projects. Referring to the two

social housing projects implemented in Montreal, Canada, a final discussion was framed to explain an appropriate way of how to achieve a successful sustainable project. Presented in detail, was the assessment of the sustainable design process reached by different systems, interviews, and case studies. These considerations are also useful for Lebanon to consider.

In conclusion, this research presented the barriers prohibiting architects, interior designers, and clients from achieving successful sustainable design projects. Focusing on presenting successful examples is essential to show how environmental design can be perceived and considered as a sustainable approach. Starting with the general view of sustainability and environmental design, to further facilitate the barriers and sustainable solutions that architects and interior designers can use as tools to improve the environmental design industry. The final discussion offered a new evaluation of the design process to mainly targeting different elements to accomplish the successful sustainable project. Accumulating several tools to form a procedure followed by architects, designers, and even citizens in two cities that are in urgent need of these approaches. Can these tools be facilitated in a platform mainly targeting clients? Is presenting a client oriented platform an appropriate solution to gather these tools in one place?

6.1. Research limitations

Different limitations were presented throughout the research study. The first limitation was the lack of the information in Beirut, Lebanon, as one of the countries targeted. Since the research study was conducted in Montreal, the lack of sustainable projects in Lebanon made it hard to collect rich data in Beirut. The second limitation was the difficulty to reach the interviewed participants easily, specifically in Lebanon. The participant's interviews were performed by "Skype" and several months of delay occurred due to these limitations.

6.2. Research contributions

Regarding contributions, this research and case studies demonstrate the need for more education and knowledge transmission to both clients and the building industry, as well as concerned stakeholders in government and the built environment fields. Documenting the approaches and successful case studies allowed for a complimenting of existing knowledge

while recognizing the pitfalls and challenges of sustainable development within existing knowledge structures.

This study shows that sustainable development, while deemed necessary for some, still has challenges for clients, in terms of making this type of environmental design a priority and in terms of government and developer willingness to changes current practices.

The need for education is evident. I will now present my idea of how I see educating the client using a platform.

6.3. The proposal for a platform

If I consider what I have learned, at the basis of sustainable development remains the choice of sustainable materials and systems that support an ecological and well-designed building. Here I propose a concept for considering future ways to think about educating for sustainability.

If we approach the materials knowledge first, we can conclude that sustainable materials have the appropriate properties for sustainable design and that the most efficient and least toxic materials are made from renewable content. Optimizing indoor air quality, have high durability and longevity and the drive to determine how to process this information are part of knowing the materials we are using. *Transparency, Green spec, Material Connexion* and *Todl Green* are four massive databases and source programs for interior designers that guide them to find sustainable materials.

> *Material and product selection should include knowledge of sustainable materials, the value of sustainability, and guiding principles in our practice and personal background. This should result in the increase of interior designer's engagement with environmental interior design practice.* Cargo A., (2013)

A well-structured materials database can be perceived to simplify the choice for clients. By presenting all gathered information about materials properties and characteristics in a well-organized database, can facilitate future considerations. A platform presenting a formulated database facilitates the process for clients, society, and the industry. Materials database can be

one of the tools that will help clients to better understand and implement sustainable solutions in their projects. We are in need for a platform that prepares all needed sustainable and environmental design information for the client and for everyone in larger society. Depending on the issues found in this study, both countries need facilitated sustainable tools for their citizens, to allow them to learn about and understand sustainable design. The lack of education of society and of the client continues to be problematic. Thus the need to educate society and clients about sustainability is also apparent.

As a future consideration for this research, this system could be a platform that allows the public to be educated and to have access to sustainable solutions, materials database, sustainability feasibility studies, researches, and sustainable strategies. Presenting this platform to interior design clients improves the communication skills between them and the sustainable solutions. For example, when studies are placed among these issues as sustainable solutions, then much time needed by the interior and architecture designer would be saved. Thus this will reduce the fear of expenses and time found by the client. Another example could be by having some effective sustainable solutions and financial studies that can give an idea of what expenses the client would be paying before going further into the choice of solutions. This platform could allow clients to have access to sustainable materials database which cannot be known for public, except categorized by professional.

