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THE ROLE OF ENVIRONMENTAL AWARENESS IN POSTGRADUATE RESEARCH IN THE FIELD OF ARCHITECTURE: EXAMPLE OF TURKEY

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Abstract: *The objective of this study was to investigate the role of environmental awareness in postgraduate research in the field of architecture in Turkey. The keywords used to present environmental awareness were “ecology”, “sustainable”, “environmental impact”, “climate”, “energy effective”, “thermal insulation”, “green building”, “life cycle”, “air pollution”, “quality of air”, “construction and demolition waste”, “global warming”, “emission”, and “greenhouse gas”. A search was conducted using these keywords in Turkey Council of Higher Education, and resulting findings were evaluated to make future recommendations.*

Key Words: *Environmental Awareness, Postgraduate Research, Architecture*

INTRODUCTION

It has become a global issue that human being, who is constantly interaction with the environment, regards the environment only as a source. It has been recognized that natural sources is rapidly depleted from the second half 20th century in particular; environmental protection movements became a current issue in 1960's, and the concepts, e.g. “sustainable improvement” and “sustainable development” were included in development strategies of governments as of 1980's. During this period, the World Commission on Environment and Development, established by a decision of General Assembly of the United Nations, submitted General Assembly of the United Nations the “Our Common Future” report, also known as “Brundtland Report”, in 1987. This report suggests “sustainable development” (Uysal, 2002).

Brundtland Report defines sustainability as a worldview aiming at meeting environmental, social, and economical needs without compromising future generations' life conditions (Oktay, 2007). A number of meetings were conducted after issuance of this report, which had impacts on the world countries. 1992 Rio Conference on Environment and Development played a substantial role in such meetings to create policies for perceiving environmental issues, raising awareness of environment, and preventing consumption of natural sources as well as pollution. Focusing on establishment of future environmental policies, the Rio Summit's

“Agenda 21”, signed by several countries, explains how to implement the established principles and is an action plan for the 21st century (Perker, 2004; Uysal, 2002).

The concept of sustainable development, on which Brutland Report and Rio Summit placed substantial emphasis, is currently seen as a fundamental goal and holistic approach of solution in almost all fields concerning the environment and society. On one hand rapid consumption of natural environment and energy sources and on the other hand adverse impacts of built-up areas on the ecosystem in time have required to produce environment-friendly living spaces and buildings that would not damage the natural cycle, would maximize the compatibility with nature, and minimize the energy consumption during their production (Bektas, 2012; Sev, 2009; Tonuk, 2001). This especially becomes more important in countries with high building activities.

The effects of Rio Summit in 1992, the Agenda and the implementation “Local Agenda 21” in Turkey in the late 1997 are significant start-offs for perceiving national environmental issues and raising awareness of environment, and this has brought with relevant postgraduate research in the field of architecture as in all fields of science (Perker, 2004). Postgraduate architectural studies to be conducted on creating building and living spaces with high environmental consciousness are believed to make a significant economic contribution to Turkey that has a high building activity. In this sense, the objective of this study was to investigate the role of environmental awareness in postgraduate research on architecture in Turkey.

Literature on environmental studies were reviewed to determine several keywords that could present environmental awareness in postgraduate studies in the field of architecture (Bektas, 2012; Kislalioglu & Berkes, 2009; Sev, 2009; Tonuk, 2001; Uyar, 2009; Yasa, 2009). These keywords included “ecology”, “sustainable”, “environmental impact”, “climate”, “energy effective”, “thermal insulation”, “green building”, “life cycle”, “air pollution”, “quality of air”, “construction and demolition waste”, “global warming”, “emission”, and “greenhouse gas”.

Findings for Postgraduate Research in the Field of Architecture

In this study, records of Turkey Council of Higher Education were reviewed from early 1950’s to November 2014. During this period of time, 5415 master degrees and 1025 doctorates were done in the field of architecture. Postgraduate studies in architecture between 1950 and November 2014 comprised 1% of all postgraduate studies performed in Turkey (TurkeyCoHE, 2014). Review of Turkey Council of Higher Education’s records for postgraduate studies for environmental awareness in the field of architecture was initiated in 1992, the year of the Rio Summit. Findings from this review are presented below.

The number of postgraduate research on environmental awareness in the field of architecture by keywords is presented in the figure, which was achieved by a search in Turkey Council of Higher Education’s records using the keywords “ecology”, “sustainable”, “environmental impact”, “climate”, “energy effective”, “thermal insulation”, “green building”, “life cycle”, “air pollution”, “quality of air”, “construction and demolition waste”, “global warming”, “emission”, and “greenhouse gas” (TurkeyCoHE, 2014). The keyword “sustainable” had the highest rate in number as represented by the review. It was followed by “ecology”, “climate”, “energy effective”, “green building”, “life cycle”, “environmental impact”, “thermal insulation”, “air pollution”, “quality of air”, “construction and demolition waste”, “global warming”, “emission” and “greenhouse gas” respectively (Figure 1).

