

HOW ACHIEVABLE IS BIOCLIMATIC DESIGN TO IMPROVE SUSTAINABILITY WITHIN THE MASS HOUSE BUILDING INDUSTRY?

RESEARCH PROPOSAL

Bethan Stroud

1702210

Module: Postgraduate Research Methodology
Tutor: Chris House

Contents

1.0 - Introduction	3
1.1 - Aims and Objectives	3
2.0 - Literature Review	4
2.1 - Bioclimatic Homes	4
2.2 - Do Homeowners Want Bioclimatic Homes?	5
2.3 - Are Bioclimatic Homes Expensive to Build?	6
2.4 - Mass House Builders and Issues of Sustainability	6
3.0 - Research Methodology	7
3.1 - Case Study	7
3.2 - Interview with Local Authority	8
3.3 - Desk Research	8
4.0 - Results and Evaluation	9
5.0 - Timescale	9
6.0 - References	10

1.0 - Introduction

The construction industry is a damaging sector in terms of sustainability and its environmental impact. To become more 'green' and lessening the impression which construction leaves on the environment is an important and growing topic, which is however not being explored enough by mass house builders within the United Kingdom. The largest house builders within the United Kingdom build tens of thousands of homes each year, the majority of which do not include sustainable, eco-friendly or bioclimatic features. The Author will be researching the challenges which are faced by the mass house builders to incorporate bioclimatic designs in to their homes, cost implementations and whether it is a viable way to increase sustainability within this sector. By carrying out this research it would expand understanding, achievability and knowledge for housing developers and their future possibilities of planning to incorporate bioclimatic design in to their homes. It will detail the obstacles and limitations to bioclimatic design, which forms the basis of the Author's hypothesis that mass house builders would not utilise bioclimatic design due to the cost of installation and the effect on profit margins.

1.1 - Aims and Objectives

The aims of the research are to:

1. To identify obstacles and challenges with integrating bioclimatic design in to the mass house building industry.
2. To recognise if bioclimatic homes are viable and realistic construction methods within the mass house building industry.

To achieve the above aims, the following research objectives should be met:

1. Identify the cost implications of integrating bioclimatic design in to mass, newly built homes.
2. Explore the bioclimatic methods which would be appropriate to be utilised by mass housing developers.
3. Are bioclimatic homes a viable option within the housing sector and for the end user?

The Author believes these are appropriate and realistic aims and objectives to achieve within the research, as well as providing information which would answer the questions a housing developer would ask and assess prior to integrating bioclimatic and sustainable methods in to their homes. The Author recognises that there are many aspects of sustainable construction within the industry, however felt that the housing sector is one which does not fully utilise the available methods, especially among large housing developers. It is also recognised that there are many available methods to create sustainably built homes, but the research will be focussing on the bioclimatic processes and use of the surrounding environments. These barriers must be laid to outline the specific research the Author will be carrying out.

2.0 - Literature Review

To form the background of the Author's research, a literature review has been carried out to establish existing knowledge within the research area, as well as providing the basis to the exploration. It is important to outline the research issues and to critically evaluate this data to provide and ensure correct groundwork material within the research. In addition to this, it is key to criticise and discuss the existing literature to establish further understanding in the area. The Author will be reviewing existing information regarding bioclimatic homes, their background, how successful the homes are in use, known cost implications and mass housing developers current known stance on sustainability.

2.1 - Bioclimatic Homes

Bioclimatic homes are not a new ideology within construction. It has been used for centuries, before the modernisation of constructing homes. Houses were required to utilise their environments, surroundings and locations to ensure efficiency. *"The Bioclimatic Architecture is the design and construction of buildings taking into account the climatic and environmental conditions: The Sun, the vegetation, the rain, the winds, the altitude, the land ... If we know well those conditions and we build according to them , we can take advantage of its benefits and adapt better to the environment. For centuries, man has learned to build his houses with bioclimatic criteria: which wall should have the most windows, where should you put blinds, on which side of the mountain is sunlight better used, how should you protect yourself from the winds? For this reason, traditional architecture is bioclimatic. As construction has become massified today, homogenizing it to reduce costs, we have moved away from that model. And we must recover it to improve our health and that of the planet."* (Carme Espinosa Rufat, 2020). Rufat is an experienced Architect who has previously studied *"a Masters in Environment and Bioclimatic Architecture at the Polytechnic University of Madrid"*, bringing reliability to her work and knowledge which will be important to establishing the groundwork to this research. The literature Rufat provides in her work is coherent to the work the Author is studying, and will be useful to gain in-depth case study examples to review within the research. Rufat goes on to mention that she is *"a member of GEA Association of Geobiological Studies), a member of the Plataforma de Edificación Passivhaus (PEP)"* which brings further influence to her as a source.