The interior design which includes general ideas of the interior designer responsibilities will allow the client to adapt the environmental design project that would play a major role in achieving the goal.

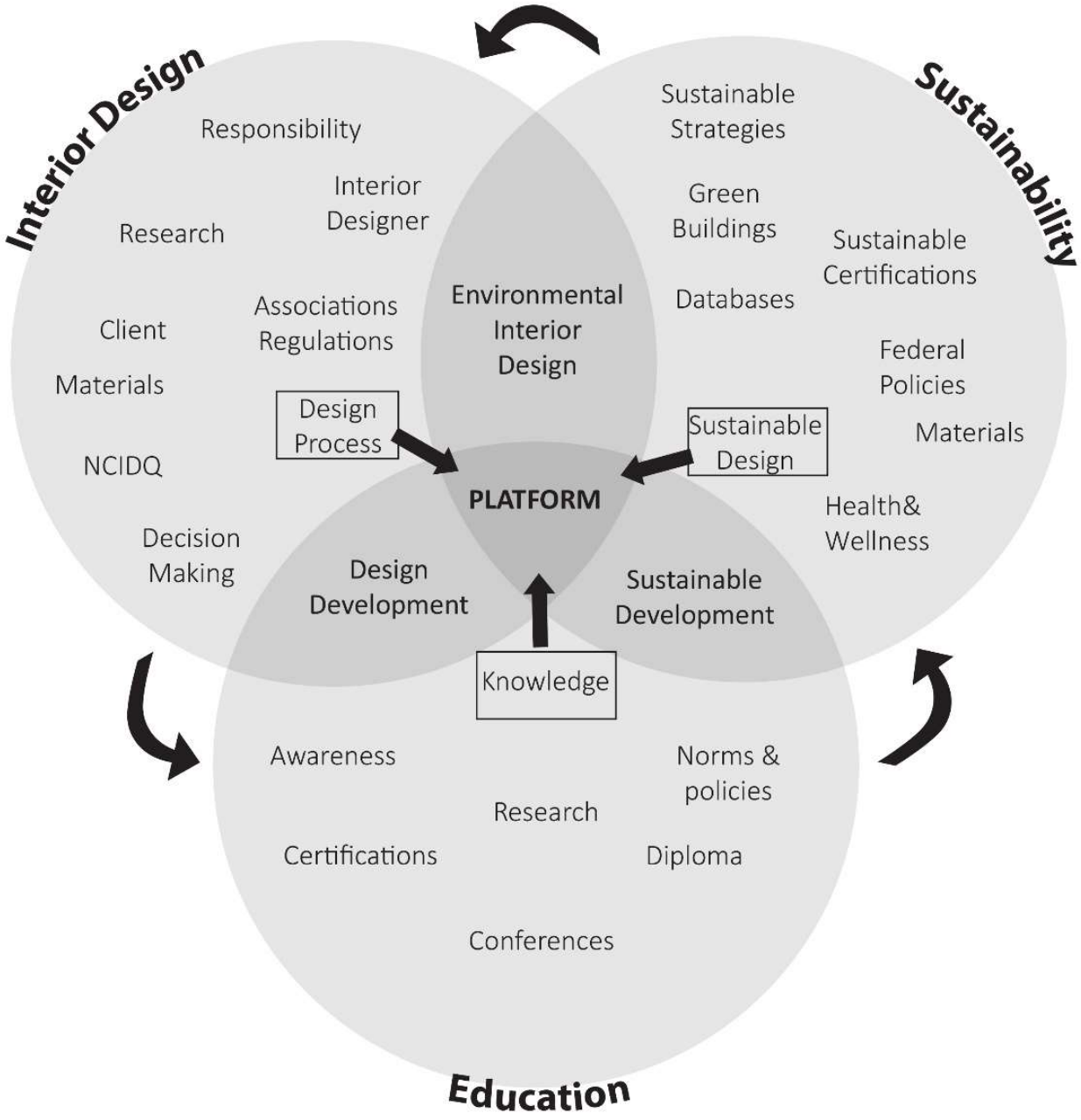

Figure. 8 – Environmental interior design platform proposal

(Source: A. El-Khatib)

In Figure 8, interior designer and the client approaches have been studied to understand the relation between both, and how to improve the communication skills between them without compromising the environmental design concept. Research, material selection, associations and regulations, and the decision-making will play a major role in the subject understanding.

