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Sustainable Development of Istanbul Built Environment

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Abstract

Marmara Sea and Black Sea connected with renowned Bosporus surround Istanbul, the city, which owns the privilege of bridging Europe and Asia. Besides such inland seas; forests and wetlands fragmented around and in the city maintain the natural cycle in the region. However, Istanbul as a fast developing urban area witnesses environmental issues like many other urban areas in global scale. Rapid economic and population growth of the city increase the pressure on above mentioned natural resources.

Sustainable development of built environment is one of the best solutions in order to mitigate environmental damages of urban areas. The solution comes with green construction projects and systems yet the city and the market itself have barriers to block or slow the process of sustainable development. Identification of such barriers and reviewing international sustainable development practices paves the way for generating recommendations for environmentally friendly urban expansion in Istanbul.

Survey targeting market professionals was conducted to identify sustainable development barriers in Istanbul and in order to address such barriers the thesis refers to conducted interviews and international practices presented in the literature review.

The thesis draws economic, market and governmental recommendations which are particularly focused on financial incentives, raising awareness and enacting green laws involving all stakeholders of construction and real estate market.

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List of Abbreviations

BREEAM: Building Research Establishment Environmental Assessment Methodology (British Green Building Certification System)

ÇEDBİK: Turkish Green Building Council

HVAC: Heating Ventilating and Air Conditioning

LEED: Leadership in Energy & Environmental Design (American Green Building Certification system)

OPEC: Organization of the Petroleum Exporting Countries

SEEB-Tr: Sustainable Energy Efficient Buildings (Turkish Green Building Certification System)

1. **Introduction**

When the Danish fairytale writer Hans Christian Andersen visited Stockholm 1850, he wrote that this beautiful city of wide straits and high hills reminded him of Constantinople (Istanbul). The comparison was indeed valid: both cities had the same stench, dirt and poor sanitation; both were ugly ducklings (Hårsman, 2013).

Until today both cities has followed different paths apparently because Stockholm was appointed as the first of *Green Capital of Europe* in 2010 whereas Istanbul has suffered from unplanned urbanization. Stockholm like Istanbul has extensive coastal area and surrounding forest and according to 2012-2013 population growth both cities report fast, *1.7%* population growth per year (SCB, 2013; Tüik, 2013).

Increasing population and exponential rise of consumption bring pressure on the natural resources and especially on the vicinity of human settlement areas. Excessive energy consumption and its results are recognized among the main contemporary issues of many developed and underdeveloped countries.

Fast development in the name of urbanization tends to ignore environmental concerns and break natural cycle to some extent. Dwellers of urban zones especially in underdeveloped countries have begun to suffer from the destructive sides of growing urbanization. Construction and real estate industry -built environment- stands out with considerably high level of energy consumption and waste material (Ortiz et al, 2009). Percentage levels per capita vary across different countries and some of which step forward when it comes to energy efficiency and waste management.

Some countries including Sweden and the Netherlands seem to gain early consciousness on sustainable development as seen in the literature review sections yet some others including Turkey takes the first steps.

The biggest city of Turkey, Istanbul with almost 15 million dwellers consumes 40 billion kWh/year of electricity (Teiaş, 2013). Istanbul dwelling report states that building stock will double and exceed 5 million by 2023 (Gurlesel, 2012). Proactive approach as sustainable development strategies would be enormously beneficial such an exponentially developing city. Yet Istanbul has drawn relatively slow paced trend in sustainable development issues which are only sponsored by a very limited segment of society.

The way to sustainable development passes through effective strategies and recommendations. However, without the awareness of barriers to such development and knowledge of international models proactive approach cannot be exercised. So, a survey analyzing contemporary state of Istanbul construction market and validity and power of barriers which are filtered from international studies was conducted in local market. International models from different countries and urban areas like Stockholm, Amsterdam, Singapore are presented as referable models. Interview sections discuss and interpret possible solutions for sustainable development for Istanbul. Finally, recommendations and strategies are generated on the grounds of survey and interview results, international models and my personal reasoning.

1.1 Research Objective

The purpose of this study is to explore the possible sustainable development recommendations for Istanbul built environment by investigating sustainable development barriers, practices and local market conditions.

The target study area is residential and commercial construction and real estate market in urban areas. The thesis focuses on new sustainable/green projects and their development and does not have particular aim of green renovation. Topics such as overall sustainable urban planning and sustainable infrastructure are also out of scope. In this study sustainable or green development refers to development of sustainable residential or commercial buildings.

Sustainable development is a high priority issue for such a fast growing city-Istanbul. The city's insufficiently planned urbanization and environmentally inefficient residential and commercial building stock is about to turn into a destructive weapon for city itself and the vicinity. Sustainable development seems to be the vital solution to be undertaken by different parties in society. Ideas and recommendations drawn in this thesis will be beneficial mainly for Istanbul, Turkey or reference for other developing markets (in terms of sustainable development) around the world. Besides government, municipalities, construction and real estate sector including professionals and investors, educational units could adopt such recommendations.

1.2 Research Questions

Fast developing city Istanbul lags in sustainable development and barriers blocking or slowing the practice of sustainable development in the city should be identified.

1) What is the current state of Istanbul from sustainable development barriers perspective?

Many developed countries in the global arena have created and followed sustainable development practices to assure environmentally friendly buildings and cities.

2) What are the featured practices of sustainable development in international arena?

Thus, Istanbul as a fast developing urban area needs sustainable solutions urgently.

3) What are the recommendations that will promote sustainable development in Istanbul built environment?

1.3 Research Limitations

- Green renovation topic and strategies related to green renovation are not covered.

- Other urbanized cities of Turkey may show different patterns in sustainable development and require different set of strategies.

- The target group in the survey is construction sector professionals or students who have been affiliated with sustainable development in some ways and the opinions of general society are not tested.

- 3 professionals from construction sector (one from municipality) and 1 academician are interviewed. The number of interviews could be increased in future studies by interviewing with government officers, employees from financial institutions, academicians from various departments and leading investors.

1.4 Thesis Disposition

The thesis is organized as the following way;

Section 2 literature review begins with theoretical context of sustainable development, sustainable urban development and green buildings. Both green certification systems and green building benefits are presented before sustainable development barriers. Sustainable development barriers accumulated by numerous articles are stated under 4 titles; economic barriers, technical & market barriers, social barriers, municipal & governmental barriers. In order to answer research question *#2* sustainable development in Stockholm together with other international practices is also included in this section. International practices presented here are aimed to help through the generation of recommendations for Istanbul market. Finally, sustainable development achievements in Istanbul are briefly covered to recognize what the market already done so far.

Section 3 is reserved for outline of research methodology. Both survey and interview methods are explained in this section.

Section 4 analyzes the results of survey which examines whether sustainable development barriers which are recognized by the literature apply to Istanbul construction and real estate market and generates discourses based on the detailed results. Besides, interviews reflect the opinions and suggestions of 4 professionals; 2 from private sector, 1 from municipality, 1 from academia.

Section 5 presents recommendations for sustainable development strategies in Istanbul based on literature reviews, survey analysis and interviews.

Section 6 draws conclusion and summarizes the findings in the thesis.

2. **Literature Review**

Literature review section begins with theoretical context - definitions and features - of sustainable development, sustainable urban development and green buildings. In the following section barriers of sustainable development are stated by the mean of international studies which analyze different markets around the world. Last sections under literature review where Stockholm models take the lead are allocated to international models and implementations. Sustainable development achievements in Istanbul also reviewed in this section.

2.1 Sustainable Development

Sustainability as an overarching term has evolved in the course of last decades and it still evolves with ever changing human needs and perception. The term *sustainability* can be used in a variety of professions or concepts yet this thesis focuses on sustainable development which is discussed within the scope of construction and real estate industry, in the other words built environment.

Sustainability in the perspective of built environment has the roots in 1970s. Green building report of Marble Institute (2007) explains kick start of sustainable development movement through OPEC oil embargo in those years. People began to gain the consciousness that the development has its own limitations and side effects.

United Nation conference held in Stockholm in 1972 has following statement:

A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well-being depend. Conversely, through fuller knowledge and wiser action, we can achieve a better life. To defend and improve the human environment for present and future generations has become an imperative goal for mankind.

Such statement briefly advises a mindful progress to all humanity for a better and sustainable future. In 1987, The World Commission on Environment and Development defined sustainability as *meeting the needs of the present without compromising the ability of future generations to meet their own needs*. This definition subtly highlights the tradeoff between social/economic expansion and environmental concerns. Population rise and urbanization during post war era brought development and environment dilemma.

Three major impacts of sustainable development in construction industry sit on those three factors social, economic and environmental. The three perspectives could draw how sustainability could be involved in construction industry. As mentioned in Pitt (2009) environmental impacts cover natural resource related issues such as energy consumption, recycling, water use and pollution.

Economic impacts, on the other hand, cover economic performance, economic value as a result of sustainable implementations.

A report of construction industry research and information association states that social impacts cover health, satisfaction, the performance, quality and design of commercial and residential buildings, as well as access to services and recreation can directly affect quality of

life, promotion of healthy living and cohesiveness of society (CIRIA, 2010). Such three main impacts are also revisited under the following green buildings and certification sections.

2.2 Sustainable Urban Development

Sustainable development comes under spotlight especially in urban context. The reason lies under the extent of human settlement. Urban pattern sometimes turn into urban sprawl and makes dwelling damaging to the nature. Fast development in the name of urbanization has been less considerate when it comes to environmental concerns and many urban dwellers are able to observe such phenomenon.

Commercial and residential buildings are the biggest slice in urban areas and each building block composing the whole urban fabric partially responsible for environmental tradeoff. Urban formation imposes costs in the form of congestion, different kind of pollution, heat effects, water shortage and waste problems (Hårsman, 2013).

Such problems have urged discussions and different discourses have been generated by professional circles for decades. The one that is used widely, often with ecological and green connotations is sustainable urbanism. In practice, sustainable urbanism focuses on identifying small scale catalytic interventions that can be applied to urban locations. The approach includes the following elements: building and growing more densely and compactly, integrating transportation, cycling, walking through the implementation of car free areas, creating health and environmental benefits by linking humans to nature, neighborhood storm water systems, waste treatment and investment in and commitment to sustainable, renewable and passive technologies integrated into the built form (Marcus, 2013).

2.3 Green buildings

Sustainable development or sustainable urban development is generally associated with sustainable building in practice. Within construction and real estate circles sustainable development directly refers to sustainable buildings as the basic units of such fabric. As stated in sustainable urban development section; sustainable, renewable, passive technologies show themselves in built environment as integrated forms.

Energy conservative structures could be entitled by more than one term. *Sustainable building*, *green building* and *energy efficient building* terms are used in the literature interchangeably to refer buildings which targets energy efficiency and environmentally friendliness. *Green building* name steps forward in general use in academia and private sector maybe because the tag of green and its direct environmental connotations. This name is also commonly spelled in the titles of various associations around the world as in *Turkish Green Building Counci*l or *Sweden Green Building Council*.

Green building can be defined as *healthy facilities designed and built in a resource efficient manner, using ecologically based principles*. Also this term refers to the quality and characteristics of the actual structure created using the principles of sustainable construction (Kibert, 2008). That reference examines the principles of sustainable construction which requires a comprehensive research to address different angles in construction market.

An international research networking organization CIB (Conseil International du Batiment) defines the goal of sustainable construction in 1994 as *creating and operating a healthy built environment based on resource efficiency ecological design*. CIB articulated seven principles

of sustainable construction which would ideally inform decision making during each phase of the design and construction process.

1) *Reduce resource consumption*
2) *Reuse resources*
3) *Use recyclable resources*
4) *Protect nature*
5) *Eliminate toxics*
6) *Apply life cycle costing*
7) *Focus on quality*

As seen in these seven principles, the aim in sustainable development is decreasing overall need to energy either by reducing consumption or reuse/recycle process. Quality concern eases long term goals by proactive approach yet this approach should include life cycle assessment.

High performance green building features are summarized by American state of Pennsylvania's Green Government Council as the following; (Kibert, 2008)

- *A project created via cooperation among building owners, construction professionals, designers through a collaborative team approach.*
- *A project that engages the local and regional communities in all stages.*
- *A project that considers the true costs of a building's impact.*
- *A building that uses resources and energy efficiently.*
- *A project that minimizes demolition and construction wastes.*
- *A building with healthy indoor environments.*
- *A project that uses appropriate technologies, including natural and low-tech products and systems.*
- *A project that educates building occupants and users about green issues in the project.*

2.3.1 Green Certification Systems

Green building concepts and sustainable development principles fulfill the technical understanding but how a building gets green building title is a more practical story. Sheer number of new structures enter the built environment yet a slight percentage of them is labelled as green. In the other words, some of the buildings meet the green standards.

Certification systems are the assessment authorities when it comes to testing such standards. Degree of compliance or efficiency brings different levels of green labels. So, the specific aspects of a building should be introduced and evaluated to earn either minimum or higher level labels based on the requirements. Many countries have their own certification systems such as LEED (USA), BREEAM (UK), Miljöbyggnad (Sweden). LEED and BREEAM are also actively used around the world other than their origin countries.

LEED system is broadly preferred in both Sweden and Turkey and either in commercial building stock or residential buildings. For *LEED*-newly constructed assessment standard following procedures are predefined.

As mentioned in Kibert (2008), LEED standard is structured with seven prerequisites and evaluation divided into six major categories. Those seven prerequisites are conditions that must all be successfully addressed for a building to be eligible for consideration for a LEED rating. Those prerequisites and major categories could be seen in Appendix A**.** Points that are earned from each category are added up and building rating gets a result from base-certified level to top-platinum level.

Other international or local certification systems share the similar evaluation categories or approaches but point scoring system may be adapted and manipulated regarding the needs of the society, area or the country. For example, in Sweden water source problem could stay in the background because body of water is abundant compared to other countries whereas other aspects like heat insulation may get the priority in evaluation. So, each country may create its own criteria either by directly adopting internationally known certification systems or by modifying, merging them.

Thus characteristics of green development projects or building can be summarized as following based on LEED criteria. Respecting present green fabric and being within the close proximity of public transportation hubs or lines comply with site planning criteria. Use of environmentally responsible, renewable materials meets material selection criteria. Furthermore, generating needed electricity on site from renewable resources or purchasing green power as well as water efficient equipment, waste water treatment and maximized day lighting make the structure energy conservative. HVAC system and building envelope to optimize interior climate or intelligent heating/cooling systems contribute to efficiency of the structure.

After the definitions and criteria of sustainable development and green building, below, the benefits of such commitments are stated.

2.3.2 Benefits of Green Buildings

The whole green construction and maintenance is a commitment because from the design of the structure to the material selection and changing occupant habits many major changes are adopted to deserve green certification and gain its benefits. So what do we gain by going green? Actually what mentioned under green certification criteria are explicit clues of such benefits.

Sustainable site as mentioned under Stockholm Hammarby Sjöstad project is relatively the biggest achievement of sustainable projects. In Hammarby case formerly brownfield area which had negative effects on the vicinity has been turned into a complex of sustainable project and home and workplace of thousands. Also public transportation solutions made the area both economically and environmentally sustainable. We can include water efficiency, decreased carbon emission, use of sustainable and renewable construction materials, and energy efficiency under sustainable site title. Those benefits cannot be limited only to green project site and neighborhood but to some extent be conveyed to the whole region or the country.

Other than environmental benefits, financial benefits accompany green projects. To be specific, Eichholtz (2010) states that an otherwise identical commercial building with an Energy Star certification (an American green building certification system) rents about 3% more per square foot, the difference in effective rent is estimated to be 7%. The increment to the selling price may be as much as 16%.

What leads to such value premium then? If we look from office base perspective, studies imply increased indoor air quality of green building which directly effects productivity of

employees or occupants. Day-lighting is a supportive actor when it comes to productivity of employees or psychological state of tenants. Besides energy efficiency of day-lighting raises economic savings and decreases environmental side effects.

Design innovation and feeding other projects or professionals with progressive green design are big social and technical added values to construction and real estate sector.

Many countries have tax benefits for green buildings but neither Sweden nor Turkey has such incentives yet.

Benefits like lower construction costs or operation costs depend on the condition of analyzed country or region because availability of green materials and their prices tightly connected to the local economy, matureness of the sector and material production base. If optimum circumstances could be carried then construction and operation costs might be reduced in green projects and buildings.

2.4 Sustainable Development Barriers

Sustainable development and green buildings have many benefits for the sector and society as mentioned above. However, driving factors as well as obstacles shape the current and future state of sustainable development in local or national scales. In this thesis, such factors and obstacles are named as motivators and barriers respectively. Although barriers and motivators change across the countries or even regions academic works help to compile probable driving or retarding forces for particular urban areas.

The thesis quests common barriers in international market under this section by the medium of literature review and then the survey under the methodology part reveals whether the barriers present in global markets apply to Istanbul construction and real estate market.

Here the barriers are classified under four titles namely; economic, technical & market, social and governmental & municipal. These four different perspectives cover quite wide range of contemporary Istanbul market aspects and are believed to be backed by the survey. As mentioned in the United Nations Environmental Program's vision, sustainability as well as its barriers is directly related to the stakeholders in the sector which are government/municipality, investors, developers, buyers, education units, technical companies, non-governmental organizations, and financial institutions. So majority of the barriers mentioned under four titles are the result of such stakeholders' decisions, actions or expectations.