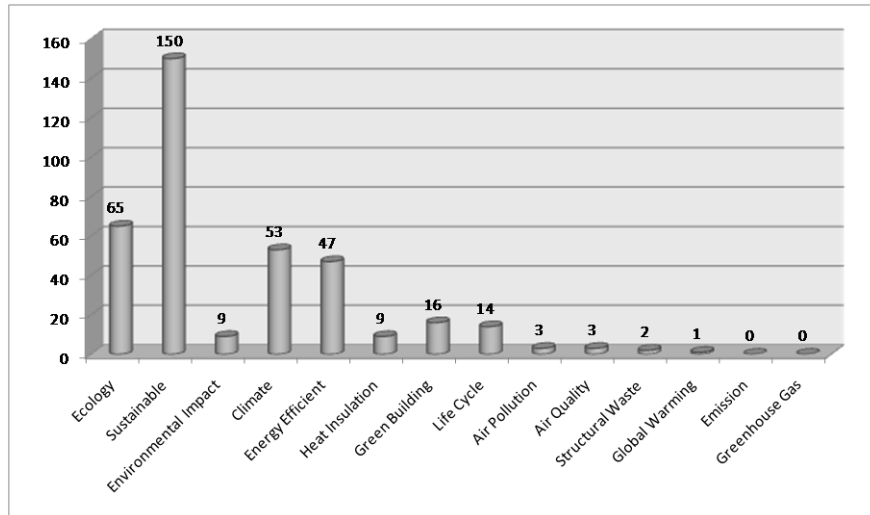


Figure 1: The Number Of Postgraduate Research on Environmental Awareness in the Field of Architecture by Keywords

A total of 1140 records were found in review of Turkey Council of Higher Education's database using the keyword "ecology". 6% of these records constituted postgraduate studies in the field of architecture (Figure 2). Of postgraduate architecture studies with the term "ecology" in their heading, 86% were postgraduate dissertations and 14% were doctorate dissertations (Figure 3). The distribution of study numbers by years is presented in Figure 4. Based on this number, the number of dissertations was very few in 1990's. The major reason for this is that policies for environmental awareness were newly created during that period across the world. The time period between 2010 and 2012 had the highest rate for the keyword "ecology" used in postgraduate studies in the field of architecture. The number of studies was significantly decreased in the past two years. On the other hand, the number of doctorate dissertations was approximately 1/6 of postgraduate dissertations (TurkeyCoHE, 2014).

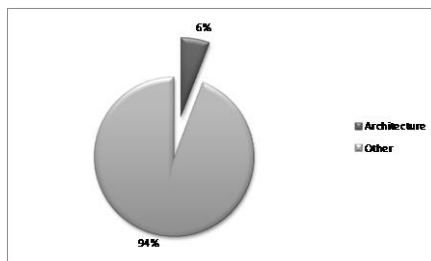


Figure 2: The Proportion of Architecture Studies on "Ecology" to All Studies on Ecology

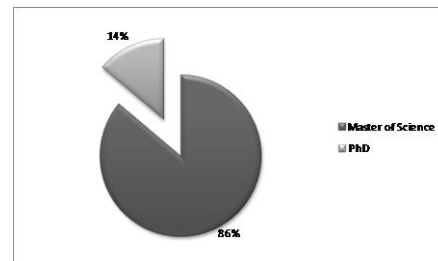


Figure 3: The Distribution of Architecture Studies on "Ecology" by Postgraduate and Doctorate Levels

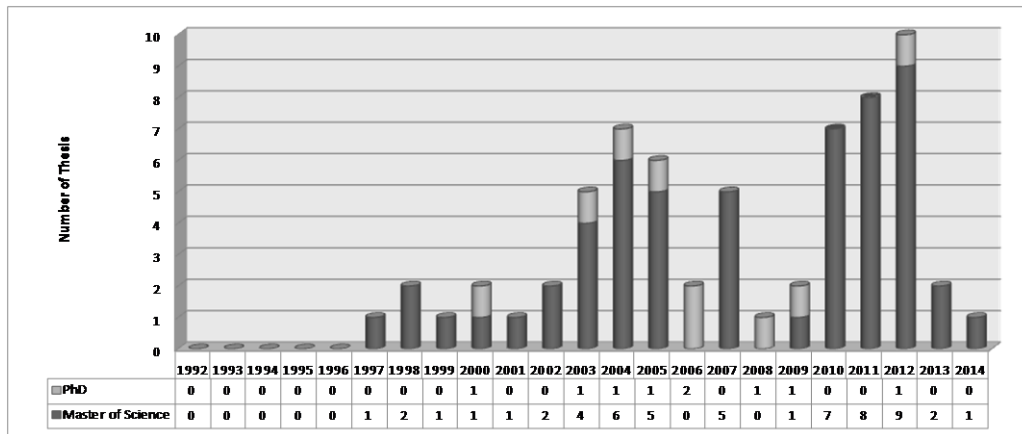


Figure 4: The Distribution of Architecture Studies on “Ecology” by Years

Postgraduate studies with the term “ecology” in their heading in the field of architecture make scientific contributions to ecologic urban planning, architectural design and ecology, smart buildings, high-rise buildings and ecology, ecological office buildings, ecological characteristics of traditional and rural housings, ecologic villages, ecologic building – aesthetics relationship, ecologic construction systems, building materials and ecology, energy in ecologic buildings, ecologic building – insulation relationship, and the relationship between ecological architectures and tourism (TurkeyCoHE, 2014).

A total of 739 records were found in review of Turkey Council of Higher Education’s database using the keyword “sustainable”. 19% of these records constituted postgraduate studies in the field of architecture (Figure 5). Of postgraduate architecture studies with the term “sustainable” in their heading, 83% were postgraduate dissertations and 17% were doctorate dissertations (Figure 6). The distribution of study numbers by years is presented in Figure 7. The time period between 2010 and 2013 had the highest rate for the keyword “sustainable” used in postgraduate studies in the field of architecture. The number of studies was significantly decreased in the recent year. In addition, the number of doctorate dissertations was approximately 1/5 of postgraduate dissertations (TurkeyCoHE, 2014).