Another credible source to refer to within the Author's research is Smart Houses Portugal, although this is a business and not an academic's literature, the business obtains many certifications and large experience with building bioclimatic homes and knowledge of architecture. *"Although the term is recent, bioclimatic architecture is not new. Indeed, since the early days of building, local climate and environment were taken into account during the design phase. Even more recently, before the use of fossil fuels for heating became more widespread the bioclimatic rules were applied. Indeed, the sun was used for heating in winter and the buildings in the surrounding area were used to protect against excessive heat in summer. It is necessary to orientate correctly the house in order to take maximum advantage of solar gains in winter and to limit solar gains in summer. For this reason, we recommend to place the least used rooms to the north, such as the bathroom, garage, laundry room, traffic areas or stairwell. They will act as a buffer zone that will reduce heat loss from walls in contact with these areas by up to 30%. We will favor the living spaces in the Southwest (living room and dining room) and the bedrooms in the East."* (Smarthouses Portugal, 2019). The source gives relevant information, inline with Rufat's previous literature, as well as information regarding the construction and methods

of bioclimatic architecture. A point which the Author would raise is that both of these sources are from Spain and Portugal, and found many other sources from other European countries which seem to be warmer in climate, giving the impression that bioclimatic architecture is more highly used outside of the United Kingdom due to the lack of warmer weather. However, warmth and sun is not the only utilisable method to integrate in to bioclimatic design and architecture. Smarthomes Portugal are admittedly an experienced construction business which the Author can review a portfolio buildings to add to research, although there may be subject of bias among the data due to the nature of the business.

2.2 - Do Homeowners Want Bioclimatic Homes?

To be able to gather information on whether bioclimatic houses are even wanted by homeowners, to form apart of the research, the Author would require literature and data on a large group of homeowners. This is an important aspect to touch upon, although not in-depth, to find out whether homeowners would even want to purchase a home of a bioclimatic and sustainable nature. Andrea et al have published an article for Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, Greece, which provides detail of *The Citizens' Views on Adaptation to Bioclimatic Housing Design*, which contributes massively to the Author's knowledge and research. As previously highlighted in section 2.1 - Bioclimatic Homes this article is based on Greek homes, utilisation of the warmer climate and some differentiated methods of construction which would not be within the United Kingdom. With that said, the article and Andrea et al's research would be very relevant to this study, up to date and including subject specific data without the possibility of bias. The research was carried in the Municipality of Orestiada, mainland Greece. *"To estimate the sample size, pre-sampling was implemented. The sample size was determined as being 50 citizens. Thus, for each quantitative variable, its variation or standard deviation was determined, and for each qualitative variable, the proportion was calculated. The majority of the citizens agreed that there is need to embrace bioclimatic housing design by the design phase of the buildings that will passively meet their needs for heating and cooling. In particular, more than half of the residents (55.8%) totally agree to its implementation in houses, while an important percentage of 35.5% also agrees. 7.5% of the citizens have no opinion as they stated neither agree nor disagree. Finally, a small percentage of 1.2% disagree and consider that bioclimatic design is not necessary in homes."* (Andrea et al, 2020). The article goes on to mention that more than a third of the citizens have larger than average window openings on the North side of their homes and less on the South, which does however contradict the correct positioning which Smarthomes Portugal highlights in section 2.1 - Bioclimatic Homes to achieve an efficient bioclimatic design. This information is important as housing developers do not accurately plan, or consider the appropriate orientation of homes and how it can maximise efficiency. This would not necessarily incur a cost for the developer, which will be further detailed in the following section 2.3 - Are Bioclimatic Homes Expensive to Build?

2.3 - Are Bioclimatic Homes Expensive to Build?