2.4.1 Economic Barriers

Economic reasons or forces are the most dominant ones when it comes to make a decision in every stage of a project which, most importantly, includes whether to build green.

Procurement of green material, installation, testing new systems and coordinating or allocating labor for brand new implementations may cost extra money for the developers. So the fear of higher investment costs for sustainable building compared with traditional one and the risks of unforeseen costs and higher risks for clients are three prominent economic barriers (Häkkinen, 2011).

Clients, for sure, seek for remedy for such risk and banks or insurance companies are the direct address in this case. However, financial institutions locally or nationally should have set sustainable building risk policies to be able cover sustainable projects.

Zhou et al. (2003) claims that the misperception of incurring higher capital costs and the inadequate market value are among the barriers of sustainable development. Higher capital cost perception brings the concern whether sustainable building's potential cost savings in the whole life cycle compensates the capital cost.

Edwin (2009) draws attention to insufficient fiscal incentives from the government to help off-set the perceived higher upfront cost of sustainable building and products. That is a vital issue for the trend of sustainable development especially in the developing markets like Istanbul. Government support may encourage investors to suppress the perception of higher capital cost and let market to absorb more sustainable projects. Other than government, banks may involve in the process by green credits or low interest loans for green investors. Neglecting such support to the sector may be put in a position of being indirect barrier.

Häkkinen and Belloni (2011) state that the demand and the willingness of clients eventually determine the trend of sustainable development. So, not enough client demand may stagger sustainable development projects. Big investors' position may also affect and lead the general atmosphere in the market.

Another point is the image of green building cost in developers' mind. Perception of high cost of sustainable building could come out as higher selling and rental prices to tenants which in return discourage tenants to head for green buildings. Image of expensive green building and affordability dilemma in buyers' minds is a quite strong barrier which cuts the dialogue between green developers and buyers.

2.4.2 Technical & Market Barriers

Technical barriers emphasize implementation dimension of sustainable/green buildings. In order to put sustainable development into practice construction companies need green materials, systems, experienced labor and sub-contractors.

According to Azizi et al. (2011) lack of experienced consultants and contractors with respect to green projects results in schedule delays of the project. Contractors in the market may lack of the skills to properly implement green oriented technology. As a result, this could hinder the technology effectiveness.

The discourse above applies to Istanbul market because according to certification records only very slight percentage of building stock is verified as green in Istanbul. That means limited number of contractors and green construction experienced employees.

Again, according to Azizi et al. (2011) availability of green materials in the market is a risk during the construction stage. This is a challenge to contractors as sourcing materials become difficult. The consultants are then faced with the challenge to audit the work of the contractor to ensure compliance. These risks become a barrier to the implementation of green buildings.

Green materials are not only structural elements of under construction buildings, during the maintenance works facility also may need green materials. In the other words, green materials are needed for sustainable performance of green buildings in their whole life cycle.

Overall performance of a green building has a significant influence in the decision making process to implement green buildings that will affect the market position (Azizi et al., 2011). So, any concern about the performance or living quality may drive clients to reconsider their decisions or hesitate about green building investments.

Market risks mainly stem from misperception or insufficient knowledge about sustainable development. Integration with green construction is crucial for architects and engineers

otherwise scarcity of competent professionals leads either ineffective green design or not green at all.

Collaboration between designers, constructors, facility managers is important for realizing the design and construction of high efficiency buildings. Integrated design leads to simpler buildings which are not only robust but also work better (Richardson, 2007).

If green material procurement delays collaboration between the units and scheduled work flow fail. On the other hand if inexperienced contractors attempt to construct green duration of the construction may get longer or even the project may be left on hold.

The existence of many unrecognized eco-labeling for green products as well as the lack of coordination of consistency in rating tools are holding back the interests of the potential stakeholders (Edwin, 2009).

Besides Edwin's position, internationally recognized labels - if directly get adopted – may not be enough or may be redundant in local cases. So, not nationally or locally optimized certification systems could be seen as a burden to the clients.

Not sufficiently classified definitions and benefits of sustainable development by academic circles or other organizations may interrupt the knowledge flow to the public and built environment professionals and that eventually leads to some social barriers to sustainable development.

2.4.3 Social Barriers

Early discipline integration is crucial for green buildings, it is as much important to have educated team members in the process. Unfortunately green building knowledge is not equally spread among the project participants within the industry (Pedini, 2010). So, especially engineers and architects who are lack of sustainable development notion happen to cause a social barrier which gradually grows into technical barrier.

As mentioned under technical barrier section, sustainable construction needs new technology and working methods. According to Häkkinen and Belloni (2011) resistance to new technologies or systems occurs because they require process changes, entailing the perception of possible risks and unforeseen cost.

Lack of awareness of environmental impacts as well as beneficial sides of sustainable development by stakeholders and the public is a deep rooted, formidable obstacle. The solution of such barrier may need a multi-disciplinary initiative of the sector, media and academic circles.

Non-governmental sustainable development organizations or educational institutions (universities, public education centers) could be the key elements in order to raise awareness among professionals or of public. There are many different ways which such organizations could apply like seminars, meetings, publications and courses. As a result, malfunctioning organizations could be a barrier on the way to sustainable development. Indifferent mass media to green projects serves in the same way as malfunctioning organizations.

Some circles may assert that Istanbul does not suffer from environmental issues which arising from built environment. That discourse indirectly backs up the idea that no effort is needed to make already green city greener.

Winston (2010) explains the multiplicity of interest groups as a big barrier. Lots of groups do very useful jobs, some voluntary, some paid for, some progressive but they all have their own axe to grind. So that points out sustainable development initiatives are open to disorder if due diligence is not exercised.

2.4.4 Governmental & Municipal Barriers

Importance of government's role in assisting sustainable development is well recognized in many ways because government has a major economic and legislative power. Not providing tax pile or impact fee abatement by the government or municipality may deter investors to consider green. No regulations regarding sustainable development also discourages the local developers to invest on green buildings.

Lower energy prices, locally or nationally, may lead owners to ignore cost-wise gain from being green or energy efficient.

Thus it should be kept in mind that in order to make built environment sustainable the local authorities like municipalities, local governmental agencies should have green mindset in their administrative power.

2.5 Sustainable Development in Stockholm

Development of sustainability idea and green building concept take their inception point back in 60s in Sweden, Stockholm. Istanbul's and Stockholm's ways separated at that point of the time because Istanbul has been an open stage of fast structuring since then. Environmental concerns were pushed into the background and the main scene has been invaded by human settlement inflation. Until 2000s the only concern was building enough shelter for dramatically increasing population of Istanbul. Meanwhile Stockholm has not been subjected to five time population increase by 2000s as Istanbul has. Stockholm construction market could be considered as a saturated market compared to Istanbul and more mature and saturated markets are more favorable when it comes to new and constructive ideas. At least the following flashback about both cities implies so.

European Union gave the first European Green Capital Award to Stockholm in 2010. Jury motivated this result by noting that city council has holistic vision with ambitious long term targets and performance indicators as well as the solidly budgeted environmental program with its focus on combining economic growth with an environmental sensibility (Metzger, 2013). Integration of economic sense and environmental concerns emerged a strong motivation for sustainable development by breaking the barriers within the management levels. Stockholm deserved such an award because the municipal and local governmental establishments saturated an integrated management system, coordinated act and eventually they actualized/executed their plans.

Stockholm achieved to give its dwellers green areas in the vicinity of central settlements, well integrated waste management/recycling, public transportation connecting the whole widespread city, sustainable development areas such as Hammarby and Royal Sea Port, green office and residential buildings and most importantly green mindset. High quality isolation which greatly contribute to energy conservation is very common is Stockholm, of course, partially in consequence of cold climate.

The roots of such commitment could be traced under the branding effect. The city and the dwellers enjoy the proud of being green and the brand that they carry. How this brand is created spans throughout more than four decades. During the 1960s various groups in the Swedish Parliament introduced an institutionalization process of the brand of *Green Sweden*. Also in national and local scales different environmental groups acted together by the common goal of a need to protect the natural environment (Stenberg, 2006).

Meanwhile, new laws about environmental concerns passed. That shows a multi-dimensional approach even in 1960s; legal and social acting hand in hand. Another great milestone was the United Nations Conference on Human Environment dated 1972. This conference also called as Stockholm Conference was the first top-level international gathering that seriously addressed what has since come to be called sustainable development (Metzger, 2013). In 1970s the Swedish Parliament began to take steps to increase public investment funds aiming at reducing energy consumption which became a powerful role model for the building sector to be more aware of energy saving in the built environment. At those times basic technical solutions, which were easy to handle and measure, such as heat recovery, heat exchangers, heat pumps and thick insulation, were implemented in green construction projects (Stenberg, 2006).

1970s are also the years of first eco houses built in Stockholm. Indoor living quality especially in office stock drew public attention in 1980s. This realization emerged another perspective which aimed to enhance the quality of work places. Because people spend substantial amount of time in their working environment and all they are susceptible to what the indoor systems offer. Sick building syndrome is the generally accepted name of the situation in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified (United states environmental protection agency) Those effects could stem from heating, ventilation, air conditioning, molds or moisture. High media exposure of SBS (Sick building syndrome) problems triggered research groups and the building sector to solve the problem by bringing together scientists from different disciplines to form a new research based group within the building sector aiming promotion of healthy buildings (Dawidowicz et al., 1987).

In 1997 the government declared that Sweden should be *a driving force and a model for sustainability* and in order to support the claim sustainable development research programs were introduced, e.g. MISTRA Sustainable Building (1997–2002), Research on Environment and Health in Buildings (1997–2003) and Building and its Indoor Environment (1998–2006). Also, new Environmental Code (1999) was enacted to force the building sector to implement measures and apply the best available technology to protect people's health and the environment (Stenberg, 2006).

Procurement process became more environmentally friendly. Approximately 40 per cent of the organizations in the building implemented a certified Environmental Management Systems (Baumann, 2003).

Architects with experiences from eco-villages were mobilized in other kinds of green building projects (Stenberg, 2000). That is a good example of snowball effect. The people who gained experience in the first green building attempts had leading roles in the development of new and numerous green projects; beyond that transferred the green knowledge to new teams. All those people together with new regulations helped to institutionalize sustainable/green development. Even in the 1990s, unlike contemporary Istanbul, large construction companies were enthusiastic about sustainable projects and green buildings were not personal works of a few architects any more.

Several voluntary collaborative environmental initiatives have been launched striving toward sustainability, each of these with different areas of priority. The Eco-cycle Council for the Building Sector (ECBS); the dialog project Building, Living and Property Management (BLPM); and the Phase-out of Particularly Hazardous Substances (BASTA), all of them with their own particular technological frame and environmental logic. By these voluntary agreements and projects the building sector took the initiative in the transition towards sustainability. Basta project gathered biggest construction companies and governmental

institutions together (Stenberg, 2006) which seems the only way to make sustainable development commonly recognized and workable.

In the wake of new era sustainable development concept had already been raised on the shoulders of big companies, government and non-governmental organizations. Even though the deployment of policy instruments is one of the main reasons why Stockholm has been comparatively successful in promoting and implementing sustainable development (Högström, 2013) the new era has focused on ordinary dwellers to make sustainable mindset more prevalent. In 2000s citizens were encouraged to personally shoulder the responsibility of *doing the right thing* becoming responsible consumers who consume environmentally friendly products and service, take care of nature, sort their garbage and think about indoor environment to prevent health problems (Stad, 2003). Buying a property can be resembled as buying a product and knowing the side effects of this product and deciding accordingly are the things that a responsible dweller normally do. All responsible occupant idea was a great and progressive step because well informed, responsible society basically means more demand for green buildings and mitigated economic concerns of investors.

Stockholm's environmental programs introduced after 2000 aims environmentally efficient transport, non-toxic buildings, sustainable energy use, sustainable use of land and water, environmentally efficient waste management and healthy indoor environment (Östling, 2013). Having such targets gives the motivation to the city including its dwellers. Once the dwellers show their interest to green buildings such projects become more profitable and government or municipal support gradually becomes redundant.

Stockholm's official goal is to reduce energy consumption by 40% by 2050 compared with 2006 levels. To achieve these goals, the city authorities themselves understand that *in consultation with the public actors, energy companies – municipal, national and private – should review the possibilities of generally improving the efficiency of the infrastructure and distribution of energy in order to achieve a safe and environmentally friendly energy supply for all areas of the Stockholm region* (Byman, 2010). Collaboration of energy companies and the government is also introduced in the Netherlands in a progressive way as mentioned in international practices section.

Many progressive decisions have been made to support construction sector and its stakeholders to make them adopt green mindset and green buildings through all those decades. But what happened and happens in reality? Following parts give real cases/projects from the timeline of sustainable development progress.

2.5.1 Glashusett

In 2005, together with the energy company Fortum, the City of Stockholm released an advertisement for *a city district where some of the buildings are unusually intelligent* (Bylund, 2006). This intelligent building refers to Glashusett which was built in a district called Hammarby Sjöstad. This building became the symbol of environmental targets and aimed to motivate people to be a part of green friendly lifestyle. The building was not intended to be a local attraction point but an international model.

According to the creators of the idea, Glashusett provides advice on how to have less environmental impact and conserve resources among other things. It is also here that the residents can get paper bags for free for their biodegradable waste. The building informs people about eco-cycle and environmental issues. Glashusett itself is also designed as a green building.

Visitor records show interest of many people and 75% of whom coming outside of Hammarby area.

According to Högström (2013), as an actor, Glashusett performs, or is evoked somewhat three different but still interconnected roles, with both discursive and material connotations. First, through its physical presence in Hammarby Sjöstad, Glashusett is a constant reminder to the area's inhabitants to take their environmental responsibility seriously and to *go green*. Second, it is also a powerful actor in the marketing and export of Swedish sustainable city models and green technology. Third, Glashusett is also an actor that is used within the City if Stockholm in order to build momentum for new large scaled sustainable development projects.

2.5.2 Hammarby Sjöstad

Hammarby Sjöstad is a former large industrial area in the vicinity of Södermalm-Stockholm. The area was planned to host 11000 apartment units when the construction is completed. The project under which a transformation into an environmentally friendly built environment is targeted has been completed to a large extent so far. Inception of the idea, planning phase, implementation phase, briefly the whole project sets a good example for other similar attempts around the world.

Integration of different units and coordinated act has delivered such a long term goal, Hammarby Sjöstad. Of course the Swedish knowledge on sustainable development which has accumulated for decades supports the planning and construction process of the area. Swedish green brand, as mentioned in sustainable Stockholm part, glitters in the following sentence which describes aim of Hammarby project taken from City of Stockholm's own publication: *it should impose as little demand as possible upon resources, and be an environmentally well-adapted city district, whilst being at the forefront of international strivings towards sustainable development in densely populated urban areas. The importance of Hammarby project lies in the implementation of environmental programs on the course for generating a new built environment.*

Hammarby obviously is not an individual building project but a complex of residential and commercial units which are presented as sustainable. Stakeholders which constitute the project could be stated as architects/engineers, municipality/city, contractors and investors. Approved (by City of Stockholm) Hammarby Model could be summarized as the following.

All buildings in Hammarby are connected to a district heating network. Domestic waste and purified waste water are main sources of energy in this network. Waste water also used for cooling purposes in commercial and office areas. The systems in the project makes use of the things comes out of the district in the form of waste (domestic waste or wastewater) to return into the district in the form of energy (electricity, district heating and cooling, and transport fuel) (Iverot et al., 2011).

Energy need of the buildings is reduced by the use of green design and materials or systems hereby recovered energy meets considerable amount of it. Furthermore solar cells support the system inside. According to City of Stockholm water consumption in the area is reduced substantially. That means new water saving systems and personal responsibility or green mindset as in Glashusett example give expected results. Besides, recoverable materials are preferred as structural materials during the construction phase.

Academic work and research development to improve green technologies and materials profoundly support the common use of green materials and systems in projects like

Hammarby Sjöstad. That means sustainable projects are not just the product of construction industry but coordinated, long term work of the society.

According to Iverot et al. (2011) Hammarby Sjöstad's environmental program brought the integration of environmental issues in urban district planning to a new level in Stockholm. This in turn underlines the importance of formulating a comprehensive environmental program in order to facilitate the creation of sustainable urban districts. The existence of an environmental program, specific to an urban district, reveals the environmental aspects of the project, making them visible, feasible, and possible to address. To facilitate the implementation of an environmental program for future urban districts and improve the sustainability of these districts even further, the program should be introduced and integrated in the early planning stages of the district.

The marketing led perspective has made it important for Stockholm to develop a sequel to Hammarby Sjöstad in order to maintain environmentally friendly construction trend. On the basis of knowledge and experiences from Hammarby Sjöstad Stockholm has consequently launched a new project area development, Stockholm Royal Seaport. This development aims to be more advanced with respect to sustainability, through the implementation of increased environmental requirements for buildings and technical installations.