One possible strategy is to target the interior design approach, through the assessment of design process. A sustainability design concept includes sustainable strategies and sustainable solutions in which precisely is presented in the micro aspect of sustainability about buildings such as green buildings. Having federal policies and materials databases related to sustainability are also included into this sustainability context. In compliment, an educational context includes awareness programs, certifications, conferences, diploma and norms & policies that would lead to acting as a valuable tool in the educational aspect. Knowledge has been the major element extracted from the educational approach to reach the client education.

The environmental interior design is the common aspect that combines sustainability and interior design. Design development is the common element that combines education and interior design. Sustainable development is the common element that combines sustainability and education. By highlighting these different elements found to be implemented at the beginning of the project, the importance of the first stages of the design process can affect the final stage of the sustainable project.

Resulting in the combination of the three elements extracted from interior design, sustainability, and education approaches are the design process, sustainable design, and knowledge. This element would be presented in a platform that will facilitate the work for the client and community, which can also include educating the industry. Educating stakeholders would allow us to target the core element in the building industry today. Stakeholders are considered the pioneers in deciding how a design project will proceed. Educating stakeholders will allow us to implement education and community approaches in a sustainable thinking to prove and allow them to re-evaluate their sustainable choices when it comes to the design process. This includes the research phase of the design process and specifically the involvement of the EBD and IDP from the beginning of the project along with the design and construction phase, which we have discussed in details above. By educating the client, a rising need will be approached hoping to be a reason for the construction industry to improve their sustainable standards and better fit today's sustainable needs. Since interior designers are responsible for the indoor physical spaces, comes their role in convincing and educating stakeholders mentioned above. Convincing stakeholders is a priority in our work to better achieve successful sustainable thinking. The challenges arise by highlighting the importance

of designing the physical spaces around us. The interior design role is essential to launch the awareness process to educate the public. Educating the client can start from the first stages of the design process knowing that indoor physical spaces are in place to accommodate our daily environments around us.

In conclusion, such platform responds to the issues presented in this study, as it would allow society to have preliminary and direct access to sustainable strategies and other sustainable solutions and thus help facilitate the work of architects and designers. Developing a platform to assist clients in decision-making and the better integration of sustainable choices and solutions for interior finishes, research, planning, concept and technical development is vital. This platform can also target renovation work, as this is what needs attention, being the construction work done more often by architects and designers. With the help of this research; by targeting and explaining the actual barriers found in Lebanon and Canada, and possible solutions proposed by professionals that were successfully implementing environmental design in two case studies, will allow us to achieve a well structured platform with most of the resources needed. The platform will act as a tool to help architects and designers better educate the client in a facilitated manner to assist them in targeting their sustainable choices, and implementing simplicity as the new language that can target, aid, reach and educate the design client.

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Appendixes

Appendix I: Ethics approval

Université de Montréal

Comité plurifacultaire d'éthique de la recherche

N° de certificat
CPER-16-042-D

CERTIFICAT D'APPROBATION ÉTHIQUE

Le Comité plurifacultaire d'éthique de la recherche (CPER), selon les procédures en vigueur, en vertu des documents qui lui ont été fournis, a examiné le projet de recherche suivant et conclu qu'il respecte les règles d'éthique énoncées dans la Politique sur la recherche avec des êtres humains *de l'Université de Montréal.*

Projet	
Titre du projet	**Educating Interior Design Clients about Sustainability: Issues, perceptions and sustainable expectations.**
Étudiant requérant	**Abdulkader, El-Khatib** [redacted] Candidat à la maîtrise, Faculté de l'Aménagement Université de Montréal
Financement	
Organisme	Non financé
Programme	--
Titre de l'octroi si différent	--
Numéro d'octroi	--
Chercheur principal	--
No de compte	--
Approbation reconnue	
Approbation émise par	non
Certificat:	s.o.