The Author found it difficult to find information regarding costing of a bioclimatic home in the United Kingdom, however this will be further investigated within future research. The Author also found that many articles and documents were referring to Passivhaus, which would significantly increase the cost of construction a home. Bioclimatic design is not the same as Passivhaus standard and it is important to highlight this to avoid confusion to the reader. Regarding the cost of homes utilising bioclimatic methods, it is clear that there is not a lot of knowledge documented to research. The Author believes that this is due to the lack of difference in cost to implement bioclimatic architecture, as well as lack of knowledge and utilisation within the United Kingdom. The orientation of a house would not necessarily cost any more money to construct, and would not see a significant cost in increasing the natural light within a building. Figures and data will be further researched to illustrate accurate costs and limitations for housing developers. The Author will also research the cost saving to the end user and energy usage saving.

An article which briefly referred to the lack of cost of bioclimatic design and architecture is Dania González Couret who wrote in Sustainability, Energy and Architecture, 2013, *"The 'bioclimatic solar house' was the first experimental project developed as the conclusion of research carried out from 1981 to 1984 and awarded in 1985. The aim was to show that bioclimatic design was not as expensive as some people thought, and that it was possible to use renewable energy even in less expensive houses. However, the relationship between bioclimatic architecture and the specific design for a site was not clear enough at that time. This is why the research ended up offering two prototype projects, to be located in a context specified afterwards, taking into account only their recommended orientation"* (Couret, 2013). The Author believes although the information regarding cost is not thorough due to the lack of figures, it is still understood even in the 1980's that inexpensive bioclimatic design could be used. Further investigation in to these passages would be required to discover if Couret provides explanation or back-up to costs to implement these features.

Couret also highlights the possibility for savings in costs, utilising rain water and natural illumination which would reduce energy costs. *"Tilted roofs allow convective ventilation to remove hot indoor air through upper windows, which appropriately protected from the sun, but allow diffuse daylight to enter. This is reflected from the internal surface of the tilted ceiling to enhance indoor natural illumination. The tilted roofs also allowed rainfall collection to be used in the toilet. This consumes 50% of the domestic water."* (Couret, 2013). The ability for a homeowners to retain rainwater for use would significantly reduce water bills, resulting in usage savings by implementing bioclimatic design. The saving is obviously dependent on the size of house and amount of users in a home, but would be an effective bioclimatic methods for homes in the United Kingdom.

2.4 - Mass House Builders and Issues of Sustainability

The Author believes the following article considers costing relevance among mass house builders, which has been written by Davis Langdon for the Department for Communities and Local Government in 2011. Although the document is ten years old, it still refers to the importance of cost, energy ratings, emissions and material quality among a variety of homes. The document is a reliable piece of information for the Author, exploring the cost implications of reaching mandatory emissions. This is something which all mass house builders must achieve which does come at a cost, which results in these emissions not being met or implemented by local authorities. Although it is not necessarily based upon

bioclimatic design, it explores and compares materials and methods which are used by housing developers, showing cheaper and less efficient methods are utilised in order to enlarge profit margins. Profits are a significant importance to mass housing developers, which has received a lot of negative attention in the media. A point which the Author would like to raise is that with the integration of bioclimatic design and architecture, it can save the reputation of many businesses and controversial media coverage. Langdon highlights the choice of materials which do not comply or meet mandatory emission allowances. *“The Code for Sustainable Homes is a national sustainability standard for the design and construction of new homes. In order to minimise the environmental impact of new homes, in particular energy use and CO2 emissions, Building Regulations are to be tightened over the coming years to improve the energy efficiency of and reduce carbon emissions from new homes. The Code is a voluntary standard and there are currently no plans to make it mandatory at the national level. However, the Code is increasingly being adopted by local authorities as a planning condition for new developments, and any social housing schemes seeking government funding must currently achieve at least level 3 of the Code”* (Langdon, 2011). The Author is concerned about the fact that The Code is a voluntary standard to follow and is not implemented on a national level. This will be further researched to 2021 regulations and if this is still the case. The Author believes that is there is not any regulation surrounding this, mass housing developers will not willingly submit to implementing bioclimatic designs or architecture. Although this is not a main objective or aim within the research, the Author believes it is important to briefly discuss this point due to the sustainability issue that surrounds the lack of policy among emissions and newly built homes.