2.5.3 The Stockholm Royal Seaport

The Stockholm Royal Seaport project *Norra Djurgårdsstaden* is the brand new model of sustainable development in Stockholm. As world makes a substantial progress after 2000s modern The Stockholm Royal Seaport project attracts global attention with new ecological solutions and technologies to implemented and tested. According to City of Stockholm the project contains well blended landscaping such as oak trees. The project's site bears a resemblance to Hammarby Sjöstad because both arise on former brownfield area that has been used for various industries. Former gas works in the area will be retained and transformed into a vibrant environment with art galleries, open stages and other cultural attractions. The city of Stockholm summarizes the project with the following paragraph;

The Stockholm Royal Seaport benefits from the environmental experiences drawn from Hammarby Sjöstad but goes a step further, making the new development area a unique climate positive urban development project in order to demonstrate that cities can reduce carbon emissions and grow in climate friendly ways. In order to achieve compliance with environmental profile of the development urban area, the agreements with the developers contain detailed sustainability requirements regarding housing construction. Examples of sustainability for the Royal Seaport project include environmental quality certifications, climate change adaptation, outdoor environment, energy system, recycling systems for water and waste, environmentally friendly construction and materials. An important aspect in the development of the project is the close cooperation between public authorities, the developers, the industry throughout the planning and building process. This entails a commitment among the main actors involved to work toward achieving the sustainability objectives for the urban district. Several research projects are connected to the development of the area related to energy, ecology and procurement.

The project, obviously, by adopting resource efficient construction and working in a way to guarantee indoor air quality, day lighting, recycled domestic waste, water usage efficiency and other kind of green qualities sets an adaptable example for other international cities, especially, which have delicate natural fabric next to human settlement areas.

Other than large scaled eco-projects Stockholm embodies single residential and commercial projects.

As mentioned in Lind (2013) Vasakronan rebuilt an office building *Pennfäktaren 11* in central Stockholm. The refurbished building now features the following;

- *a demand controlled ventilation system and lighting system that saves energy,*
- *a sedum roof that improves insulation,*
- *energy efficient windows,*
- *solar collectors to heat the water, provide comfort cooling and solar cells to generate electricity.*

These improvements have resulted in considerable reductions in energy usage, from 250 kWh/m^2 yearly before the renovation to 100 kWh/m^2 yearly after the refurbishment of the building. That performance brought the building LEED Gold level.

Likewise a residential project *Blå Jungfrun* took start in Farsta and achieved 60% lower energy consumption then expected in post-construction period. Airtight building envelope, good insulation, green design-energy efficient systems brought the expected results. Other green apartments in Stockholm are available both on the rental market and on the ownership-condominium market (Lind, 2013).

2.6 International Practices

This section will reveal the approaches which have been generated by different countries to break through the barriers and implement sustainable development.

The first serious concerns regarding the energy and environmental aspects of building stocks in the Netherlands took place in 70s due to OPEC embargo (Melchert, 2005)This embargo did not only hit the Netherlands but other western countries like Sweden. Swedish market also had the traces of such embargo in the way to gain sustainable development ideas in 70s. Relatively pinched economic conditions pushed such countries to find or develop alternative energy sources or systems. Built environment was affected in many ways but the most moving one was increased heating cost which affects the indoor living quality directly. In Dutch case the concern was not only heating any more it spread to the whole living concept. Solar energy features as well as thermal insulation systems were introduced. Those attempts paved the way for energy independent units (Melchert, 2005). It was an awakening in 70s. Meanwhile, in USA government issued many immediate measures such as tax benefits for the development of alternative sources of energy and had asked the public to reduce the unwanted usage of oil in their daily life (Melchert, 2005).

In 1987, the publication of the Brundtland committee's report *Our common future* drew the public attention of civil society and Dutch policy makers to environmental goals including building stocks. In 1989 the Netherlands National Environmental Policy Plan was formulated. Melchert (2005) summarizes the content of the plan as the following paragraph.

Building industry was the main target and material selection came under the spotlight. Eco-districts including heat buffers, solar boilers, sandlime bricks, cellulose insulation were constructed. At the same time the society started to accept more easily the idea of living in a more sustainable way. Government turned the implementation of sustainable building into an issue under the responsibility of each municipality.

Sustainable building examples started multiply in western society to some extent that local authorities, civil society, construction industry other important players such as designers, subcontractors started to take initiatives to provide green solutions and act together. According to International Institute for Environment and Development (1994) promoting participation of different interest groups is one of the crucial strategies of sustainable development. In the Netherlands municipalities issued manuals, programs, recommendations regarding how sustainable building should be carried out. Moreover, ministry of housing developed climate program which determines the quantity of energy that a building is allowed to use. For newly constructed buildings compliance level was predetermined and for existing buildings 25% energy consumption reduction was set forth.

As stated in Korkmaz et al. (2009) Agenda 21 of United Nations Conference on Environment and development assesses being inter-sectoral and integrative as one of the principles for national sustainable development. Dutch government takes such principle into account and requires energy companies to implement schemes of energy premium which are grants allowed by the government to be invested in energy efficient appliances and in facilities that conserve energy. Energy companies also offer green electricity derived from renewable energy sources.

International Institute for Environment and Development (1994) stated strengths and weaknesses of past strategies to be evaluated in the prospective works. One of such points was establishing innovative demonstration projects which are vitally important for immature environments that take the very first steps toward sustainable development. In Dutch case, symbolic sustainable buildings were constructed like ABN Amro Bank headquarters in Amsterdam. The building is a sustainable building that results from a consensual and cooperative environmental policy making approach which allows urban growth but at the same time seeks environmental protection (Melchert, 2005).

As it comes to financing of sustainable projects banks or government may take a supportive role. In Singapore green financing program is created as an option to green investors. Building and construction authority of Singapore government encourages commercial building investors to demand Green Mark (Singapore green certification system) by providing green credits. The first requirement of the credit is winning at least the minimum level of Green Mark by optimizing chiller plant systems in the buildings which are located in tropical Singapore climate. American version of such financing system PACE (Property assessed clean energy) is sustained by municipalities which provide low interest rate and long term credits for energy efficiency implementations in residential units (Aşıcı, 2011).

2.7 Urbanization and Sustainable Development in Istanbul

2.7.1 Urbanization in Istanbul

Fig 2.1 Istanbul Urban Expansion (1977-2014)

Istanbul is the best known example of transcontinental cities which occupies portions of Asia and Europe. Bosporus connecting Marmara Sea in south and Black Sea in north splits the city into two parts called European Side and Asian Side. Asian and European portions of the city look like two peninsulas separated by Bosporus Strait. Long coastal line and forestry owned by the city could be seen on the satellite captions. Dense urbanization on the south parts of both European and Asian sides expands in every direction and generates pressure on natural resources of the region. Top caption[1] which compiles satellite views from 1977-2009 clearly depicts that the region definitely needs a planned and environmentally friendly urban development to avoid future disasters. Green zones have shrunk consistently through more than 3 decades and the trend continues by accelerating. The reason behind such expansion is the gravity of economic development in the region which results in population growth. Since the mid-1990s, Istanbul's economy has been one of the fastest growing among OECD metro-regions. Besides the city is responsible 27% of Turkey's GDP. (OECD, 2008). Istanbul population graph based on Tüik (Turkish Statistical Institute) data validates more than five time population increase between 1980 and 2013. 1980 population 2772000 becomes 14160467 in 2013 (Tüik, 2014). Turan (2010) explains after 1980 period as the following:

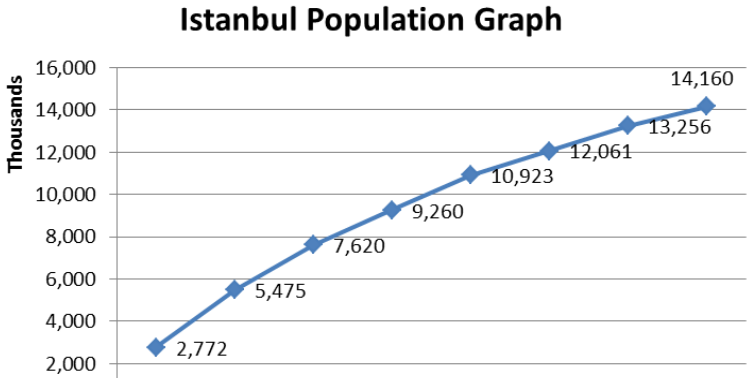

Fig 2.2 Istanbul Population Growth

Although the city still retained a relatively compact form until 1980s, the opening of the two Bosphorus Bridges (1970s and 1980s, respectively) and the creation of peripheral ring roads associated with the bridges (the E-5 international highway and the Trans-European Highway

[1] Source: Images retrieved from Google Earth & havadelisi.com (2014) and altered by the author

respectively), led to massive fragmentation. Unplanned industrial developments and illegal squatter settlements began to appear along the highways on the periphery. The fragmentation of the city occurred at different levels, each of which developed independently while triggering the growth of the others. The main changes were: (1) a dramatic increase in uncontrolled development within the outer limits of the Municipal area; (2) the spread of shanty towns; (3) state-initiated high-rise, high-density mass-housing projects on the periphery, developed by the Mass Housing Administration, which ended up serving mostly upper-middle class and higher-income groups; (4) a new financial center toward the north; (5) gated residential developments in the suburbs with easy access to the Trans-European Highway and the northern financial center. Thus, all these developments accelerated uncontrolled urban expansion.

After such detailed information of urbanization trend in Istanbul and its pressure on the environment, realization of environmentally friendly development in Istanbul seems indispensable.

2.7.2 Sustainable Development Achievements in Istanbul

This section is dedicated to historical steps of sustainable development and introduction to contemporary performance of Istanbul construction and real estate market in sustainability issues. Detailed insight about the market could be acquired in survey and interview sections. Better to state that the local market is also liable to the regulations, codes or any other legal arrangements put by Turkish Republic.

Contrary to international examples such as Dutch, Swedish; Turkish sustainable development took its major steps after 2000. That belated action towards sustainable development mainly stems from last decade's energy deficit problem, energy prices and international momentum. Western countries encountered energy crisis in 70s but Turkey as a developing country recently fell into energy hunger. Current deficit is a direct result of energy import of the country which in return triggered government to take some measures or change regulations regarding energy conversation in built environment. Report of Turkish Engineers & Architects Council states that energy consumption by built environment in Turkey is measured as 40% and 70%-90% of which is consumed by heating or cooling systems and the rest by lighting in buildings (TMMOB, 2013). That is a pretty descriptive statistic about why the government sets its focus on built environment as searching a way out. If the government or the sector succeeds to find ways to reduce energy consumption by commercial or residential units energy deficit basically mitigates.

If we go back in the history, Turkey's first green building case study took place in Middle East Technical University in 1975. The house used a variety of solar technologies such as direct-heated ventilation air, solar flat-plate collectors, photo-voltaic cells and passive solar heating systems (Korkmaz, 2009). Technical universities such as Istanbul Technical University, Middle East Technical University, Yıldız Technical University are expanding their studies on sustainable development and running case projects in collaboration with private sector. Istanbul Technical University research on energy efficiency and passive conditioning includes building technology research laboratories and pairing with corporate partners such as Kanyon Mall-Istanbul to research energy modelling techniques (Korkmaz, 2009).

In commercial and residential building stock the development of green projects is closely tied to international progress and construction sector globalization. Turkish construction companies are not only active in domestic projects but also have a corner on east Europe, Central Asia and Middle East market. Interactions between major international

design/engineering companies like ARUP, Foster&Partners and Turkish construction sector pave the way for new progressive designs even in domestic market.

British architect Zaha Hadid's Kartal-Pendik Masterplan has sustainable design touches and abundant green fabric; however, this urban center project with responsive structures and spaces has not been put into practice by Istanbul Municipality yet.

Soyak is a Turkish construction company with green ambition and they already completed a number of green projects (certified by LEED) with the availability of green credits to householders. Green credit remained limited to this particular project and was provided by a local branch of a Turkish Bank. Other than Soyak many other construction companies give a start to new green building projects especially residential and commercial ones yet so far only 115 buildings have LEED and 20 buildings have BREEAM in Istanbul. These numbers are only a slight percentage of total building number of Istanbul which is almost 2.5 million.

As a political entity, Turkey first engaged with the environment in 1978 with the establishment of the undersecretariat for the Environment and five years later, the 1982 Constitution included *the right to live in a healthy, balanced environment* and in 1983, the first Environmental Law was passed (Korkmaz, 2009). Habitat II, the Second United Nations Conference on Human Settlements was held in Istanbul in 1996. The objective of the conference was to create conditions to achieve improvements in the living environment. Of course the conference attracted the media and public attention at that times and encouraged the community to create environmentally friendly building mindset and techniques. Especially after 2000, new adjustment laws required by European Union created some incentives on environmental reform. That adjustment process which proves synergy among different countries, more specifically, collaboration or knowledge share among universities, organizations or governments globally is another determinant of growing Turkish sustainable development recently.

3. Research Methodology

Contemporary issues and situation regarding sustainable development and green buildings in Istanbul are questioned in the online questionaire survey besides the survey examined whether sustainable development barriers which are recognized by the literature apply to Istanbul construction and real estate market. The survey was conducted for two weeks 1-15 April 2014.

Interviews were carried out with 4 professional people from private sector (one from municipality) and academia. Two master architects, one civil engineer and one research associate shared their experiences, opinions and suggestions about green issues in Istanbul construction market. Interviews were conducted between 14 and 28 April 2014.

3.1 Survey Format

The first part of the two-part survey examined contemporary market situation in Istanbul which seeks answers by asking generic questions to professionals or students who have involved in sustainable development projects, studies or organizations directly or indirectly.

In the second part sustainable development barriers under four different titles were presented with likert scale answer chart. The scale breaks into 5 options which are “strongly agree”, “agree”, “disagree”, “strongly disagree” and “no opinion”. Likert scale gives the survey an opportunity of analyzing the variety of respondent stance by percentage distribution so that the severity of particular barriers could be stand out. This part which is based on the barriers presented in sustainable development barriers section aims to find out if common sustainable development barriers in international markets apply to Istanbul. Each question and statement can be found in Appendix B, part 2.

Respondents were able to present their views/opinions in Turkish or English in comment boxes placed in both parts. After all, the survey is expected to guide me to generate proper approaches in the strategy parts.

3.2 Survey Details

The survey is created as an online survey and 15 questions were directed to respondents. The survey and the results could be found in Appendix B**.** Respondents were pre-informed about the content and extent of the survey and the introduction text in the survey was aimed to give the principal points about what respondents were kindly asked to answer. Survey question types vary from multiple choice to rating scale questions.

Potential participants were selected among professionals or students who had history in sustainable development. Particularity of the subject narrowed the target group considerably; however the size of construction and real estate market in Istanbul insured a respectable number of respondents. Respondents were chosen meticulously by networking and contacting with companies, professionals, students that have experience in sustainable development area. Urgency of the survey was also kindly submitted to respondents’ information. The link of the survey was sent to 55 potential respondents who pursue their carrier in Istanbul and 36 sufficiently and effectively completed copies were stored in the system. Because of the

respondent selection process beforehand the response ratio came out as 65%. Thus the results and conclusions drawn from the answers of the survey questions could be considered dependable owing to relevant respondents.

3.3 Interview Format

The interviews are conducted in semi-structured method. Interview questions and an informative, framework paper are sent to interviewee beforehand; besides interviewee is guided by the interviewer during the session. Ideas generated during the conversation based on experiences or expectations of interviewee are recorded and then interpreted in the thesis.

4. Results & Analysis

4.1 Survey

Questions and results of survey could be found in Appendix B.

4.1.1 Contemporary Istanbul Market

The first part of the survey begins with a question asking the respondent's profession. 3 respondents skipped the question and among 33 answers 36% stated their profession as civil engineer, 33% as architect, 12% as architecture or engineering student, 10% as technician (including mechanical, electrical and civil technicians), %3 as researcher, mechanical engineer and investor each.

Even though it seems not a broad range of professions answered the survey, high percentage of architects and civil engineers working in the market supports the reliability of the survey. Some respondents also provided information about their titles as manager, planner or specialist but they were considered under their professions like civil engineer, architect.

Table 4.1 Respondents' associated green activities

Which activity/activities have you been associated with during your professional or education life?		
Answer Options	**Response Percent**	**Response Count**
Being associated with a green/sustainable development project directly or indirectly	60.0%	21
Attending green/sustainable development conferences/seminars or workshops	45.7%	16
Taking green/sustainable development courses/online courses	31.4%	11
Participating non-governmental organizations	20.0%	7
None...	11.4%	4

The following question, second question, tests the way of respondent's participation in sustainable development subject. As in the first question, higher percentage of participation against low percentage of non-participation in sustainable development activities supports the validity of the answers in the following parts. Among 35 responses 21 people claimed that they have been associated with a green/sustainable development project directly or indirectly. This option may include the actions of working in a green building project, consulting such a project, working in a company which participates such projects or any other positions which affiliate with green/sustainable projects or works.

16 people claimed that they have attended green/sustainable development conferences, seminars or workshops. So, almost half of respondents were reported to be open to gain knowledge about green issues. I believe that the rate of participation to green meetings among professionals or students is far less in other parts of Turkey because Istanbul is relatively rich in both national and international conferences and workshops on sustainability issues.

The next activity reported by 11 people is taking green design or sustainable development courses. All student respondents checked this option, besides 7 professionals out of 30 accompany the students in this action. This result may imply that such courses have recently become popular or been included in the curriculum in education units.

Only 7 people reported their interest on participating non-governmental organizations like green building council. People in professional life are reluctant to devote time to such activities in time consuming big cities like Istanbul. So 7 is a pretty optimistic number for such organizational activities.