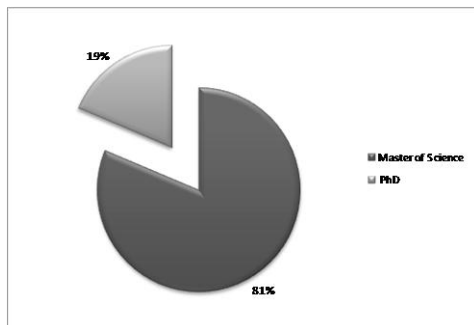


Figure 5: The Proportion of Architecture Studies on “Sustainability” to All Studies on Sustainability

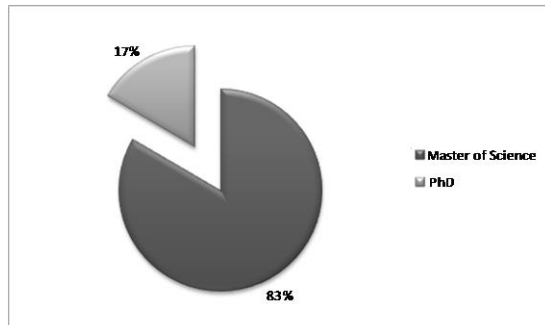


Figure 6: The Distribution of Architecture Studies on “Sustainability” by Postgraduate and Doctorate Levels

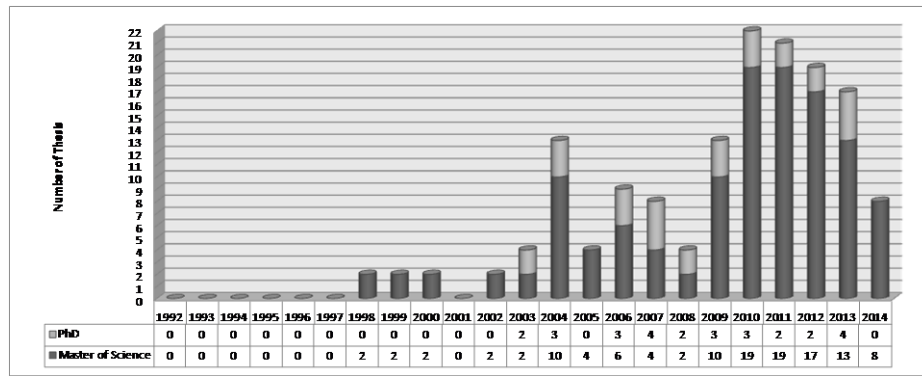


Figure 7: The Distribution of Architecture Studies on “Sustainability” by Years

Postgraduate studies with the term “sustainable” in their heading in the field of architecture make scientific contributions to the building industry including sustainable cities and planning, urban transformation – sustainability relationship, urban identity and sustainability, sustainability and building industry, sustainable design of long-span buildings, residential housings in terms of sustainable architecture, educational buildings in terms of sustainable architecture, accommodation buildings in terms of sustainable architecture, stadium constructions in terms of sustainable architecture, sustainability of high-rise buildings, sustainability of traditional and rural house architecture, architectural legacy management and sustainable tourism, sustainability and building certification systems, sustainable construction, illumination and sustainability, sustainable architecture and earthquake, sustainable architecture – energy relationship, sustainable steel constructions, sustainable building materials, sustainable architecture and smart materials, and information technologies and sustainable architecture (TurkeyCoHE, 2014).

A total of 208 records were found in review of Turkey Council of Higher Education’s database using the keyword “environmental impact”. 4% of these records constituted postgraduate studies in the field of architecture (Figure 8). Of postgraduate architecture studies with the term “environmental impact” in their heading, 78% were postgraduate dissertations and 22% were doctorate dissertations (Figure 9). The distribution of study numbers by years is presented in Figure 10. The years 2010 and 2013 had the highest rate for the keyword “environmental impact” used in postgraduate studies in the field of architecture; however in general the number of studies was very low (TurkeyCoHE, 2014).

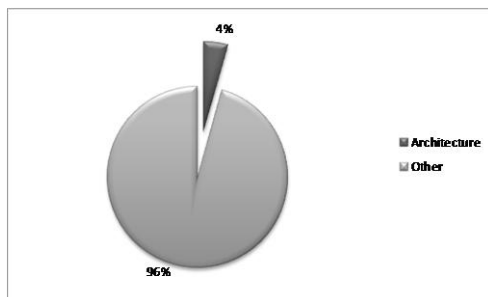


Figure 8: The Proportion of Architecture Studies on “Environmental Impact” to All Studies on Environmental Impact

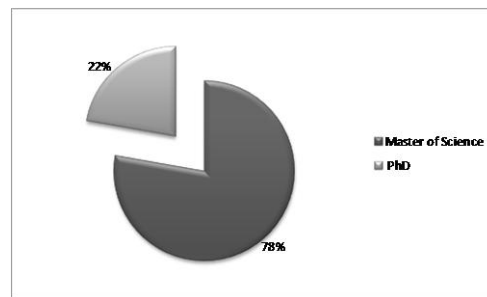


Figure 9: The Distribution of Architecture Studies on “Environmental Impact” by Postgraduate and Doctorate Levels