MODALITÉS D'APPLICATION
Tout changement anticipé au protocole de recherche doit être communiqué au CPER qui en évaluera l'impact au chapitre de l'éthique.

Toute interruption prématurée du projet ou tout incident grave doit être immédiatement signalé au CPER.

Selon les règles universitaires en vigueur, un suivi annuel est minimalement exigé pour maintenir la validité de la présente approbation éthique, et ce, jusqu'à la fin du projet. Le questionnaire de suivi est disponible sur la page web du CPER.

[redacted]

Jean Poupart, Président
Comité plurifacultaire d'éthique de la recherche
Université de Montréal

2 juin 2016
Date de délivrance

1 juin 2017
Date de fin de validité

Appendix II: Consent Form

INFORMATION FORM AND CONSENT

« Educating Interior design and Architecture clients about sustainability »

Student researcher: **Abdulkader El-khatib, Masters student- M.Sc.A Environmental Design,**
Faculty of Environmental Planning & Design, Université de Montréal

Research director: **Dr. Tiiu Poldma, Professeure Titulaire,**
Faculty of Environmental Planning & Design, Université de Montréal

You are invited to participate in a research project. Before accepting, please take the time to read this document outlining the conditions for participation in the project. Feel free to ask any questions that you consider useful to the person who presents the document.

A) INFORMATION TO PARTICIPANTS

---

1. Research Objectives

This project explores the reasons behind why design clients do not choose sustainable solutions for their projects, from the perspectives of participants in Beirut, Lebanon and Montreal, Canada. In this study, we are interested in perspectives of sustainability in the built environment in general and the interior design discipline, specifically. To do this, we plan to collect opinions of six educators and professionals who have the experience in environmental design and sustainability.

2. Participation in research

Your participation will include an interview responding to various questions about sustainable approaches that you use. This interview will be recorded, with your permission, in video format and should last about 30 minutes. The interviewer, according to your availability, will determine the place and time of the interview. For interviewees residing outside Montreal, the interview will be taking place via Skype.

3. Risks and disadvantages

There is no particular risk and disadvantage to participating in this project.

4. Advantages and benefits

You will contribute to a better understanding of the reasons and indicators that motivate Interior design clients to choose sustainable projects.

5. Confidentiality

The personal information you provide will remain confidential. No information that could identify you in one way or another will be published. In addition, each research participant will be assigned a code and only the researcher and his team will know their identity. Data will be kept in a safe place. The recordings will be transcribed and will be destroyed, as well as any personal information, seven years after the end of the project. Only data does not identify you will be kept after this period.

6. Dissemination of results

The participants will be informed when the masters is published, or they can ask for a version of the results to be received after the analysis process is completed.

7. Right of Withdrawal

Your participation in this project is voluntary and you can always remove yourself from the project without having to justify your decision and without consequences for you. If you decide to withdraw from the research, please contact the researcher at the telephone number indicated below.
At your request, all information about you may also be destroyed. However, after the outbreak of the publishing process, it is impossible to destroy analysis and results on your data.

B) AGREEMENT

Participant Declaration

- I understand that I may take my time to think before giving my consent or not to participate in research.
- I can ask for details about this project from the researcher or the research team.
- I understand that in participating in this research project, I do not renounce my rights nor do I free researchers of their responsibilities.
- I agree to keep my personal information confidential.
- Upon request, the researcher will send the results to participants.
- I have read this information and consent form and agree to participate in the research project.