4 people were happened to stay in the state of no affiliation with sustainability activities and I believe that they are, maybe even slightly, interested in sustainable development yet had no chance to take positions so far. Those people also skipped the second part of the survey which I think they did not have sufficient knowledge for reasoning of questions.

The third question was asking green certifications in Istanbul building stock. The results are not surprising for someone spending time in Istanbul construction market as LEED is the most popular and the most referenced certification system in the Turkish market.

22 out of 31 respondents approved that LEED is commonly preferred among other certification systems across the market. 9 people reported the same for BREEAM and only 2 for Energy Star. According to respondents SEEB-Tr which is recent launch of Turkish Green Building Council is not a common certification system in the market. Absorption of such new system will take time and the good sign is 9 people out of 31 are aware of that SEEB-Tr is released and on the market.

According to the overall result BREEAM follows LEED system in Istanbul building stock in terms of prevalence and national certification system is far behind of its international counterparts in ranking.

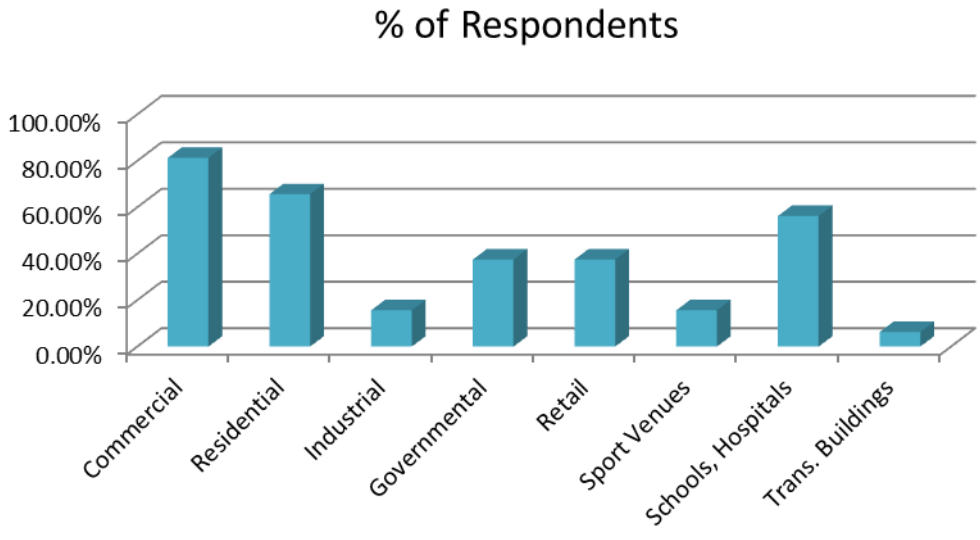

Fig 4.1 What kind of buildings mostly benefit from being green?

The forth question sponsors my reasoning of limiting the study mainly on commercial and residential building stock. (Fig 4.1) Because 26 and 21 out of 32 respondents respectively believe that commercial and residential buildings mostly benefit from being green. Public buildings like schools and hospitals follow them with 18 respondents and governmental

buildings together with retail buildings with 12 respondents for each are believed to be benefited from being green. That shows the expectations of professionals on the state to initiate more green buildings to be pioneer samples. Whereas industrial buildings, sport venues and transportation buildings were not categorized among must-green building types.

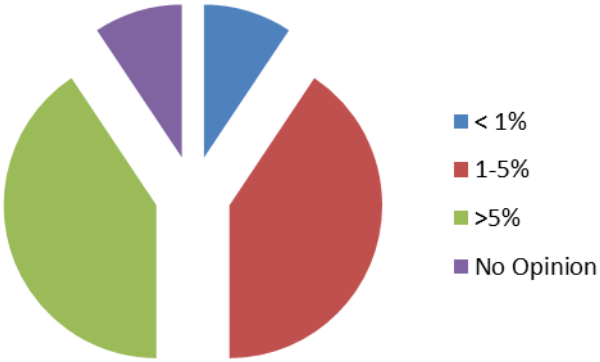

Fig 4.1 Green premium in percentages

Another critical question is the fifth question which examines financial tendencies of the professionals. 80% of 32 respondents favored to pay for 1-5% or higher percentage of green premium. (40% for each interval) This result draws a very positive image on the worth or value of green buildings among construction sector professionals who are, I believe, relatively more aware of the benefits of green buildings compared to general society. There is no test for society tendency on green premium in this study but I believe general society would answer more conservative about green premium percentage. What I mean is expecting from informed professionals to be impartial in such a question would be misleading. Thus, our respondents pointed a green premium tolerance of 1-5% in the market.

The sixth question could be interpreted as the complementary question of the forth question. Unlike the former one in this question the real market stance is sought. Apparently almost all of respondents are accustomed to encounter green commercial projects in the market. Green residential projects follow with a slight difference and both types are far more common than other type of green buildings such as governmental, industrial and retail. This promising result shows that the construction and real estate market maintain a relatively positive stance in sustainable residential and commercial development. I find such assertion dependable because the survey's professional respondents who are market insiders could observe the market attentively.

In the seventh question, asking, *what kind of green building strategy Istanbul market applies the most commonly*, the systems mentioned in each option are inspired from LEED-NC evaluation categories in Appendix A. In order a building to gain green label it is tested under such categories, so respondents asked here which system/method is the most common in Istanbul. More options or details could be added to the question but keeping brief and clear encourages respondents to answer the question not to skip. 22, 21 and 19 respondents respectively reported that day lighting/green design, intelligent central heating/cooling and waste water treatment/water efficient systems are the most commonly applied systems in Istanbul.

Other options such as preserving or adding more green fabric on site, renewable materials and energy efficient systems got lower scores. According to LEED-NC rating system, on 100 base point system, top three achievements are energy/atmosphere, sustainable sites and indoor environmental quality. So technical advancements focused on improving energy efficiency, reducing carbon emissions and addressing additional environmental and human health concerns are crucial points (Kubbe, 2012) Water efficiency comes after those mentioned points. In Istanbul the market gives the priority to day lighting and green design which

reduces carbon emission and energy consumption and gets along with LEED's most important points. Intelligent heating and cooling, likewise, play for energy efficiency. However, energy efficient systems get really low points maybe because of their high technology demand. Instead water efficiency stays in top three which is not in top three of LEED-NC categories. Drought once in a few years (ISKI, 2014) hits and that could have led Istanbul market to water efficient systems. The clause "building in the close proximity to public transportation" carries carbon emission concern yet small scale public transportation in the city disables or discourages such achievement.

Eighth question asks *the most contributive professions or entities to sustainable development* and 25 of respondents agreed that architects and architecture related entities are the top contributors. As mentioned in technical barriers section design phase and its integrity with construction phase is so important for a green building to function efficiently through its life cycle. Also it is non-negligible that many progressive construction projects and designs like green design and buildings have been introduced by architects to the market. I would like to remind that only 11 out of 34 respondents are architect so at least 14 people from other professions also agree on the power of architecture in green leading.

16 respondents for each agree upon engineering units and governmental units. So respondents also assume the leading role of government in the sector. Government has an influential power by the mean of municipalities, local agencies, regulations and the most importantly financial incentives. Then education units, research & development and non-governmental organizations complete the list. I would expect a higher rate for non-governmental organizations but those organizations working on sustainable development issues are a few in numbers in the market and that could be the reason why our respondents are not aware of such power yet. It should not be forgotten that non-governmental organizations together with government are the key players to make green certification systems more penetrative in the market as seen in international examples. Lastly, financial units like banks were not found contributive because green loans or credits are so limited that sometimes only locked to particular projects in the market.

What all those professions or entities can do for sustainable development or how they can contribute is discussed under strategy development sections.

Question 9 is the complementary question of question 8. Decision power of stakeholders is examined and both owner and investor turned out to be the most influential individuals on prospective green projects. Respondents by considering "money talks" motto agreed on owners or investors determine the future of the project whether to be built green. Contractor and architect of the project have the decision power by third and fourth degree and obviously not as much as investor and owner. Architects may be seen as creators of green design or pioneers of progressive intelligent projects yet the result of the survey implies that if architects with green mind-set could cooperate and influence investors or owners the chance of to be built green rises significantly.

Last question of the first part may seem a trivial question but the concurrence of all respondents on the opinion which is the necessity of more green projects in Istanbul draws a conclusive remark.

4.1.2 Sustainable Development Barriers

The results of the second part of the survey help me to determine a point of view and accurate approach as attempting to generate green recommendations for the local market. Barriers which are presented in "sustainable development barriers" section are tested for Istanbul market whether they are the obstacles on the way to green/sustainable development. In the

light of this part's results and interviews strategy development section of the thesis gains shape. Detailed tables of the results could be found in Appendix B. The result tables under each following section show sum of *strongly agree & agree* and *strongly disagree & disagree* percentage values and respondent numbers respectively for each statement.

Economic Barriers

Table 4.2 Economic barriers survey results

Economic Barriers				
Statements	Str. Agree+Agree		Str. Disagr.+Disagree	
S1	18.8%	6	78.1%	25
S2	87.5%	28	12.5%	4
S3	56.3%	18	40.6%	13
S4	84.4%	27	15.6%	5
S5	65.6%	21	18.8%	6
S6	40.6%	13	59.4%	19
S7	68.8%	22	31.3%	10
S8	78.1%	25	9.4%	3
S9	62.5%	20	37.5%	12

S1. *Green buildings do not compensate probable extra initial construction cost in their total life cycl*e.

Economic barriers part begins with a vital issue, whether green building compensates its probable extra initial construction cost. According (Qualk, 2009) any additional cost for greening are repaid in about one to two years and the following years bring exponential savings. Because of the manner in the statement strongly disagree (41%) and disagree (38%) responses (almost 80% in total) draw a stance beside green buildings. The professionals responding the survey either by the mean of their experiences or expectations believe that green buildings come with their financial guarantee. Only 19% do not believe that green buildings satisfy the expectations of project owners with life cycle savings. For project owners cost-benefit balance of the new investment is the main player in decision making so the knowledge of professionals about green building savings in life cycle should be spread to investors and general society.

S2. *Contractors or investors are unwilling to construct green/sustainable projects.*

Contractors and investors turned out to be unwilling to construct green according to almost 88% percent of respondents. The result seems like validating my suggestion about green knowledge sharing. A good strategy should fulfill the green knowledge gaps in the minds of people especially with the decision power who are pointed out in the first part of the survey.

S3. *Maintenance cost of green buildings is higher.*

56% reported that maintenance of green buildings cost much and 40% opposed that. So the result seem inconclusive here but still people widely believe that maintenance of green systems which are still perceived as new and expensive systems requires special labor and tools/materials in the local market.

S4. *Green construction materials are expensive.*

According to the results of Schneider Electric green consumption research, February 2013, high price of green materials stands out as the biggest barrier among Turkish consumers (Aytaç, 2013). Respondents with a vast majority (85%) reported that green construction materials or systems are expensive in the market. That may stem from either high cost of raw materials of which green materials made or lack of green materials/systems patent in local market. Importing such materials may cost extra and sometimes labor import may be needed to implement special systems or install the materials. There is knock-on effect of popularity of

green buildings on material prices by demand factor. High demand and mass import may alter the prices in a buyer friendly way. Besides more green projects encourage local market to create specialized labor on green systems.

S5. *Banks do not provide green credits or low interest loans.*

65% supported that banks do not provide green credits or low interest loans whereas 16% did not have any opinion on the issue. There was a project called *Soyak Mavisehir Optimus* that advertised their agreements with a bank to provide buyer credits. (Soyak, 2014) Still green construction credits for commercial and residential projects are unknown to the society. Some isolation (Izoder, 2014) and renewable energy (Turseff, 2014) credits are available but they are not intended to cover green construction or the whole project. Current set of bank credits or loans in Turkey is obviously not able to fulfill green market needs. What is worse is 16% of professional respondents let the society alone do not have any opinion about the existence of green credits.

S6. *Clients cannot afford (buy or rent) green buildings8office or residential).*

Respondents were divided on whether clients can afford green buildings, 41% thinks they cannot and 59% thinks they can. Personally I expected a higher rate of negative answer but once again the results show professionals can judge the prices better than random buyers in the market by defeating the luxury perception of green buildings as highlighted in the declaration of International Green Buildings Summit in Istanbul on 21st of February 2012.

S7. *Green building sale and rental values are not at satisfactory levels.*

On the contrary of previous statement the next statement looks at the case from developer perspective. 68% reported that green building sale and rental values are not at satisfactory levels and 32% reported the opposite. According to majority developer's expectations on the value stay high compared to real market prices. Whether market can absorb the prices on developers' mind needs another study.

S8. *Insurance companies do not have green building risk policies.*

S9. *Green buildings have higher financial risk.*

Last two statements of economic barriers part ask if insurance companies have green building risk policy and if green buildings have relatively high financial risk. 78% reported that risk policies for green buildings need an action because there is no such policy in the market. On the other hand 63% thinks green projects have more financial risk compared to counterparts, although (Jaffee, 2009) argues that a green building less risky than an ordinary building as the cash flow will be less sensitive to changes in energy prices band adds a rational bank should be willing to finance a green building at lower interest rates. According to the results risk issues on green projects should be considered and compatible, responsive risk policies should be developed by financial circles in the market.

Briefly, economic barriers part mainly advises to

- *focus on procurement of green materials,*
- *bank loans and risk policies,*
- *ways to drive green project values into satisfactory levels.*

Technical & Market Barriers

Table 4.3 Technical & Market barriers survey result

Technical & Market Barriers				
Statements	Str. Agree+Agree		Str. Disagr.+Disagree	
S1	96.9%	31	3.1%	1
S2	71.9%	23	28.1%	9
S3	62.5%	20	31.3%	10
S4	75.0%	24	21.9%	7
S5	40.6%	13	53.1%	17
S6	50.0%	16	46.9%	15
S7	59.4%	19	40.6%	13

Under technical perspective of barriers construction techniques and technologies are not discussed instead overall effort of technical stakeholders of construction sector is discussed. Because many professionals, if they are not specialized, are not capable of responding hardcore technical questions about green design and construction.

S1. *Scarcity of contractors who have experience on green projects.*

LEED and BREEAM labeled buildings cannot make 0.1% of total building stock of Istanbul therefore the number of green experienced contractors happens to be arguably small. Scarcity of experienced contractors in green projects was asked and 97%, almost all of respondents, agreed on the statement. That high rate points out an alarming situation in the market, indeed. Contractors which employ many architects, engineers, technicians, planners are factories of construction sectors. If they can run their business effectively the whole market benefits from the results. Green buildings need very well established teams, in this case, contractors. Experienced contractors in green construction should comprise of experienced employees and coherent interaction between them and as a result should be able to implement sustainable development principles.

S2. *Scarcity of green construction and maintenance materials.*

Scarcity of green construction and maintenance materials got 72% and there may be correlation between this result and price of such materials asked in economic barriers part. Scarcity affects price of materials and results in reluctance of contractors to build green. Especially small and medium sized contractors with financial worries are discouraged to step into green construction where big contractors tend to bid materials in short supply.

S3. *Scarcity of competent architects or engineers to design/construct green projects.*

62.5% agreement on the statement means both education units and the sector itself should seriously pump green education and knowledge share.

S4. *Lack of coordination between the professions who construct green projects.*

Coordination problems especially arouse when construction is unplanned or employees are inattentively assigned. Coordination between functioning teams within particular phases and across phases of green construction is vital to build in a timely manner and with minimum defects. Besides systems in green construction may need special care so team work has more meaning in such projects. 75% of respondents reported lack of coordination as a barrier.

S5. *Duration of green construction is longer than traditional construction.*

41% of respondents carry the belief of longer completion duration of green construction whereas 53% did not share the same view. Longer duration stands as a disincentive yet if above mentioned barriers could be addressed in a green construction, duration of the project would become no matter of concern.

S6. *Certification systems are not optimized for Turkish market.*

Although LEED and BREEAM systems are widely preferred in the local market, 50% of respondents reported not locally optimized systems as a barrier. Optimization of certification categories regarding local conditions may attract the attention of local firms and induce a pulse in the market.

S7. *The benefit of green/sustainable development is not identified clearly by academic circles or organizations.*

Spread of green knowledge is mentioned a few times but first of all benefits of being green should be clarified and published by the authorities like academic circles to convince the public and the sector. Almost 60% of respondents reported that the benefits are not identified clearly.

Thus, technical & market barriers part mainly advises to

- *focus on green knowledge creation, sharing and*
- *bringing up competent professionals who are able to work efficiently and coordinated in green constructions.*

Social Barriers

Table 4.4 Social barriers survey results

Social Barriers				
Statements	Str. Agree+Agree		Str. Disagr.+Disagree	
S1	67.7%	21	32.3%	10
S2	90.6%	29	9.4%	3
S3	84.4%	27	15.6%	5
S4	45.2%	14	54.8%	17
S5	65.6%	21	34.4%	11
S6	31.3%	10	68.8%	22
S7	90.6%	29	9.4%	3
S8	90.6%	29	9.4%	3

S1. *Engineers and architects do not get any or enough green/sustainable development education.*

In order to grow competent professionals sustainable development education is a must and not only limited to college education but extended as life-long learning. 68% of respondents think that the green education is not sufficient to feed students or professionals to establish green knowledge.