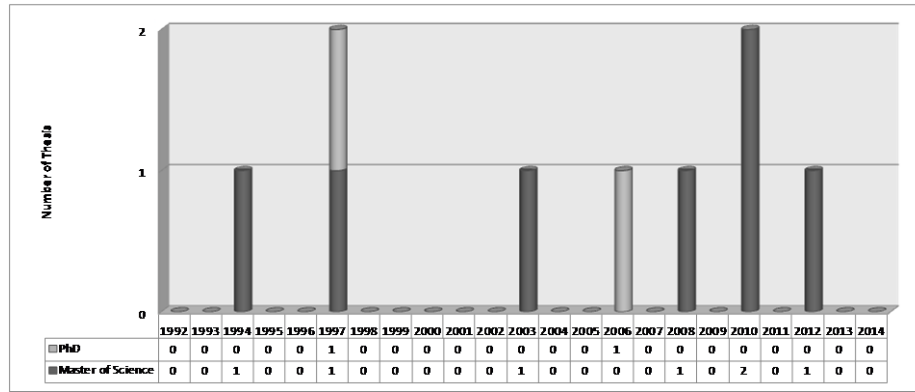


Figure 10: The Distribution of Architecture Studies on “Environmental Impact” by Years

Postgraduate studies with the term “environmental impact” in their heading in the field of architecture make scientific contributions to the building industry including environmental impacts of tourism architecture, building grading systems for environmental impacts, environmental impacts of buildings and recycle, and environmental impacts of thermal insulation materials (TurkeyCoHE, 2014).

A total of 778 records were found in review of Turkey Council of Higher Education’s database using the keyword “climate”. 7% of these records constituted postgraduate studies in the field of architecture (Figure 11). Of postgraduate architecture studies with the term “climate” in their heading, 75% were postgraduate dissertations and 25% were doctorate dissertations (Figure 12). The distribution of study numbers by years is presented in Figure 13. The time period between 2010 and 2011 had the highest rate for the keyword “climate” used in postgraduate studies in the field of architecture. On the other hand the number of doctorate dissertations was approximately 1/4 of postgraduate dissertations (TurkeyCoHE, 2014).

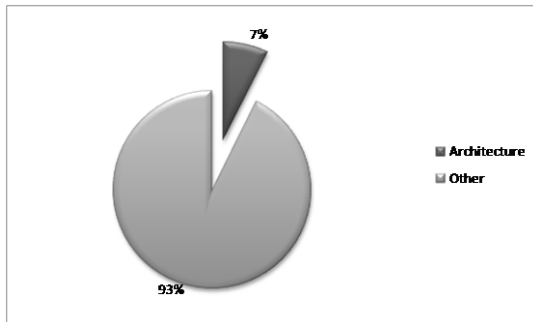


Figure 11: The Proportion of Architecture Studies on “Climate” to All Studies on Climate

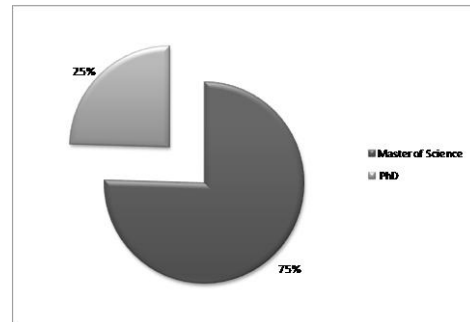


Figure 12: The Distribution of Architecture Studies on “Climate” by Postgraduate and Doctorate Levels

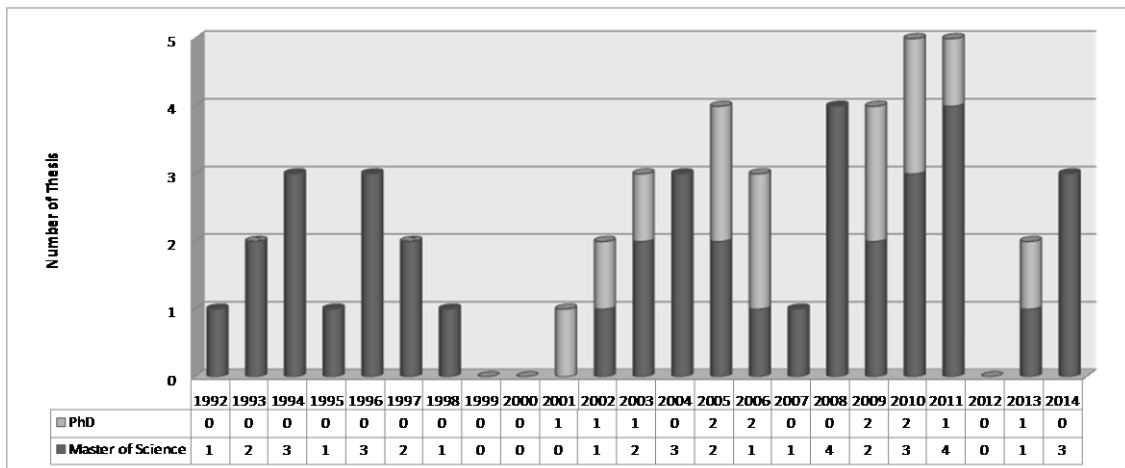
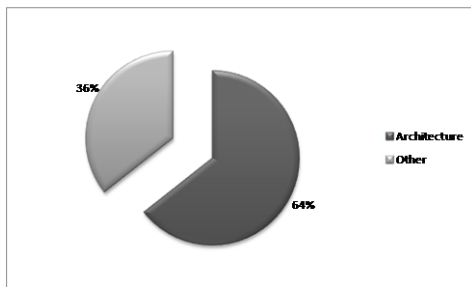
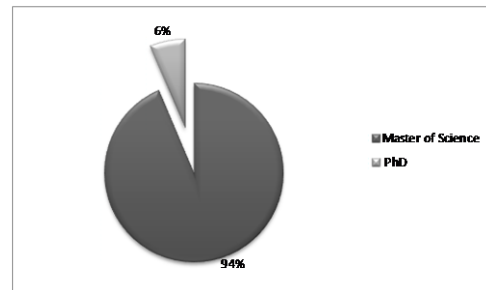
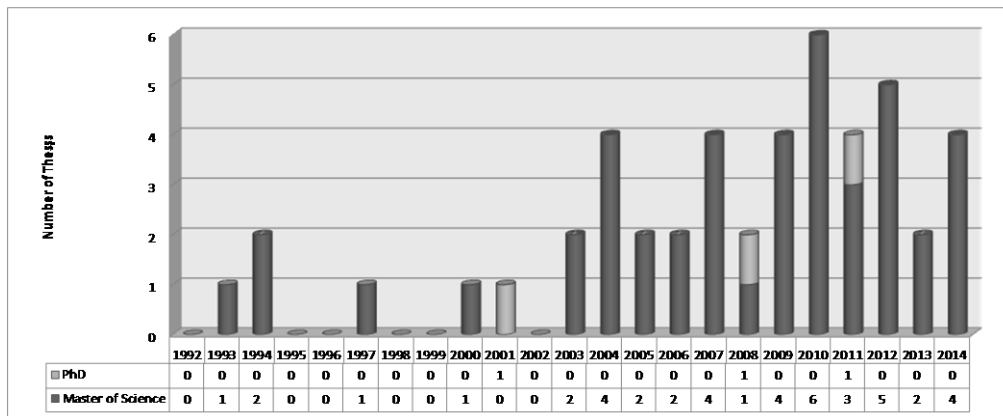