Participant signature: _____ Date: _____

Full Name: _____

Researcher commitment

I understand and have been informed, as a participant as to the conditions of participation in the research project. I answered to the best of my knowledge the questions asked and understand as a participant that I will respect what has been agreed to in this present consent form.

Researcher signature: _____ Date: _____

Full Name: _____

For questions concerning the study or to withdraw from the research, please contact Abdulkader El-khatib at [redacted] phone number or email address [redacted]

For any concerns about your rights or responsibilities of researchers regarding your participation in this project, you can contact the Ethics Committee of the multi-faculty research by email at CPER@umontreal.ca or by phone at +1 (514) 343-6111 ext. 1896 or visit the website http://recherche.umontreal.ca/participants.

Any complaint relating to your participation in this research may be addressed to the Ombudsman of the University of Montreal by calling telephone number +1 (514) 343-2100 or by emailing at ombudsman@umontreal.ca

A copy of this form was delivered to me

Appendix III: Consent Form in French

FORMULAIRE D'INFORMATION ET DE CONSENTEMENT

« Sustainable indicators and guidelines that can aid in Educating Interior design client about sustainability »

Chercheur étudiant : **Abdulkader El-khatib, Étudiant au Maitrise- M.SC. A Aménagement,**
Département d'Aménagement, Université de Montréal

Directrice de recherche : **Dr. Tiiu Poldma, Professeure Titulaire,**
Département d'Aménagement, Université de Montréal

Vous êtes invité à participer à un projet de recherche. Avant d'accepter, veuillez prendre le temps de lire ce document présentant les conditions de participation au projet. N'hésitez pas à poser toutes les questions que vous jugerez utiles à la personne qui vous présente ce document.

A) RENSEIGNEMENTS AUX PARTICIPANTS

---

1. Objectifs de la recherche

Ce projet explore les raisons pour lesquelles les clients de conception ne choisissent pas de solutions durables pour leurs projets, du point de vue des participants à *Beyrouth,* au *Liban* et à Montréal, Canada. Dans cette étude, nous nous intéressons aux perspectives de durabilité dans l'environnement bâti en général et la conception discipline intérieure, en particulier. Pour ce faire, nous avons l'intention de recueillir des opinions de six éducateurs et les professionnels qui ont l'expérience dans la conception de l'environnement et de la durabilité.

2. Participation à la recherche

Votre participation comprendra une interview répondant à diverses questions sur les approches durables que vous utilisez. Cette entrevue serait enregistrée, avec votre permission, avec le soutien vidéo et devrait durer environ 30 minutes. L'enquêteur, selon votre disponibilité, déterminera le lieu et l'heure de l'entrevue. Pour interviewées résidant à l'extérieur de Montréal, l'entrevue aura lieu via Skype.

3. Risques et inconvénients

Il n'y a pas de risque particulier à participer à ce projet

4. Avantages et bénéfices

Il n'y a pas d'avantage particulier à participer à ce projet. Vous contribuerez cependant à une meilleure compréhension des raisons qui motivent les clients de design d'intérieur à choisir des projets durables.

5. Confidentialité

Les renseignements personnels que vous nous donnerez demeureront confidentiels. Aucune information permettant de vous identifier d'une façon ou d'une autre ne sera publiée. De plus, chaque participant à la recherche se verra attribuer un code et seuls la chercheuse et son équipe pourront connaître son identité. Les données seront conservées dans un lieu sûr. Les enregistrements seront transcrits et seront détruits, ainsi que toute information personnelle, 7 ans après la fin du projet. Seules les données ne permettant pas de vous identifier seront conservées après cette période.

6. Diffusion des résultats

Les participants seront informés quand la maîtrise sont publiés, ou ils peuvent demander une version des résultats à recevoir après le processus d'analyse est terminée.

7. Droit de retrait

Votre participation à ce projet est entièrement volontaire et vous pouvez à tout moment vous retirer de la recherche sur simple avis verbal et sans devoir justifier votre décision, sans conséquence pour

vous. Si vous décidez de vous retirer de la recherche, veuillez communiquer avec la chercheuse au numéro de téléphone indiqué ci-dessous.