S2. *The construction sector shows resistance to sustainable development.*

The next statement is in line with the statement in economic barriers which is testing contractors' and investors' willingness to construct green. 88% reported reluctant contractors and investors and, here, under social barriers 90% reported construction sector's resistance to sustainable development. In order to break this resistance it is clear that initially contractors and investors should be convinced. Green systems are quite new to the sector so government could also involve in order to ease the introduction phase of new systems.

S3. *Stakeholders (investor, owner, tenant…) are not aware of beneficial sides of sustainable development.*

Green education or informing should not be limited to professionals besides beneficial sides of sustainable development should be conveyed to city dwellers who are potential investors, owners or tenants of green buildings. 85% believe that those people are not aware of what a green building brings them.

S4. *Non-governmental green development organizations do not perform actively.*

45% versus 55% reported that non-governmental green/sustainable development organizations do not perform actively. Still the majority thinks they work enough but this statistic is still not much convincing about their performance. Visibility of such organizations by the mean of conferences, publications, courses is so precious for the sector and the society. Besides number of such organizations does not seem fulfilling for a huge market like Istanbul or Turkey. Collaboration could rise as another issue in such organizations which hold many people with different backgrounds like academia, private sector and public sector.

S5. *Media (Including engineering, architectural publications) does not show support to sustainable development.*

There is a quarterly magazine called "ekoyapı" which focuses on environmental approach and green construction related issues. The magazine welcomes writings, projects, presentations, bulletins and studies of professionals, academicians, students or anyone capable of presenting his/her work in the magazine. Evaluation and selection of articles are carried out by the editorial board of the magazine. Other architectural or engineering magazines which reach wider masses touch sustainable development issues seldom because they tend to cover hot issues in the sector and unfortunately green issues are not among them for now.

S6. *Public does not have ecological concerns and does not want to live in green buildings.*

TV channels, newspapers and other mass media do not show enough support and interest in green issues. Hence 66% think this way as well. Only 34% find media support enough.

According to almost 70% of respondents public has ecological concerns and may consider living in green buildings as long as circumstances allow. 70% is a promising statistic for the future of green education because that shows the interest of public and their openness in green issues.

S7. *Green organizations, government/municipalities and education units are not coordinated and do not act together.*

The biggest problem by looking survey results (90%) in this section is lack of coordination between green organizations, government/municipality and education units. No matter how much the public demands green education or professionals are willing to join green movement if above mentioned units are not able to act together then sustainable development is bound to be interrupted at some point.

S8. *Educational institutions (Universities, public education centers) do not educate/inform the public about sustainable development.*

Works of educational units such as universities and public education centers are not sufficient according to 90% and that shares the same percentage with the previous statement. Obviously respondents are not content with the effort of educational units and cooperation between them. When education units were evaluated regarding their engineering and architectural education the result was not that significantly negative but when it comes to public education they obviously happen to fail.

Social barriers like coordination deficiency, lack of public education and sector resistance got really significant scores by respondents so they require effective strategies to be resolved in the course of green movement.

Governmental & Municipal Barriers

Table 4.5 Governmental & Municipal barriers survey results

Governmental & Municipal Barriers				
Statements	Str. Agree+Agree		Str. Disagr.+Disagree	
S1	87.5%	28	3.1%	1
S2	93.3%	28	6.7%	2
S3	100.0%	32	0.0%	0
S4	6.3%	2	93.8%	30
S5	87.5%	28	9.4%	3

This part is dedicated to two of the most influential entities of sustainable development, government and municipality. Both these entities are capable to draw an excellent path of sustainable development as long as they allocate time and resource on green issues.

S1. *Government does not provide tax pile or incentives.*

The first result of this section is quite thought-provoking with a significant majority's affirmation. 88% reported that government does not provide tax pile or incentives. Both items are seriously encouraging financial tools to lead private sector in intended direction. Unfortunately government fails to support construction sector financially in the way to become green friendly.

S2. *Laws and regulations are not enough to support sustainable development.*

The second influential tool of the government is laws and regulations but respondents with 88% think laws and regulations in local market are not enough to support sustainable development. Even a local regulation set in Istanbul, let national scale alone, may push private sector to reconsider investment decisions and plans on sustainable development.

S3. *Municipality or the government is not willing to construct an eco-district where thousands live and work.*

Eco-districts are demonstrations and living examples for the sector and the society. As in Stockholm model Istanbul may benefit from such attempt if the municipality initiates it. However, all of respondents (40.63% strongly agree, 59.37% agree) believe that the municipality or the government is not willing to construct an eco-district.

S4. *Energy (electricity, gas) and water prices are so cheap that no need for energy conservative buildings.*

Energy and water prices are not cheap in Istanbul according to 94%. Building owners or tenants have a good basic reason to move in green buildings only if they know life-cycle energy saving of green building.

S5. *Local governmental agencies and municipality do not provide technical support and do not have any unit working on green/sustainable development issues.*

87.51% reported local governmental agencies and municipality do not provide technical support and do not have any unit working on sustainable development issues. Ministry of environment and urban planning has local agency in each city so even a small unit under the agency generating technical support would feed the contractors which do not have enough technical green knowledge.

4.2 Interviews

The following sections reflect the interpreted versions of four conducted interviews. Such interviews are intended to consolidate the ideas generated by the results of survey part and draw a holistic approach for the recommendations on sustainable development of Istanbul built environment.

4.2.1 Interview with a Master Architect from Eyüp Municipality

Seven questions which could be found in Appendix C were directed to interviewee to find out his view, comments and advices on green issues.

The interviewee is a professional architect working in Eyüp Municipality which is one of the central boroughs of Istanbul with the population of almost 400000 and extends between renowned "Golden Horn" and Belgrad Forests which are natural wonders of Istanbul. The municipality carries green movement flag among other municipalities in Istanbul owing to green projects and green education organizations.

Eyüp has a big amount of old building stocks besides new tremendous residential constructions have become visible after 2000s around Kemerburgaz, Göktürk districts which are located in north part the borough. Such districts are surrounded by Belgrad forests which is the largest green area in Istanbul so special development master plans are needed to protect nature. Unlike central part of Eyüp, Göktürk and Kemerburgaz have upper class dwellers who are relatively willing to have green friendly houses.

The interviewee has involved in the construction phase of municipal green buildings. He had limited knowledge on green design beforehand and more been part of implementation and construction phase as controller. He gained green construction experience and combined them with his own architectural knowledge by being a part of design implementation solutions on construction site, seminars and conferences on green issues. He believes that personal involvement in green projects gives a great opportunity to gain green construction knowledge and skills to either professionals or students. His experiences, opinions and advices in the interview are titles and interpreted in the following parts.

Green Development in Istanbul

Last decade has been witnessed the most progressive years on green issues, national and local regulations transformed by the mean of adjustment process to European Union as well as rising green awareness in local authorities. Big contractors under the name of social responsibility and investment in the future launched green projects especially in the financial districts of Istanbul such as Tekfen Levent Office, the first green certified office building in Turkey.

Meanwhile Eyüp municipality has launched local green projects. Alibeyköy Sport Complex and Municipal Services Building will be green certified at the completion of the projects. These projects will be well functioning samples of what green buildings are capable of. Municipal Services Building will run with a yearly 50% energy saving. Professionals working in the project both municipality employees and contractors implement green principles especially solar/green energy systems. One of the big contractors of Turkey also donated a considerable amount of resource to under construction building to show company's green responsibility and support. In addition to Eyüp municipality some other municipalities like Küçükçekmece municipality also prefer to build their service buildings green.

Last year Eyüp municipality started a seminar program called “creating green building systems” with the aim of raising awareness for sustainable environment and encouraging renewable energy consumption. Academicians from technical universities in Istanbul lectured attendants who were engineers, architects and college students. Not only Eyüp municipality employees but also the ones from other municipalities attended the program and got participation certificate. In the second part of the program elementary and high school students were lectured about renewable energy and environment.

A green building prototype was opened its doors to local visitors to inform them about green buildings and their benefits as well as change their energy consumption habits. The prototype is built in a green area called “Osmanlı Parkı” which is in the heart of the borough to attract especially close by dwellers. The structure harvests solar energy and beside itself also meets energy need of social facilities next to it.

Eyüp municipality introduced a new incentive in order to make residential and commercial green buildings more common within the municipality boundary. According to new regulation, the owners who have a minimum of 2000 sq m lot and meet all or partial energy consumption with renewable energy and aim to get green certification for the project are allowed to increase total building area by up to 5%.

A Greener Development

Green buildings in Eyüp should be increased in number by the continuous support of the municipality. Constructing new green buildings is one side of the coin, on the other side thousands keep living and working in old building stock. Green renovation of traditional building stock should be the main agenda in the future. Renovation could be introduced with old municipal and governmental buildings to make people familiar with the comfort of green buildings. Biggest problem to be addressed in green renovation is unclear renovation cost and anticipated benefits after it. If the municipality prepares a technical cost-benefit analysis for residential and commercial renovation or new constructions people could decide to build green by calculating their own approximate cost-benefit tables based on building size, location and material types.

Municipality could reserve development areas next to Belgrad forests only for green buildings so that effect of human settlement could be minimized.

The ultimate aim could be being good enough to host international conferences on green issues but of course that will mean by that time the host already has remarkable green projects, models or systems to present to international participants.

Unfortunately neither direct nor indirect financial support of government through municipalities is available. Government shows its support through urban renewal projects in Istanbul but such projects do not aim green certification. Nonetheless newly built projects under urban renewal initiative are far more energy efficient than former demolished buildings. Better isolation materials and more ergonomic design are the main drivers in energy efficiency in such projects.

Municipality and government together have the power of adjusting electricity and water price. Such power could be used wisely to lead or force especially commercial buildings to be more energy efficient. Recycling on the other hand could be put in order by penal sanctions especially in residential building stock.

4.2.2 Interview with a Master Architect from Construction Sector

The questions directed to the interviewee could be found in the Appendix C.

The interviewee, the owner of an architectural company in Istanbul is one of the prominent supporters of green design and construction in the market. The first green labeled building in Turkey RMI-Betek R&D Center has the architect's signature in its design. He has also designed and constructed residential and commercial building himself or together with his employees implementing green principles in each phase of the projects. The following part interprets opinions and advises of the interviewee.

Private Sector Perspective on Green Development

In order to implement green design planner, engineer and investor should open communication channels and discuss green design details of the project on a common ground. Yet the most encountered problem is green knowledge deficiency in any of these three corners of the triangle. Each party should have adequate amount of green knowledge to resolve design and construction phase problems efficiently and reach consensus in the wake of constructive meetings. Easiest way to gain or update green knowledge is attending green symposiums hold by green organizations, universities or public authorities.

Architectural and engineering firms should also consider (should not ignore) being sustainable in their agenda under project development and feasibility works. Investors should be convinced to invest green by such firms and beginning from concept design investors should be informed and updated about green implementations in progress and their future benefits.

Cost of green building could be reflected under two titles, initial investment cost and operating cost. Green construction's cost premium is reduced by new construction systems and technologies over years besides operating cost is significantly reduced in green buildings by energy efficiency. So, investors should consider total life cycle cost balance of the building. Initial cost fear could be overcome by financial government support programs. Tax deductions could be supportive for small-medium size investors. Government should also consider special tax regulations for green material import and manufacturers developing green materials.

Maximum energy consumption per sq m should be limited for residential and commercial spaces besides higher level isolation standards for specific regions should be introduced by new regulations.

Another subject is certification systems and their popularity in the market. Green consulting firms are the key players to guide contractors through green certificates and ease green label acquiring process. If LEED, BREEAM, Seeb-Tr could find place in government's agenda consulting firms could be bridge between the sector and the government.

Construction sector in Istanbul is already familiar with grey water recycling, ground source heat pumps, solar panels, wind energy, rain water recycle and renewable materials. Intelligent sensor systems, cell membranes, advanced heat insulation, advanced HVAC systems and green roofing are in their infancies in the market. Government should take the initiative in such advanced green systems by state sponsored green constructions.

4.2.3 Interview with a Research Assistant

Academic studies on green issues, ability of academic circles to support public and professional green education, research and development on green systems/materials and SEEB-Tr national green certification system were asked to the interviewee who is a research assistant in Istanbul Technical University under faculty of architecture and pursues her research partly on green issues.

Academic Perspective on Green Issues

January 2014 became a milestone in green movement of Turkey because national green building certification system SEEB-Tr was introduced to public. Non-governmental organizations (Green Building Council – ÇEDBİK) together with academicians created an optimized system for Turkish standards by comprehensive research on international certification systems, LEED, BREEAM, CASBEE, DGNB. 15 different groups are identified in the system, five different structure types (residential, school, office, hospital, hotel) times three construction type (new, renovated, built). 13 main categories are supported by 600 sub-categories in point scoring system. Weight of each criterion is determined by scientific and sectoral studies besides approval and control system of the certification created by relevant departments of universities in Turkey.

SEEB-Tr enables small size architectural groups to build green by using user friendly online interactive green design tools without any necessity to specialist. Responsive online system not only serves for professionals but also for students.

Green design and construction education is limited at universities. The subject is given under elective courses not mandatory ones. Green studies are interdisciplinary studies so they need the presence of some relevant departments such as architecture, civil engineering, urban planning, landscaping yet only a few universities have wide range of built environment departments in their body. Workshop opportunities are also limited in private colleges and mostly only applicable in technical universities. Thus, students may support their green development knowledge and background with extracurricular activities on site if the conditions in the campus are not fulfilling. Green design competitions are also golden opportunities to either improve green skills or prove them.

Research and development on green systems and materials is quite limited and ongoing studies are mostly carried in cooperation with non-governmental organizations. Green building performance studies are generally dispersed that particular systems have been tested by different departments and fully integrated green building performance could not be monitored yet.

4.2.4 Interview with a Civil Engineer from Construction Sector

The interviewee after his graduation from Boğaziçi University-Istanbul has been followed his career in commercial and residential building projects. Even though he is not affiliated with green organizations or companies he had a chance to attend green conferences and work in green projects. I informed him about eco-district models of Stockholm and we discussed if the market in Istanbul can generate eco-districts. He shared ongoing energy efficient district plans in Istanbul.

Prospective Eco-Districts in Istanbul

Energy efficiency law and regulations on energy performance in buildings were introduced in 2009 in Turkey and that was a quite late attempt compared to European countries. So popularity of green buildings in the market still lives its early ages but at the same time indicates an optimistic local green market in the future. Other than particular green building attempts Istanbul will host energy efficient districts in the future just like its European counterparts like Stockholm.

Kadıköy municipality with the population of 500000 has an ongoing urban renovation project in Fikirtepe district. Thousands of old buildings have been demolished and contractors are about to give start to new residential buildings on 1340000 sq m land. Kadıköy municipality,

on the eve of that big amount of new residential stock, has already taken a proactive approach and introduced the project of sustainable development criteria for newly developing projects within the borders of the municipality. That new initiative especially concerns Fikirtepe projects. Eco-district is the expected ultimate result but such a big area needs intelligent transportation and green friendly site planning to achieve such a result. Fikirtepe region unlike Stockholm Hammarby project does not have railway access yet. Instead, integrative recycle systems are planned so far. Grey water recycle is obligated for the lots with more than 200 apartment units or in use of commercial purposes. Isolation, roofing or façade system minimum requirements will be met by the contractors in the course of constructions. So the municipality expects constructive responses from contractors in progress and their environmentally responsible projects.

Another potential model is Ömerli-Sancaktepe residential development model. The area is another newly developing area on the outskirts of Istanbul and lies through Ömerli fresh water basin. Some restrictions are put in order to hinder unplanned settlement there. As mentioned in thesis study of Bilge Aydın from Istanbul Technical University, minimum lot size limited to 3000 sq m in order to optimize the density of development for a well-functioning infrastructure system. Low population density in the region and continuous active-passive recreation areas ensure a conserved natural fabric in the vicinity. Besides, each lot is planned to convey solid or liquid waste to central waste recycling unit.

5. **Recommendations for Sustainable Development Strategies in Istanbul**

Some recommendations are already implied in the interpretation of survey result and interview sections; and this section aims to consolidate recommendations and complete the list of strategies. Ideas here are inspired by international practices in literature research section and the interpreted versions of both survey results and interviews.

5.1 Economic Recommendations

Financial sides of green issues either lead to strong barriers or influential motivators if right actions are taken. Survey and interview data show professionals and society are mostly concerned about financial issues when considering going green. Even though majority believes that in long term green buildings compensate probable initial extra cost obviously luxury and high cost image deters many investors.

- Banks should take the leadership on the way to support investors and projects financially. Credit programs coordinated with local municipality or government should meet initial cost compensation amount in order to mitigate concerns of investors. Tenant credits/mortgages by the mean of bank, contractor cooperation should be provided to encourage people to buy green. Insurance companies on the other hand should adapt new risk policies by analyzing and taking green construction risks into account. So, insurance companies should be ready to send unit teams to inspect on construction sites to find out particular financial and technical risks.

- Government seems to fail when it comes to tax piles/reductions according to the survey and the interviews. Tax policy is a strong tool to support investors. Government should recognize tax piles with flexible ratios regarding green extent of particular projects.

- Municipality should reduce local tax burden on green building owners because recycling systems and energy efficiency mitigates infrastructure burden of municipalities.