Figure 13: The Distribution of Architecture Studies on “Climate” by Years

Postgraduate studies with the term “climate” in their heading in the field of architecture make scientific contributions to the building industry including interaction of climate change of urban design, association of architectural design parameters with climatic data, relationship of air conditioning systems with the quality of in-building air, house design compatible with climate, the effect of climate on design in an environment with traditional structure, climatic comfort and energy economy, thermal performance of building components according to climatic zones, conservation of heating energy in cold-climate areas, conservation of cooling energy in hot-climate areas, and solar architectural components (TurkeyCoHE, 2014).

A total of 73 records were found in review of Turkey Council of Higher Education’s database using the keyword “energy-effective”. 36% of these records constituted postgraduate studies in the field of architecture (Figure 14). Of postgraduate architecture studies with the term “energy-effective” in their heading, 94% were postgraduate dissertations and 6% were doctorate dissertations (Figure 15). The distribution of study numbers by years is presented in Figure 16. The year 2010 had the highest rate for the keyword “energy-effective” used in postgraduate studies in the field of architecture. On the other hand, the number of doctorate dissertations was approximately 1/15 of postgraduate dissertations (TurkeyCoHE, 2014).

**Figure 14:** The Proportion of Architecture Studies on “Energy Effective” to All Studies on Energy Effective**Figure 15:** The Distribution of Architecture Studies on “Energy Effective” by Postgraduate and Doctorate Levels**Figure 16:** The Distribution of Architecture Studies on “Energy Effective” by Years

Postgraduate studies with the term “energy-effective” in their heading in the field of architecture make scientific contributions to the building industry including energy-effective settlement texture, energy-effective building design principles, improvement of energy effectiveness of building shell, energy-effective housings, enhancement of energy effectiveness of office buildings, educational buildings and energy effectiveness, energy-effective facade systems, energy-effective wall systems, energy-effective window types, energy-effective smart buildings, energy-effective buildings using renewable resources, energy-effective illumination design of mass housings, and energy-effective design criteria for outer illumination of buildings (TurkeyCoHE, 2014).

A total of 29 records were found in review of Turkey Council of Higher Education's database using the keyword "thermal insulation". 31% of these records constituted postgraduate studies in the field of architecture (Figure 17). All of the postgraduate architecture studies with the term "thermal insulation" in their heading was postgraduate studies. The distribution of study numbers by years is presented in Figure 18. The year 2012 had the highest rate for the keyword "thermal insulation" used in postgraduate studies in the field of architecture (TurkeyCoHE, 2014).

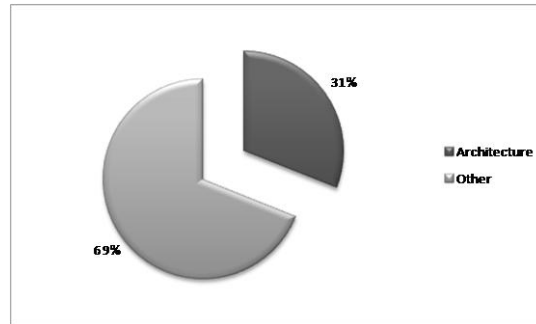


Figure 17: The Proportion of Architecture Studies on "Thermal Insulation" to All Studies on Thermal Insulation

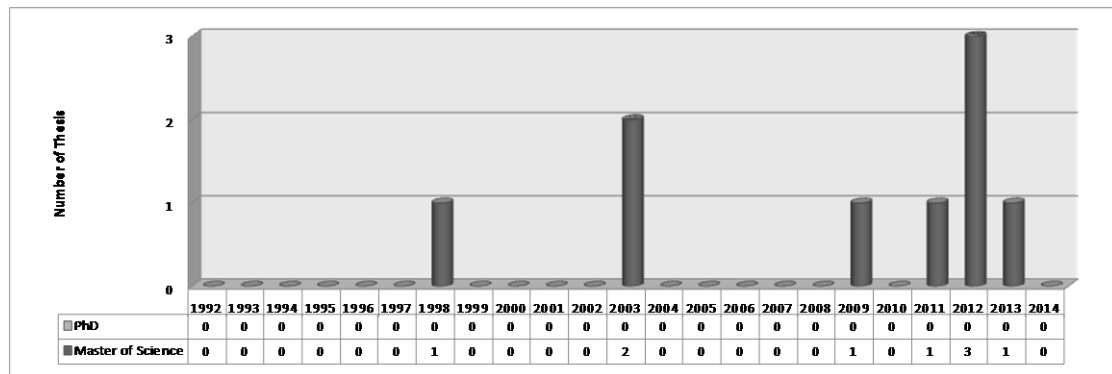


Figure 18: The Distribution of Architecture Studies on "Thermal Insulation" by Years

Postgraduate studies with the term "thermal insulation" in their heading in the field of architecture make scientific contributions to the building industry including thermal insulation problems of buildings, housing's exterior walls and thermal insulation, siding materials and thermal insulation, energy-efficient buildings – thermal insulation – cost interaction (TurkeyCoHE, 2014).