À votre demande, tous les renseignements qui vous concernent pourront aussi être détruits. Cependant, après le déclenchement du processus de publication, il sera impossible de détruire les analyses et les résultats portant sur vos données.

B) AGREEMENT

Participant Déclaration

- Je comprends que je peux prendre mon temps pour réfléchir avant de donner mon accord ou non à participer à la recherche.
- Je peux poser des questions à l'équipe de recherche et exiger des réponses satisfaisantes.
- Je comprends qu'en participant à ce projet de recherche, je ne renonce à aucun de mes droits ni ne dégage les chercheurs de leurs responsabilités.
- Je suis d'accord pour garder mes renseignements personnels confidentiels.
- Sur demande, le chercheur envoie les résultats aux participants.
- J'ai pris connaissance du présent formulaire d'information et de consentement et j'accepte de participer au projet de recherche.

Signature du participant : _____ Date : _____

Nom : _____ Prénom : _____

Engagement du chercheur

J'ai expliqué au participant les conditions de participation au projet de recherche. J'ai répondu au meilleur de ma connaissance aux questions posées et je me suis assurée de la compréhension du

participant. Je m'engage, avec l'équipe de recherche, à respecter ce qui a été convenu au présent formulaire d'information et de consentement.

Signature de la chercheuse : _____ Date : _____

Nom : _____ Prénom : _____

Pour toute question relative à l'étude, ou pour vous retirer de la recherche, veuillez communiquer avec Abdulkader El-khatib au numéro de téléphone [redacted] ou à l'adresse courriel [redacted]

Pour toute préoccupation sur vos droits ou sur les responsabilités des chercheurs concernant votre participation à ce projet, vous pouvez contacter le Comité pluri facultaire d'éthique de la recherche par courriel à l'adresse CPER@umontreal.ca ou par téléphone au +1 (514) 343-6111 poste 1896 ou encore consulter le site Web http://recherche.umontreal.ca/participants.

Toute plainte relative à votre participation à cette recherche peut être adressée à l'ombudsman de l'Université de Montréal en appelant au numéro de téléphone +1 (514) 343-2100 ou en communiquant par courriel à l'adresse ombudsman@umontreal.ca **(l'ombudsman accepte les appels à frais virés).**

Une copie du présent formulaire m'a été remise

Appendix IV: Interview Questions & Themes

List of Themes and Issues for interview (Used to Perform the Research Interviews)

Part A: Questions for participants

- Barriers prohibiting interior designers to achieve sustainable design solutions.
- Environmental design education. How to communicate with clients?
- Issues and perspective on how to convince interior design clients of adapting environmental design solutions.
- Cost & Time as two targeted elements to improve the client's perspective toward sustainability. What are potential strategies?
- The role of private sustainable systems such as LEED, BREEAM, and Cradle to Cradle in the client's perspective.
- The follow up role done by LEED & BREEAM to assure the continuous sustainable process. What do they suggest to improve these system's process?
- What are the Guidelines used to educate interior design clients?
- What are the indicators used to identify environmental interior design?
- Having new perspectives of the potential client system to achieve environmental interior design. How? What are these potential elements?

Part B: I will also be presenting some of the following elements and ask for their views.

- A review of sustainable policies in general that are related to interior design specifically in Montreal, Canada & Beirut, Lebanon.
- Review of some indicators and guidelines chosen that can be used in re-evaluating environmental interior design.
- The role of government policies to influence interior design association's regulations. How can we improve these policies to target environmental interior design?
- Sustainable solutions that can aid improving the environmental interior design industry.

- Different tools can be used to aid and sensitize clients as being citizens in a city of the urgent need of environmental approaches.
- The need of sustainable initiatives in both cities Montreal and Beirut.
- The need of educating interior design client's about sustainability.
- The urge need to re-evaluate the interior design project process to reach sustainable solutions.
- A review of proposed sustainable solutions & findings that the research has reached.