- Green material costs, their domestic production and import should be regulated by the government. Green material research and development by either universities or private companies should be funded by the government. Technical support to green material manufacturers also has financial implications by making production process more efficient. Import of newly developed green materials should be initiated as a part of governmental green projects procurements or by the government itself through interstate agreements. Cooperative procurement -as asserted by Programme (2007)- of the materials by a group of contractors also makes green contractors more penetrative power in material trade market. I personally believe that domestic green material production will reduce the price of such materials.

- Green certification systems have indirect economic boost for green buildings. Green certified buildings increasing with attained level of label could be valued more compared to regular buildings in the neighborhood. So, having green label brings the positive features of the building and satisfies the owner with probable escalated value.

- As in Dutch example; private energy companies in Istanbul Bedaş and Ayedaş should be required to implement schemes of energy premium by government so that energy efficient systems could be installed to building stock to make consumption efficient.

5.2 Municipality & Government Recommendations

2007 and 2009 performance law and isolation regulations have stressed the issue of sustainability yet in order to achieve green building requirements both municipalities and government by the support of construction industry should consider more pushing regulations on local basis. Laws without local regulations are lack of practicability in the market. Survey results also point critical deficiency of laws and regulations to support sustainable development.

According to Kingsley (2008) efforts of local authorities have three goals.

- *Raise awareness of green buildings*
- *Reduce the costs of building green by providing best practices or case studies that can be used as models*
- *Convince private developers to build green by demonstrating financial benefits of doing so.*

Eyüp municipality in Istanbul as mentioned in Interview part has succeeded on green education of both public and professionals. There are more than ten municipalities like Eyüp in Istanbul which would definitely benefit from sustainable development.

- All borough municipalities and Istanbul Metropolitan Municipality in particular should give start to green seminars and demonstration organizations in cooperation with non-governmental green organizations like ÇEDBİK and universities which have relevant departments and academicians.

- Green building demonstration prototypes (as in Eyüp and Glashusett examples) built by either government or municipality have many benefits for the market. Financial savings through energy efficiency and recycling, upgrade of indoor living quality, increased building value and mitigated environmental damage should be emphasized in informative meetings.

- New school, hospital and governmental building projects as appeared in survey should be designed and constructed green as green models to private investors.

- By constructing green projects government should also publish a technical guideline and lifecycle cost-benefit assessment report of green buildings.

- As mentioned in interview parts, prices of electricity and other energy sources for especially office buildings should be regulated region by region. Increased energy prices in central financial districts could drive major players to build more energy efficient and green.

- Private sector tends to ignore the fact that the future of Istanbul's natural resources are at stake. If market does not respond to new laws or regulations, more mandatory measures could be considered in energy efficiency and more codes could be enacted like Sweden did with Environmental code in 1999.

- Government should take the initiative in advanced green systems (the systems not implemented in local market widely) by state sponsored green constructions.

-Eco-district master plans should be prepared for different parts of the city. In my opinion new Ataşehir financial district which will include both governmental and private banks and commercial offices and serve 30000 people in completion could be designed green to carry Istanbul to higher levels in green scale among other international destinations. Of course such a project needs total collaboration and devotion of the government and Istanbul metropolitan municipality.

- Green branding as mentioned under Stockholm model could be considered for newly developing areas of Istanbul to boost dwellers' feelings of proud of living green. If such branding could be succeeded the people living in such areas would be living examples and broadcasters of green lifestyle.

- Istanbul metropolitan municipality should aim to host international green conferences and form a green memory by the synergy of guests.

Stockholm has an official goal to reduce energy consumption by 40% by 2050 compared with 2006 levels.

- Istanbul should target a level of energy consumption reduce for long term and generate new regulations toward this target.

5.3 Market Recommendations

The biggest slice in strategies section goes to market strategies because I will define collaborative strategies of green stakeholders in this section.

- Design phase of a green building is so important to decrease probable extra cost and build a well-functioning building so, well-integrated green design and monitoring in construction phase by green consulting or architecture firms should become a routine. Scheduling of such projects may need special work and be subjected to many interim revisions due to unstable procurement duration of green materials, inexperienced labor force in green implementations.

- Contractors should learn to calculate lifecycle cost benefit of green buildings by consulting academicians, governmental agencies or most importantly specialized consultancy firms.

- Leading contractors or architectural firms in the sector, in the name of social responsibility, should build or design green to be example projects or support green movement by resource donation.

- Renewable materials and low cost green systems should be used even in traditional construction projects.

- Lack of coordination between the professions in green projects seems to be a problem as survey results reveal. Green experienced construction managers who also constantly improve themselves in green technics should be assigned to green projects. Breaking professional barriers and making collaborative decisions should be the main duty of such managers.

- Coordinated act between green organizations, government and education units to spread green knowledge is also essential.

- Non-governmental organizations and chamber of architects and engineers should organize educational programs for construction market professionals and investors.

- Istanbul environment and urban planning office (local governmental office of ministry of environment and urban planning) could assign a unit working on green design and models and visiting construction firms to educate their employees free of charge. Eventually, energy efficiency saving in built environment in the case of standardized exercise of green buildings will substantially mitigate Turkey’s financial deficit.

- SEEB-Tr, local green certification has been introduced to the market in a short while ago, so both government and market itself should positively discriminate the new system to boost its use in domestic market. As interpreted in the interviews, green consulting firms are the key players to guide the market, so more consulting firms should be introduced and their actions should be supported by laws and regulations.

- SEEB-Tr, BREEAM, LEED certification education seminars should be arranged by chambers of engineers and architects in order to authorize people or firms to label buildings.

- Survey result and interview revealed the need of universities to start mandatory sustainable development related courses or increase the number of them in built environment departments. Workshops should be a mandatory part of the courses to develop implementation skills. Universities should also educate public to accustom green lifestyle and form green mindset through public education units. Additionally, R&D and green knowledge share across the universities should be accelerated. Online sustainable development courses should be included in course catalog of universities for distance education opportunity to professionals.

- Academic research on the benefits of sustainable development and green buildings should draw clear results to be published and inform green interest groups.

- Number of green building organizations (Çedbik) and periodicals (Ekoyapı dergisi and Yeşil Bina dergisi) should be increased by the support of government, construction industry and universities. Besides, mass-media should recognize green movement achievements by broadcasting or advertising like green building special series broadcasted by BloombergHT (A Turkish news channel) in 2012 (Cedbik, 2007). Leading architecture and engineering magazines have a considerable amount of subscribers in Istanbul so they should give publicity to green issues or case projects to incept green ideas.

Soyak Holding (a Turkish construction company) adopted green guidelines in company's agenda and renovated headquarter building to gain LEED certification (Çamlıbel, 2011). Company also generated responsive recycling strategies in the building.

- Construction companies should adopt green guidelines in their policies and update them periodically as Soyak Holding achieved. Municipalities should also follow the same strategy as Stockholm did many years ago. However, there are many local municipalities in Istanbul, so clear definitions and concurrence on guidelines among those municipalities prevents probable implementation problems.

- Real estate companies should give priority to green buildings especially in central Istanbul to ensure high occupancy rate. Besides, promotion of green buildings by highlighting higher living quality and efficient systems may attract distinguished buyers of the market.

- Conglomeration of design and engineering offices around prospective eco-districts may also create a synergy and lead innovative design and implementation.

- Contractors should sponsor green building design competitions and publicly announce winner projects as green building models. Such competitions also encourage both professionals and students to make an effort on green issues.

- Contractors should also provide funding by sponsorship to universities or R&D companies which work on green innovation.

6. Conclusion

Sustainable development in Istanbul is living its very first decade compared to global developed markets. So, before the maturation there is a suitable environment for proactive approaches in the market. Exponentially expanding human settlement in metropolitan Istanbul already makes sustainable solutions essential.

Survey respondents stated that residential and commercial buildings would substantially benefit from being green. However, less that 1% of building stock is green labeled in Istanbul. Most of sustainable development barriers presented in literature review are also validated for local market (Istanbul) by survey results. Here are the most significant ones:

Economic barriers;

- Financial problems in procurement of green materials,
- Lack of green loans and risk policies,
- Unsatisfactory level of green building values.

Technical & Market Barriers;

- Lack of green knowledge and its share in society,
- Incompetent contractors and professionals,
- Lack of coordination among entities and people.

Social Barriers;

- Lack of media coverage,
- Not enough sustainable development education,
- Sector resistance to sustainable development.

Governmental & Municipal Barriers

- Lack of financial and technical support,
- Lack of legal support.

International practices in general and the parts focusing on Stockholm model reveal the pathway of sustainable urban development. Stockholm enacted many laws and regulations for decades to keep the position of model green city. Integrated actions of both government and sector enabled the city to build green and establish a green mindset. Glashusett project aims to give green mindset to people and builds momentum for future green projects. Hammarby Sjöstad as an eco-district is a perfect example of coordinated act and sustainable development model. Green systems used in the project substantially reduce energy and water hunger and enable recycling. The Stockholm Royal Seaport project also represents the integration of environmental issues in urban districts as an under construction eco-district. Importance of early green planning and commitment together with coordination in stakeholders are underlined as well. LEED gold level building with green systems in Vasakronan building reveals the power of certification in energy consumption reduction.

As mentioned in International practices section, manifestations drew the attention of public to sustainable development like Brundtland committee report. In Dutch examples many policies

have been enacted to ensure sustainable development. Symbolic green building models were also built in the Netherlands. USA and Singapore generated financial incentives for green investors by green credits and low interest loans.

International practices, survey results and interviews enable thesis to yield recommendations for sustainable development strategies for residential and commercial building stock in Istanbul.

Recommendations are presented under three titles. Here is the itemized summary:

Economic Recommendations;

- Favorable credits and loans for green buildings,
- Tax reductions,
- Green material production in domestic market.

Municipality & Government Recommendations;

- Raise awareness of public and professionals,
- Provide financial support through tax,
- Provide technical support in green systems and design,
- Build model projects like singular buildings or eco-districts,
- Enact more laws and regulations on green issues,
- Target energy consumption reduction for long term and internalize it,
- Host green conferences in global scale.

Market Recommendations;

- Integrated green design and early green planning,
- Extend the use of SEEB-Tr (Turkish green building certification system),
- Coordinated act of different entities including public, private sector, organizations and education units,
- Green R&D funding support,
- More sustainable development courses in education units.

Recommendations generated in the thesis are expected to be beneficial to construction and real estate industry and all stakeholders for a sustainable future and sustainable Istanbul. Hopefully this study becomes an effective reference for public and succeeds to initiate new sustainable development studies in Turkey.

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APPENDICES

Appendix A

Overview of LEED for New Construction Version 2.2 (LEED-NC 2.2)

SUSTAINABLE SITES (SS)		Points
Prerequisite 1	Construction Activity Pollution Prevention	None
Credit 1	Site Selection	1
Credit 2	Development Density & Community Connectivity	1
Credit 3	Brownfield Redevelopment	1
Credit 4.1	Alternative Transportation: Public Transportation Access	1
Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
Credit 4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	1
Credit 4.4	Alternative Transportation: Parking Capacity	1
Credit 5.1	Site Development: Protect or Restore Habitat	1
Credit 5.2	Site Development: Maximize Open Space	1
Credit 6.1	Stormwater Design: Quantity Control	1
Credit 6.2	Stormwater Design: Quality Control	1
Credit 7.1	Heat Island Effect: Non-Roof	1
Credit 7.1	Heat Island Effect: Roof	1
Credit 8	Light Pollution Reduction	1
	Possible SS Points	**14**

WATER EFFICIENCY (WE)		Points
Credit 1.1	Water Efficient Landscaping: Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation	1
Credit 2	Innovative Wastewater Technologies	1
Credit 3.1	Water Use Reduction: 20% Reduction	1
Credit 3.2	Water Use Reduction: 30% Reduction	1
	Possible WE Points	**5**

ENERGY & ATMOSPHERE (EA)		Points
Prerequisite 1	Fundamental Commissioning of the Building Energy Systems	None
Prerequisite 2	Minimum Energy Performance	None
Prerequisite 3	Fundamental Refrigeration Management	None
Credit 1	Optimize Energy Performance	1–10*

*As of June 2007, the USGBC was balloting a recommendation that all buildings must achieve a minimum of two points under Optimize Energy Performance.

Credit 2	On-Site Renewable Energy	1–3
Credit 3	Enhanced Commissioning	1
Credit 4	Enhanced Refrigeration Management	1
Credit 5	Measurement & Verification	1
Credit 6	Green Power	1
	Possible EA Points	**17**

MATERIALS & RESOURCES (MR)		**Points**
Prerequisite 1	Storage and Collection of Recyclables	None
Credit 1.1	Building Reuse: Maintain 75% of Existing Walls, Floors and Roof	1
Credit 1.2	Building Reuse: Maintain 95% of Existing Walls, Floors and Roof	1
Credit 1.3	Building Reuse: Maintain 50% of Interior Non-Structural Elements	1
Credit 2.1	Construction Waste Management: Divert 50% from Disposal	1
Credit 2.2	Construction Waste Management: Divert 75% from Disposal	1
Credit 3.1	Materials Reuse: 5%	1
Credit 3.2	Materials Reuse: 10%	1
Credit 4.1	Recycled Content: 10% (post-consumer + ½ pre-consumer)	1
Credit 4.2	Recycled Content: 20% (post-consumer + ½ pre-consumer)	1
Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regionally	1
Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Regionally	1
Credit 6	Rapidly Renewable Resources	1
Credit 7	Certified Wood	1
	Possible MR Points	**13**

INDOOR ENVIRONMENTAL QUALITY (EQ)		**Points**
Prerequisite 1	Minimum IAQ Performance	None
Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	None
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3.1	Construction IAQ Management Plan: During Construction	1
Credit 3.2	Construction IAQ Management Plan: Before Occupancy	1
Credit 4.1	Low Emitting Materials: Adhesives and Sealants	1
Credit 4.2	Low Emitting Materials: Paints and Coatings	1
Credit 4.3	Low Emitting Materials: Carpet Systems	1
Credit 4.4	Low Emitting Materials: Composite Wood and Agrifiber Products	1
Credit 5	Indoor Chemical and Pollutant Source Control	1
Credit 6.1	Controllability of Systems: Lighting	1
Credit 6.2	Controllability of Systems: Thermal Comfort	1
Credit 7.1	Thermal Comfort: Design	1
Credit 7.2	Thermal Comfort: Verification	1
Credit 8.1	Daylight and Views: Daylight 75% of Spaces	1
Credit 8.2	Daylight and Views: Views for 90% of Spaces	1
	Possible EQ Points	**15**

INNOVATION IN DESIGN (ID)		**Points**
Credit 1.1	Innovation in Design 1	1
Credit 1.2	Innovation in Design 2	1
Credit 1.3	Innovation in Design 3	1

Credit 1.4	Innovation in Design 4	1
Credit 2	LEED Accredited Professional	1
	Possible ID Points	**5**

Summary for LEED-NC 2.2

For LEED-NC 2.2, there are 64 possible base points plus 5 points for Innovation in Design, a total of 69 points available.