A total of 30 records were found in review of Turkey Council of Higher Education's database using the keyword "green building". 47% of these records constituted postgraduate studies in the field of architecture (Figure 19). All of the postgraduate architecture studies with the term "green building" in their heading was postgraduate dissertations. The distribution of study numbers by years is presented in Figure 20. The time period between 2011 and 2013 had the highest rate for the keyword "green building" used in postgraduate studies in the field of architecture (TurkeyCoHE, 2014).

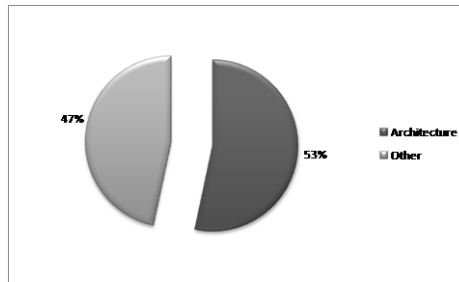


Figure 19: The Proportion of Architecture Studies on “Green Building” to All Studies on Green Building

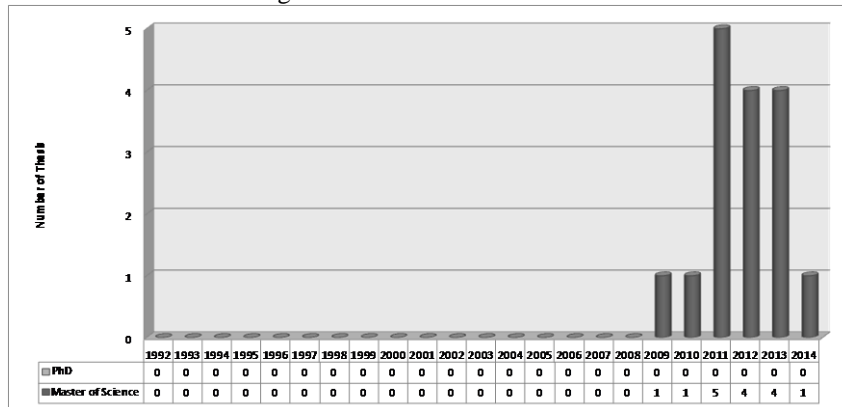


Figure 20: The Distribution of Architecture Studies on “Green Building” by Years

Postgraduate studies with the term “green building” in their heading in the field of architecture make scientific contributions to the building industry including green architectural principles, green building certification, project management of green buildings, the relationship between certification systems for green buildings and production of buildings, green roof performance in areas with different climates, landscape design – green roof relationship, and green roof in energy-efficient building design (TurkeyCoHE, 2014).

A total of 51 records were found in review of Turkey Council of Higher Education’s database using the keyword “life cycle”. 27% of these records constituted postgraduate studies in the field of architecture (Figure 21). Of postgraduate architecture studies with the term “life cycle” in their heading, 79% were postgraduate dissertations and 21% were doctorate dissertations (Figure 22). The distribution of study numbers by years is presented in Figure 23. The years 2005, 2007, 2010 and 2012 had the highest rate for the keyword “life cycle” used in postgraduate studies in the field of architecture. On the other hand, the number of doctorate dissertations was approximately 1/4 of postgraduate dissertations (TurkeyCoHE, 2014).

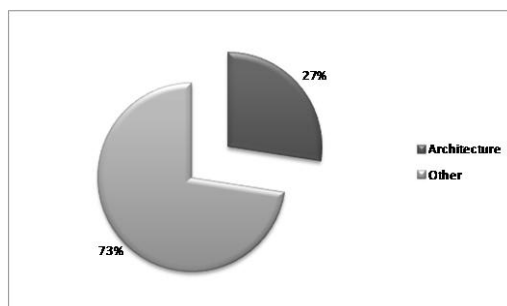


Figure 21: The Proportion of Architecture Studies on “Life Cycle” to All Studies on Life Cycle

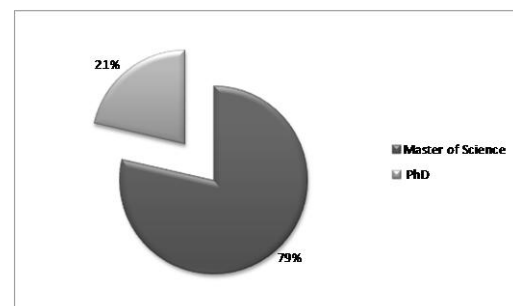


Figure 22: The Distribution of Architecture Studies on “Life Cycle” by Postgraduate and Doctorate Levels