Certification levels for LEED-NC 2.2 are as follows:

Certified: 26–32 points
Silver: 33–38 points
Gold: 39–51 points
Platinum: 52 or more points

Appendix B

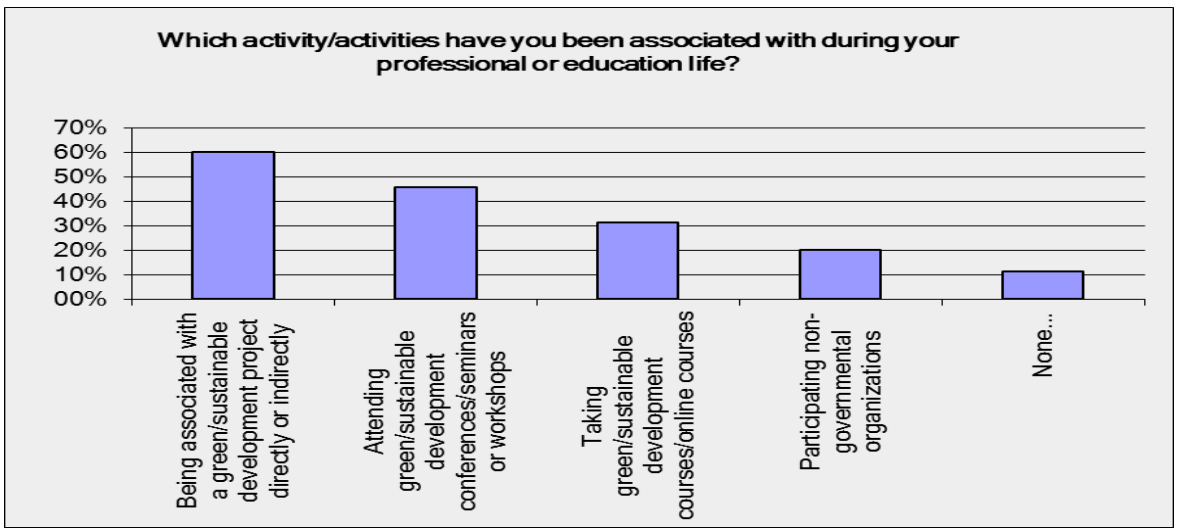
Survey Results

Q1:

State your profession	
Answer Options	Response Count
	33
answered question	33
skipped question	3

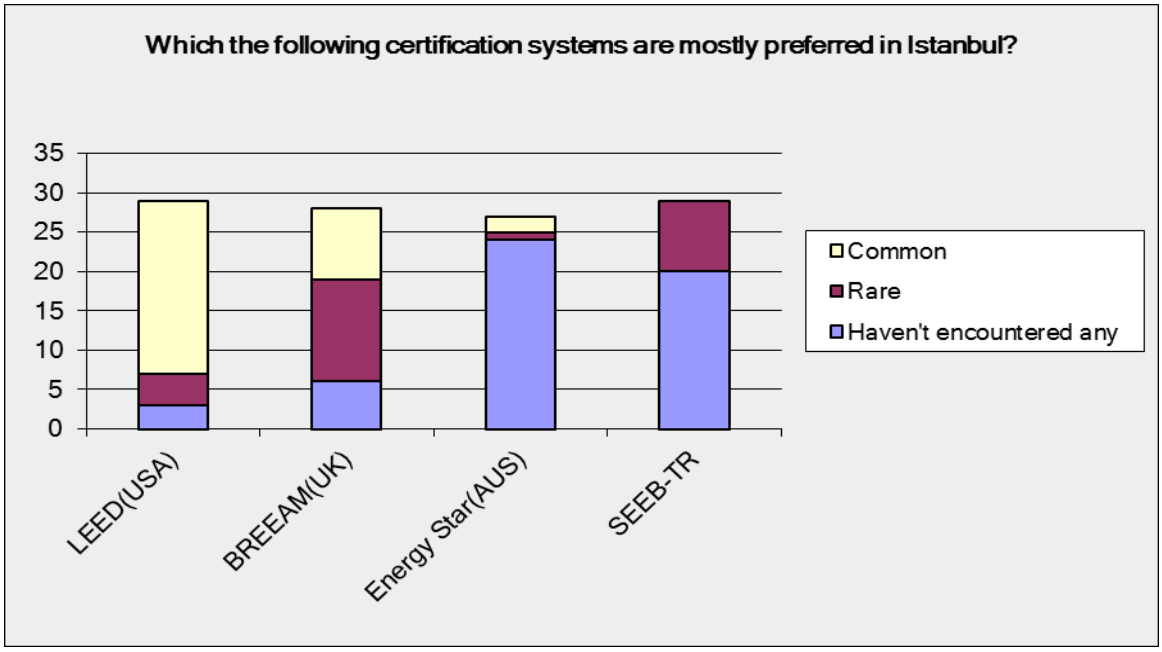
Q2:

Which activity/activities have you been associated with during your professional or education life?		
Answer Options	Response Percent	Response Count
Being associated with a green/sustainable development project directly or indirectly	60.0%	21
Attending green/sustainable development conferences/seminars or workshops	45.7%	16
Taking green/sustainable development courses/online courses	31.4%	11
Participating non-governmental organizations	20.0%	7
None...	11.4%	4
Other (please specify)		0
	answered question	35
	skipped question	1



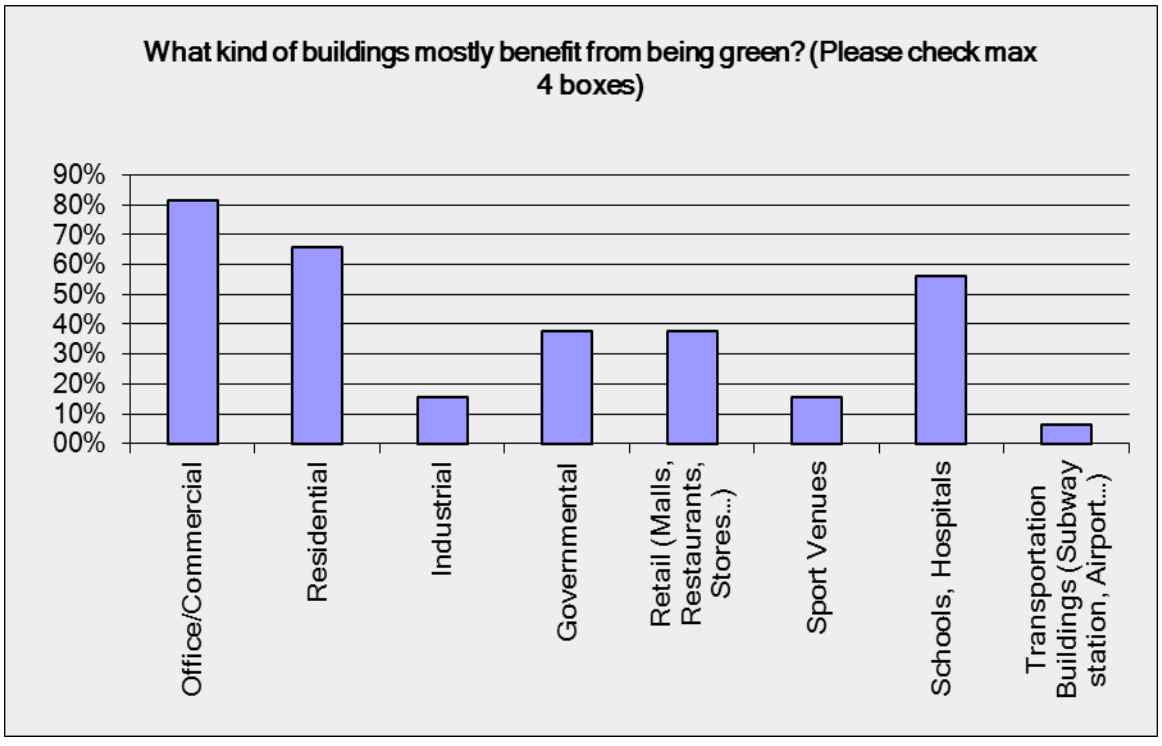
Q3:

Which the following certification systems are mostly preferred in Istanbul?				
Answer Options	**Common**	**Rare**	**Haven't encountered any**	**Response Count**
LEED(USA)	22	4	3	29
BREEAM(UK)	9	13	6	28
Energy Star(AUS)	2	1	24	27
SEEB-TR	0	9	20	29
Other (please specify)				0
			answered question	31
			skipped question	5



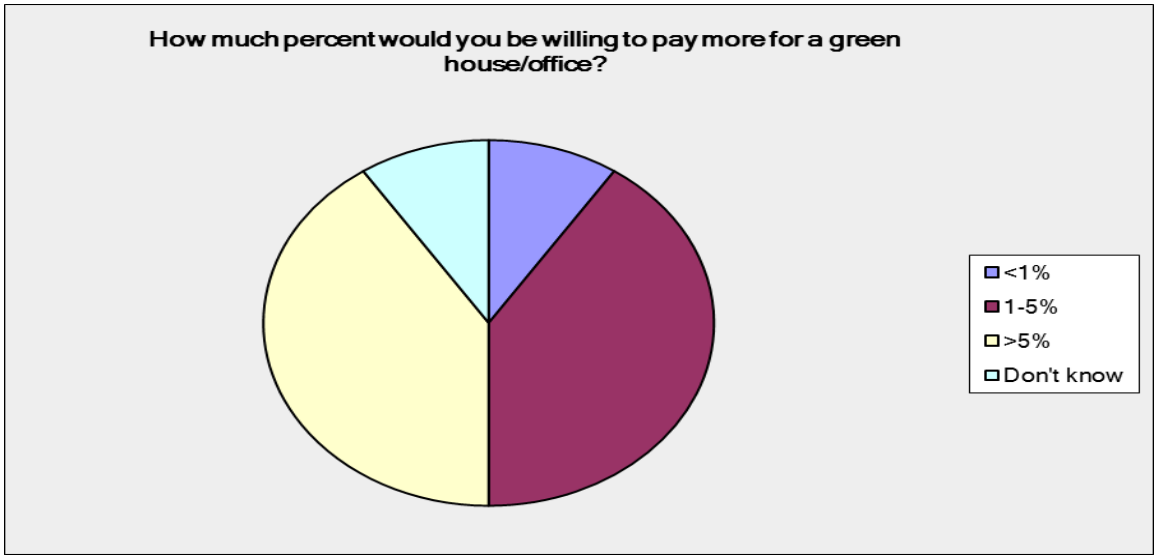
Q4:

What kind of buildings mostly benefit from being green? (Please check max 4 boxes)		
Answer Options	**Response Percent**	**Response Count**
Office/Commercial	81.3%	26
Residential	65.6%	21
Industrial	15.6%	5
Governmental	37.5%	12
Retail (Malls, Restaurants, Stores…)	37.5%	12
Sport Venues	15.6%	5
Schools, Hospitals	56.3%	18
Transportation Buildings (Subway station, Airport…)	6.3%	2
	answered question	32
	skipped question	4



Q5:

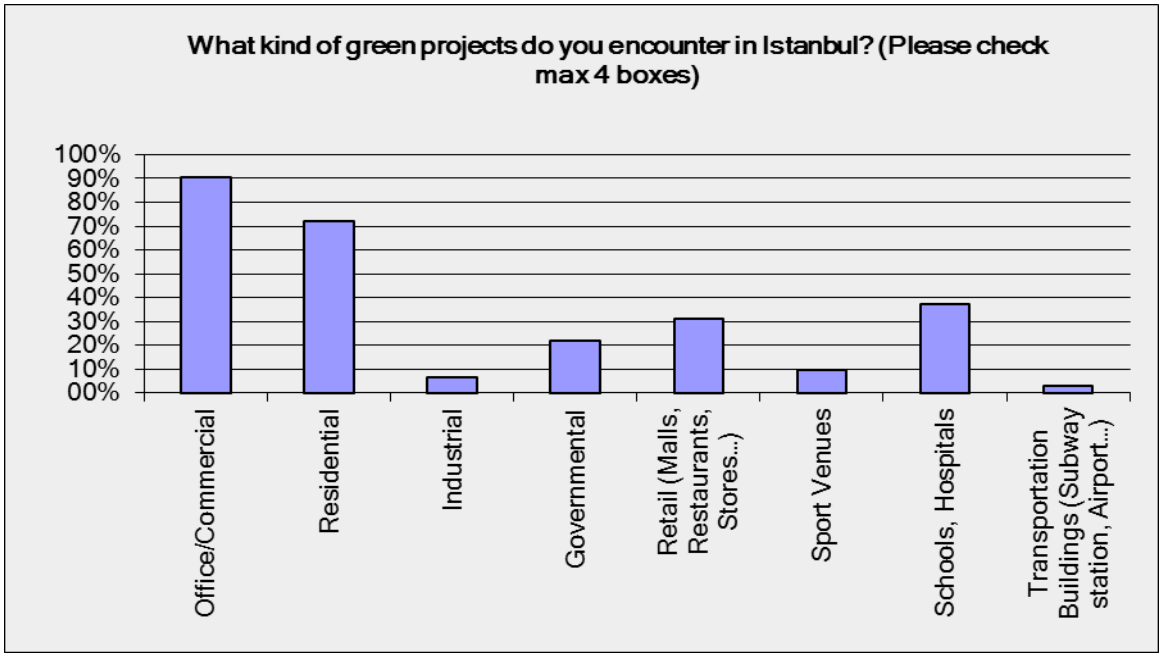
How much percent would you be willing to pay more for a green house/office?		
Answer Options	**Response Percent**	**Response Count**
<1%	9.4%	3
1-5%	40.6%	13
>5%	40.6%	13
Don't know	9.4%	3
answered question		32
skipped question		4



Q6:

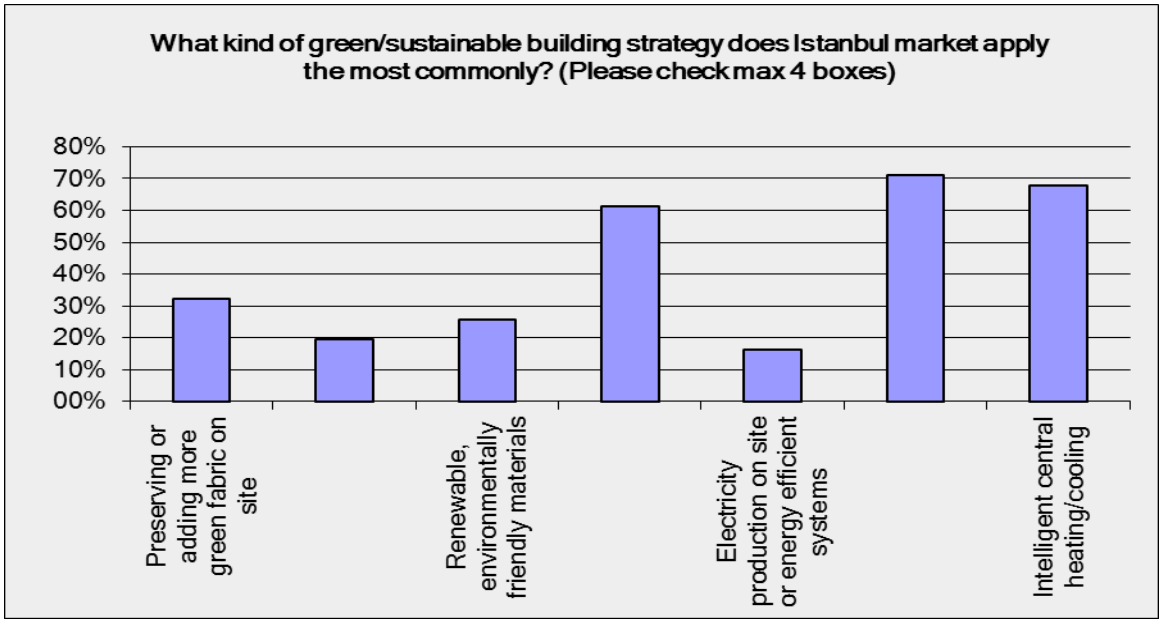
What kind of green projects do you encounter in Istanbul? (Please check max 4 boxes)		
Answer Options	**Response Percent**	**Response Count**
Office/Commercial	90.6%	29
Residential	71.9%	23
Industrial	6.3%	2
Governmental	21.9%	7
Retail (Malls, Restaurants, Stores…)	31.3%	10
Sport Venues	9.4%	3

Schools, Hospitals	37.5%	12
Transportation Buildings (Subway station, Airport…)	3.1%	1
	answered question	32
	skipped question	4



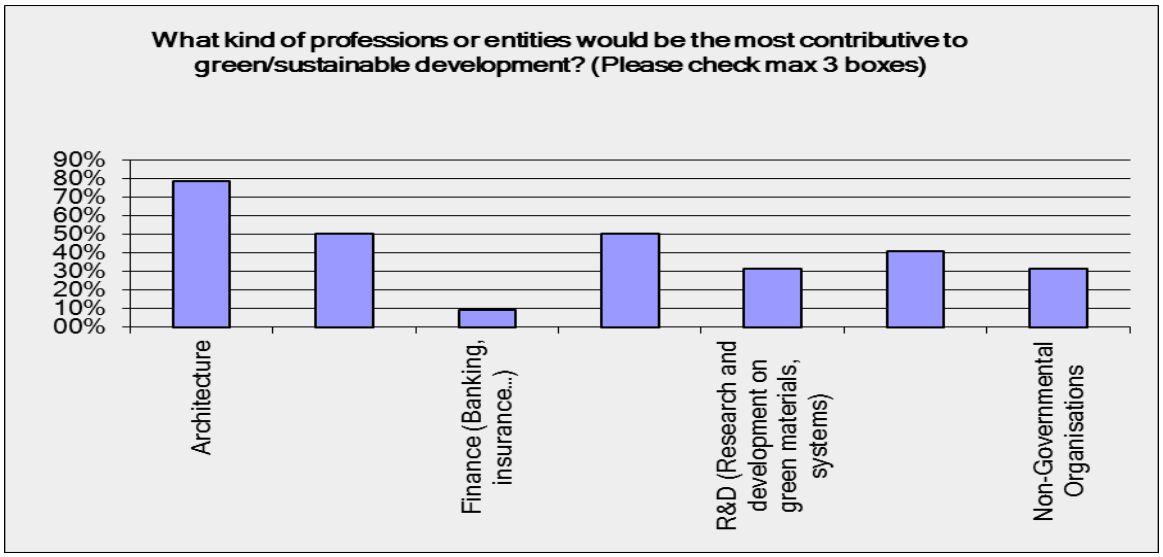
Q7:

What kind of green/sustainable building strategy does Istanbul market apply the most commonly? (Please check max 4 boxes)		
Answer Options	**Response Percent**	**Response Count**
Preserving or adding more green fabric on site	32.3%	10
Building in the close proximity to public transportation	19.4%	6
Renewable, environmentally friendly materials	25.8%	8
Waste water treatment/water efficient systems	61.3%	19
Electricity production on site or energy efficient systems	16.1%	5
Day lighting/green design	71.0%	22
Intelligent central heating/cooling	67.7%	21
Other (please specify)		0
	answered question	31
	skipped question	5