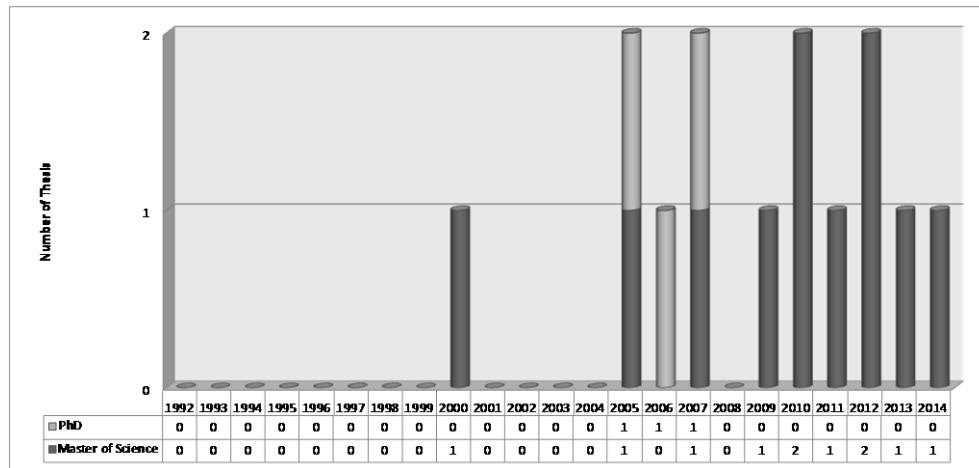


Figure 23: The Distribution of Architecture Studies on “Life Cycle” by Years

Postgraduate studies with the term “life cycle” in their heading in the field of architecture make scientific contributions to the building industry including housing design – life cycle relationship, life cycle – constructional cost relationship, life cycle analyses of building products, and evaluation of life cycle in renovation projects (TurkeyCoHE, 2014).

A total of 161 records were found in review of Turkey Council of Higher Education’s database using the keyword “air pollution”. 2% of these records constituted postgraduate studies in the field of architecture (Figure 24). Of postgraduate architecture studies with the term “air pollution” in their heading, 67% were postgraduate dissertations and 33% were doctorate dissertations (Figure 25). The years 2005, 2007, 2010 and 2012 had the highest rate for the keyword “air pollution” used in postgraduate studies in the field of architecture. On the other hand, the number of doctorate dissertations was approximately 1/3 of postgraduate dissertations. The total number of studies were 3, of these studies, 2 were postgraduate studies in the field of architecture performed in 2008 and 2010 and 1 was doctorate study in the field of architecture performed in 2008. These studies make scientific contributions to the building industry including effects of natural ventilation on reducing air pollution inside the house, building products – in-building air pollution relationship, and effects of air pollution on building materials (TurkeyCoHE, 2014).

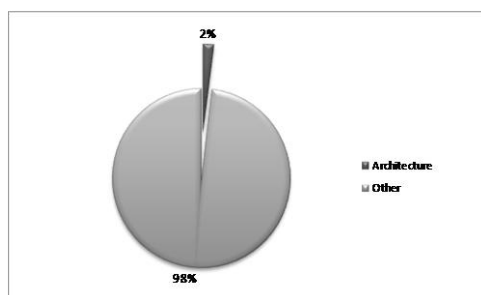


Figure 24: The Proportion of Architecture Studies on “Air Pollution” to All Studies on Air Pollution

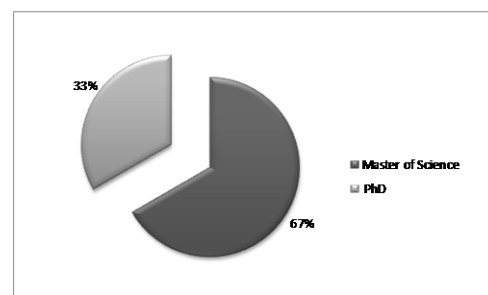


Figure 25: The Distribution of Architecture Studies on “Air Pollution” by Postgraduate and Doctorate Levels

A total of 65 records were found in review of Turkey Council of Higher Education’s database using the keyword “quality of air”. 5% of these records constituted postgraduate studies in the field of architecture (Figure 26). The number of the postgraduate architecture studies with the term “quality of air” in their heading was 3 and all of them was postgraduate dissertation. These studies were performed in 2004, 2007 and 2012, and make scientific contributions to the building industry including building design – interior environment’s quality of air relationship, and quality of interior air in educational buildings (TurkeyCoHE, 2014).

A total of 3 records were found in review of Turkey Council of Higher Education's database using the keyword "construction and demolition waste". 67% of these records constituted postgraduate studies in the field of architecture (Figure 27). The number of the postgraduate architecture studies with the term "construction and demolition waste" in their heading was 3 and all of them was postgraduate dissertation. These studies were performed in 2009, and make scientific contributions to the building industry including reducing construction and demolition waste, and investigation on how to recycle construction and demolition waste (TurkeyCoHE, 2014).

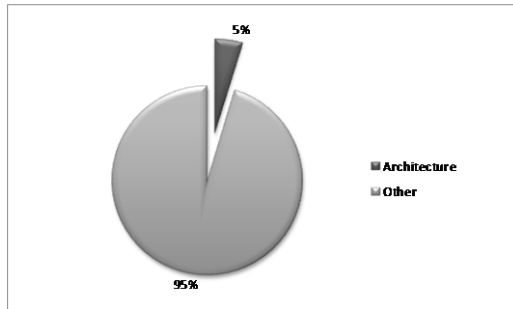


Figure 26: The Proportion of Architecture Studies on "Quality of Air" to All Studies on Quality of Air

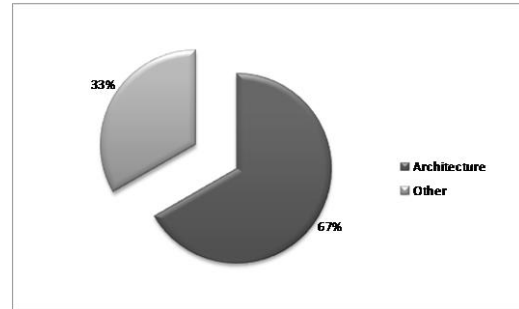


Figure 27: The Proportion of Architecture Studies on "Construction and Demolition Waste" to All Studies on Construction and Demolition Waste

A total of 39 records were found in review of Turkey Council of Higher Education's database using the keyword "global warming". 3% of these records constituted postgraduate studies in the field of architecture (Figure 28). The number of studies was 1 and performed as postgraduate dissertation in 2006. This study investigated the relationship of raised water level related to global warming with domestic architecture (TurkeyCoHE, 2014).

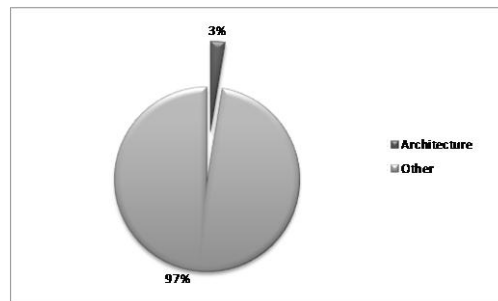


Figure 28: The Proportion of Architecture Studies on "Global Warming" to All Studies on Global Warming

A total of 540 records were found in review of Turkey Council of Higher Education's database using the keyword "emission", but none of them was related to architecture. A total of 19 records were found in review of Turkey Council of Higher Education's database using the keyword "greenhouse gas", but none of them was related to architecture (TurkeyCoHE, 2014).

DISCUSSION & CONCLUSION

This review suggests that environmental awareness had a certain role in Turkish postgraduate studies in the field of architecture. The number of postgraduate and doctorate dissertations was increased, which were performed in

the field of architecture between 1992 and 2012 and had keywords implying environmental awareness in their heading. In 2013 and 2014, the number of studies on several topics was neither decreased nor increased; however the number of studies on certain topics was decreased. In general, those dissertations have made significant contributions to the building industry from 1992 to the present day thorough their original subject. However, given the fact that building industry has a substantial share in development of Turkey, the number of postgraduate studies in the field of architecture appears to be low (INTES, 2014). Although building industry is affected by many industries, it is an industry which should be provided with research and development support mainly from architecture and civil engineering. In this sense, research in architecture becomes more important. Yet, based on records in the Turkey Council of Higher Education, the proportion of postgraduate studies in the field of architecture performed from 1950's to all postgraduate studies is only 1%, which needs to be increased (TurkeyCoHE, 2014).

The review of Turkey Council of Higher Education's database indicated that the rate of postgraduate studies on environmental awareness in the field of architecture was 6% in overall architecture studies. On the other hand, the review revealed that the number of studies on "ecology", "sustainability" "environmental impact" and "green building" was decreased over the past two years. Recently, Turkey has imported approximately 72% of the energy it uses, therefore it is vital that architecture postgraduate research on environmental awareness should be increased and scientific support should be provided to the building industry for the benefit of Turkey's national economy (AktifHaber, 2013; TurkeyCoHE, 2014).

In this study, the number of architecture postgraduate studies found by polling performed by the keywords "Environmental Impact", "thermal Insulation", "Air Pollution", "Quality of Air", "Construction and Demolition Waste" was significantly greater than the number of architecture postgraduate studies found by polling performed by the other keywords. Moreover, polling performed by the keywords "Emission" and "Greenhouse Gas" returned no studies on architecture (TurkeyCoHE, 2014). At first glance, it might be attributed to the indirect association of selected keywords with architecture. However, these keywords are directly related to both internal structure and production process of building products and materials. In this context, it becomes critically important to perform studies particularly on air pollution, quality of air, construction and demolition waste, emission, and greenhouse gas in cooperation with Environmental Engineering; and on thermal insulation in cooperation with Mechanical Engineering. Interdisciplinary studies need to be increased.

The review of Turkey Council of Higher Education's database indicated that the number of doctorate dissertations in the field of architecture was lower than that of postgraduate dissertations; and the review performed by the keywords "Quality of Air", "Construction and Demolition Waste" and "Global Warming" revealed that there were no doctorate studies on the relevant subject in the field of architecture (TurkeyCoHE, 2014). As known, doctorate studies make significant contributions both to the building industry and to the sciences. On one hand, doctorate studies performed in the field of architecture provide specific support to the building industry, and on the other hand they raise environmental awareness of undergraduates being educated by academics doing their doctorate. In this sense, it is required to increase the number of doctorate studies and to guide prospective academics into architecture postgraduate research on environmental awareness in the field of architecture.

The review performed for the study showed that dissertations were mainly focused on the relationship of urban and architectural design with sustainability and ecology; the relationship of housings, offices and educational buildings with ecology, sustainability, in this sense with energy and insulation; environmental impacts of buildings; and energy-effective walls, facades and fittings, and they made substantial scientific contributions to the building industry. Furthermore, the review demonstrated that there were no studies investigating health care – sports buildings, cultural buildings, social centers and administrative buildings for sustainability, ecology, environmental impact, energy, etc (TurkeyCoHE, 2014). These fields should be considered when selecting subjects for future postgraduate research. In addition, the review performed for this study suggested that studies on the life cycle were generally discussed as part of building; and the number of studies examining the relationship between building materials/products and life cycle was insufficient. In this sense, studies addressing building materials and products in detail should be performed and life cycle should be evaluated accordingly. In addition, we believe that postgraduate studies are needed to address production process of building materials and products in terms of ecology and effective use of energy, and interdisciplinary studies should be increased.

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