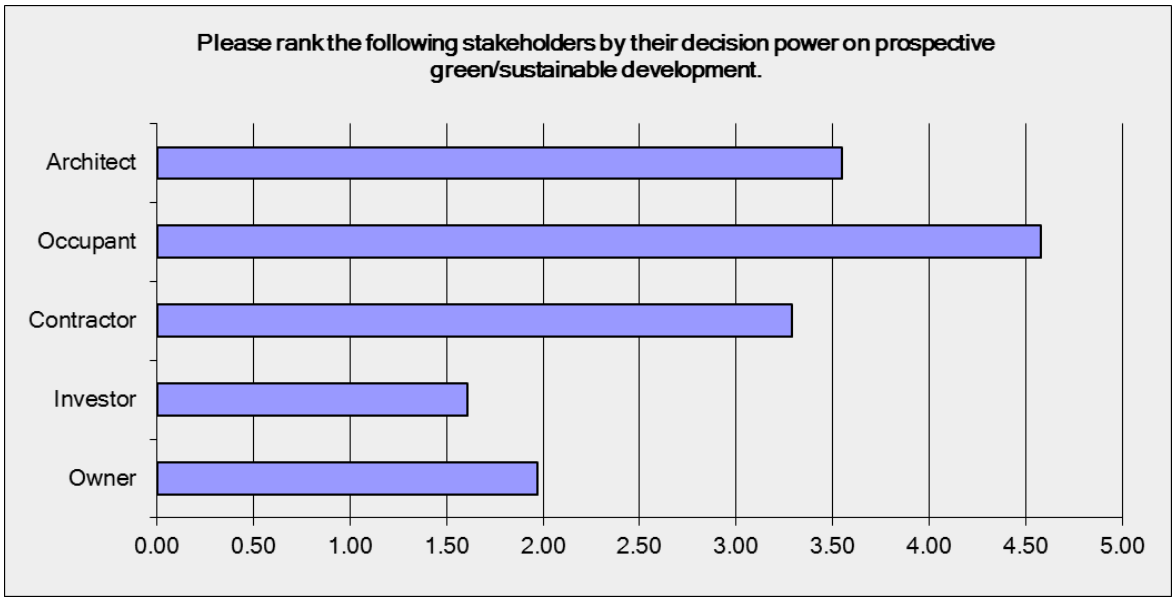
Q8:

What kind of professions or entities would be the most contributive to green/sustainable development? (Please check max 3 boxes)		
Answer Options	**Response Percent**	**Response Count**
Architecture	78.1%	25
Engineering (Civil, mechanical…)	50.0%	16
Finance (Banking, insurance…)	9.4%	3
Governmental (Including municipal vocations)	50.0%	16
R&D (Research and development on green materials, systems)	31.3%	10
Education Units(Universities...)	40.6%	13
Non-Governmental Organisations	31.3%	10
Other (please specify)		1
	answered question	32
	skipped question	4



Q9:

Please rank the following stakeholders by their decision power on prospective green/sustainable development.							
Answer Options	**1**	**2**	**3**	**4**	**5**	**Rating Average**	**Response Count**
Owner	12	14	1	2	2	1.97	31
Investor	16	13	1	0	1	1.61	31
Contractor	1	2	16	11	1	3.29	31
Occupant	1	0	0	9	21	4.58	31
Architect	1	2	13	9	6	3.55	31
						answered question	31
						skipped question	5

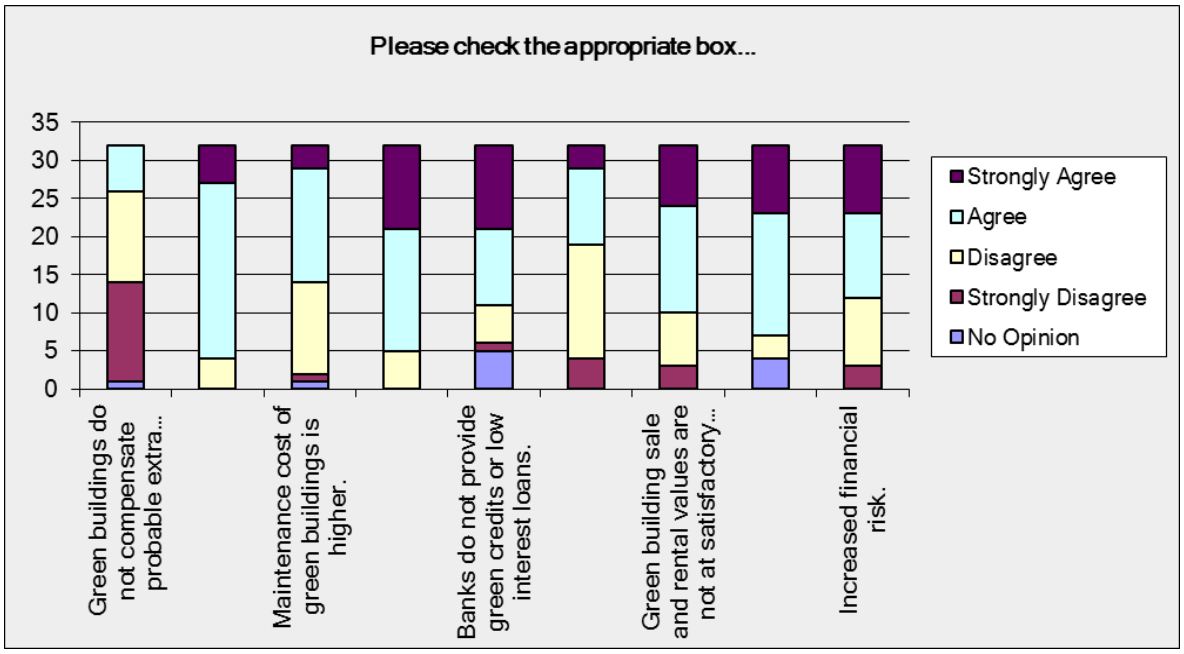


Q10:

Do you think that Istanbul needs more green/sustainable projects(Residential or commercial)?		
Answer Options	**Response Percent**	**Response Count**
Yes	100.0%	32
No	0.0%	0
Don't know	0.0%	0
	answered question	32
	skipped question	4

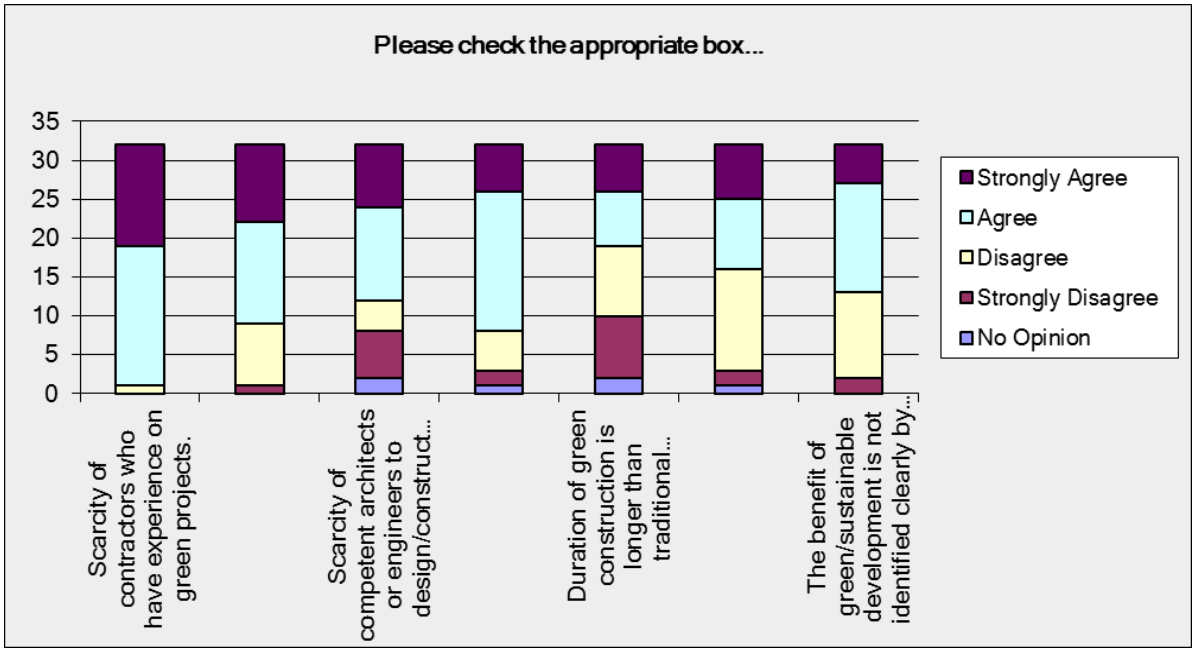
Part 2) Q11: Economic Barriers:

Please check the appropriate box...						
Answer Options	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion	Response Count
Green buildings do not compensate probable extra initial construction cost in their total life cycle.	0	6	12	13	1	32
Contractors or investors are unwilling to construct green/sustainable projects.	5	23	4	0	0	32
Maintenance cost of green buildings is higher.	3	15	12	1	1	32
Green construction materials are expensive.	11	16	5	0	0	32
Banks do not provide green credits or low interest loans.	11	10	5	1	5	32
Clients cannot afford (buy or rent) green buildings (office or residential).	3	10	15	4	0	32
Green building sale and rental values are not at satisfactory levels.	8	14	7	3	0	32
Insurance companies do not have green building risk policies.	9	16	3	0	4	32
Increased financial risk.	9	11	9	3	0	32
					answered question	32
					skipped question	4



Q12: Market & Technical Barriers:

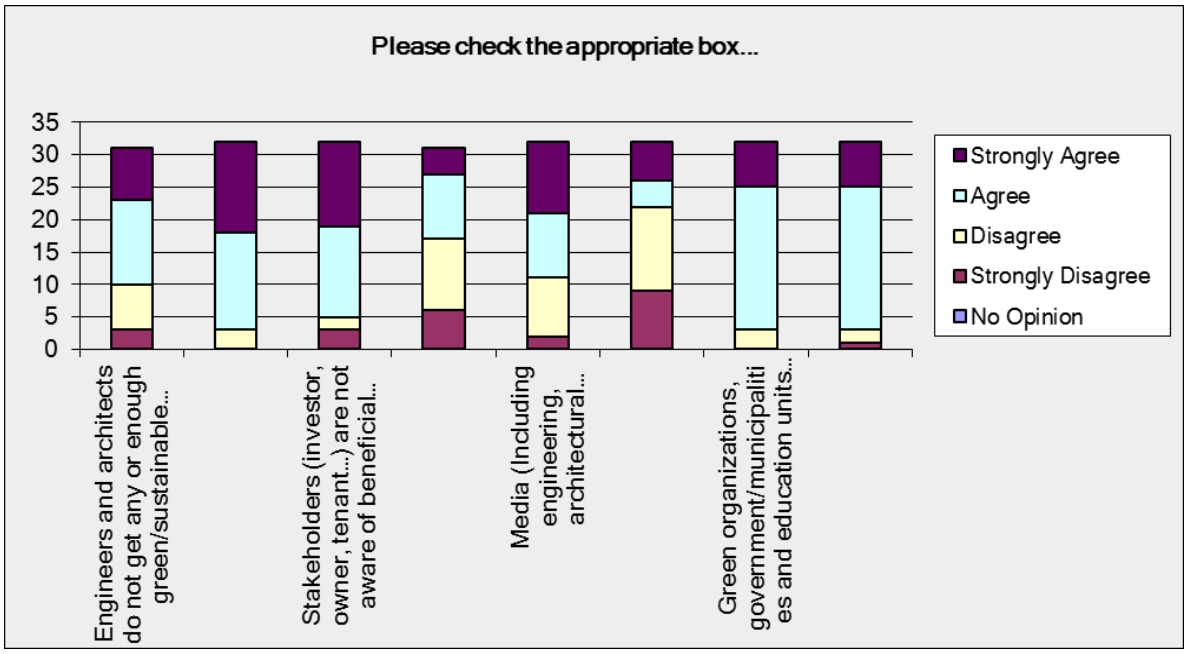
Please check the appropriate box...						
Answer Options	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**No Opinion**	**Response Count**
Scarcity of contractors who have experience on green projects.	13	18	1	0	0	32
Scarcity of green construction and maintenance materials.	10	13	8	1	0	32
Scarcity of competent architects or engineers to design/construct green projects.	8	12	4	6	2	32
Lack of coordination between the professions who construct green projects.	6	18	5	2	1	32
Duration of green construction is longer than traditional construction.	6	7	9	8	2	32
Certification systems are not optimized for Turkish market.	7	9	13	2	1	32
The benefit of green/sustainable development is not identified clearly by academic circles or organizations.	5	14	11	2	0	32
					answered question	**32**
					skipped question	**4**



Q13: Social Barriers:

Please check the appropriate box...						
Answer Options	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**No Opinion**	**Response Count**
Engineers and architects do not get any or enough green/sustainable development education.	8	13	7	3	0	31
The construction sector shows resistance to sustainable development.	14	15	3	0	0	32
Stakeholders (investor, owner, tenant…) are not aware of beneficial sides of sustainable development.	13	14	2	3	0	32
Non-governmental green development organizations do not perform actively.	4	10	11	6	0	31
Media (Including engineering, architectural publications) does not show support to sustainable development.	11	10	9	2	0	32
Public does not have ecological concerns and does not want to live in green buildings.	6	4	13	9	0	32

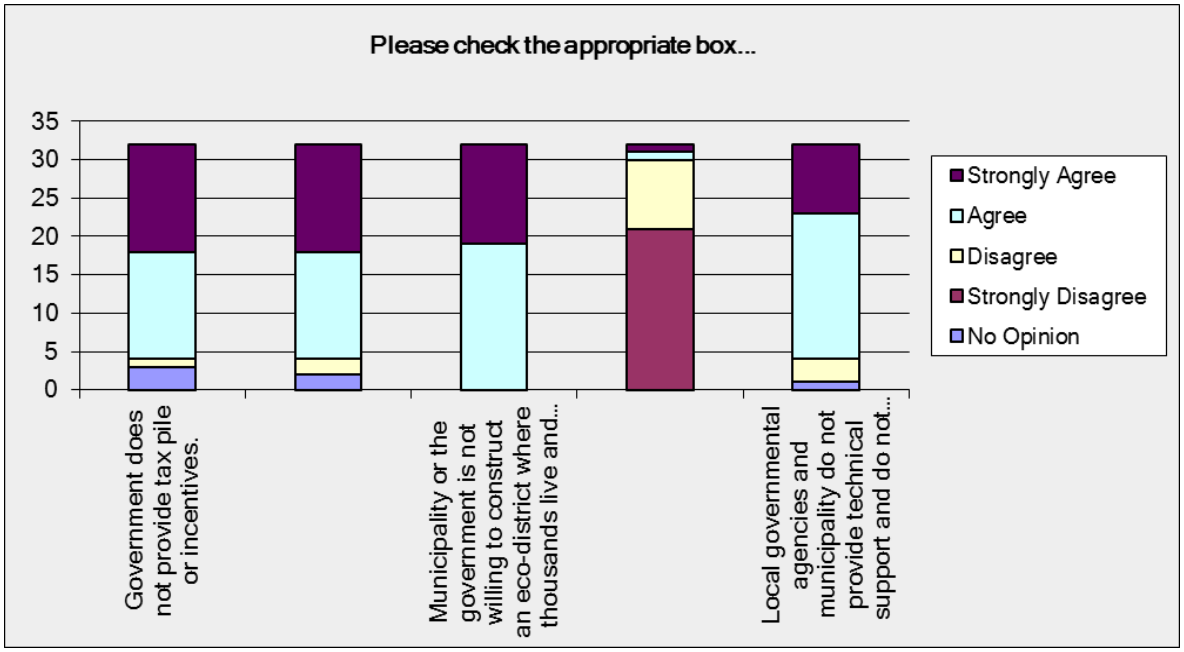
Green organizations, government/municipalities and education units are not coordinated and do not act together.	7	22	3	0	0	32
Educational institutions (Universities, public education centers) do not educate/inform the public about sustainable development.	7	22	2	1	0	32
					answered question	32
					skipped question	4



Q14: Governmental & Municipal Barriers

Please check the appropriate box...						
Answer Options	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**No Opinion**	**Response Count**
Government does not provide tax pile or incentives.	14	14	1	0	3	32
Laws and regulations are not enough to support sustainable development.	14	14	2	0	2	32
Municipality or the government is not willing to construct an eco-district where thousands live and work.	13	19	0	0	0	32

Energy (electricity, gas) and water prices are so cheap that no need for energy conservative buildings.	1	1	9	21	0	32
Local governmental agencies and municipality do not provide technical support and do not have any unit working on green/sustainable development issues.	9	19	3	0	1	32
					answered question	32
					skipped question	4



Appendix C

Interview questions directed to the master architect from Eyüp Municipality

1) Have you ever involved in green/sustainable construction projects in your professional life?
2) Does Istanbul construction sector make progress in green design and construction? In what ways are contractors, architects or engineers encouraged to green construction?
3) Does the municipality which you work for have green projects or joint projects with government?
4) Does the municipality provide technical or educational support to the sector?
5) Does sustainable development receive government or municipal incentives in Istanbul? How do municipalities or local governmental agencies encourage sustainable development (Financial, educational, legal…)?
6) How could the municipality raise the awareness of public?
7) Further comments…

Interview questions directed to the master architect from construction sector

1) Have you ever involved in green/sustainable construction projects in your professional life?
2) Does Istanbul construction sector make progress in green design and construction? In what ways are contractors, architects or engineers encouraged to green construction?
3) In what ways could engineering and architectural firms take step for sustainable development?
4) Do you think that green construction costs more? How could such probable extra cost be mitigated?
5) Does sustainable development receive government incentives in Istanbul? How do local governmental agencies encourage sustainable development (Financial, educational, legal…)?
6) What is your opinion on development of national green certification system?
7) What kind of green construction technologies and systems are mostly implemented in Istanbul?