3.0 - Research Methodology

To carry out the research methodology, the Author will be using multiple methods to ensure accurate, reliable and a variety of subjective information is obtained. The following section will explore the methods which will be tackled to carry out the research to complete the project. By gathering information from a variety of sources, it will ensure the methodology to be equal and sound, resulting in the Author to come to an unbiased conclusion of the results and evaluation.

3.1 - Case Study

One research method which the Author will be carrying out, is the assessment of a case study. The case study will be based on a test house, with volunteer family, which is being built by a mass housing developer to monitor and trial a new ‘green homes’ method of construction. The volunteer family will not be contacted, nor will they be apart of the research in discussion. The Author will be assessing the methods which the mass housing developer has incorporated in to the green home, as well as the cost implications to the developer, possible savings for the family and overall corporate standing on bioclimatic homes. To support the case study, an interview will also be completed to gain further knowledge and background on the case. It will obtain qualitative information to assist the quantitative aspect of the research, creating a well-rounded source. The Author believed that an interview with a senior member of staff with the housing developer would be important to assist with the case study, as it will provide the opportunity to obtain further information compared to just assessing the case study. It will create discussion and the ability to add any further questions and information which may not have been found within the case study. Due to the unforeseen circumstances in 2020, it may

become difficult to carry out said interview as per Covid-19 restrictions. However, if restrictions are not lifted in time to carry out an 'in person' interview, this can be carried out over the phone or via email. The Author does however see a disadvantage to carrying out an interview by email as it can limit discussions. Another disadvantage to the case study is the timescale. The case study will be carried out for two years to gather information regarding the monetary savings from the volunteer family, but this case study and interview research is planned to be completed by August 2021.

3.2 - Interview with Local Authority

The Author will also be carrying out an interview with a member of the local authority. This is an effective method of research as it will contrast to the case study and interview with the mass housing developer, as they would often be expected to have differing opinions on sustainability and the idea of bioclimatic design and architecture. The interview may also be prone to issues resulting from Covid-19 restrictions, but as per the interview with the housing developer, it can be carried out via phone or email. The Author has not generated a full and detailed list of interview questions, but would ask questions such as:

1. What can mass housing developers do to increase sustainability within their homes, as well as during the construction process?
2. What is the opinion of incorporating bioclimatic design and architecture in to mass built new homes?
3. Does the Local Authorities believe there are challenges faced by mass housing developers to create more sustainable homes?
4. Is it believed that bioclimatic homes are a viable option to achieve sustainability within the local area?
5. What legislation does the Local Authority enforce to mass house builders to ensure sustainability in your area?

It is important for the Author to gather a full understanding of the Local Authority's enforcements, opinion of sustainability and also among mass housing developers within the local area. These questions are currently examples and will be further developed, as well increasing the quantity of questions asked. A plan will be put in place to ensure all aspects relevant to the research are discussed. This will also be completed for the case study and interview.

3.3 - Desk Research

The Author will also carry out desk research. This is secondary quantitative research, as the information has been provided from the research of someone else. It is ready available data, information and sources, which can assist with the Author's primary research. The secondary research can back-up primary research outcomes if the work correlates, provide substantiation or even contrasting points of view for discussion within the Author's results.

4.0 - Results and Evaluation

The results which are expected to be collected are of quantitative and qualitative data to be able to answer and achieve the research aims and objectives. It will be important to find out the cost implications of implementing bioclimatic design and architecture in to mass built homes, as well as the opinion of a variety of stakeholders in the case. This will ensure the Author to gather a fair and unbiased conclusion to the research. Limitations to the research and results will be timescale, as previously mentioned within 3.1 - Case Study. The volunteer family are due to be living in the green home for two years, to be able to gather accurate figures of savings, comparing cost to outcome and whether this is a viable option for the mass housing developer. As this case study research is due to be completed by August 2021, it will be completed before the detailed outcome information will be available. Another limitation will be the Covid-19 restrictions on conducting interviews. The interviews will most likely be carried out via email or phone, which can restrict the ability for discussion and topics which may not have been asked but still important to the research. This will ensure the Author to carry out a detailed plan to cover all areas. Among the results, the Author will be costing and comparing the difference between a standard mass built home and one with bioclimatic features. This may become difficult due to the lack of information and gap in the bioclimatic market within the United Kingdom. The Author may need to use the secondary research to assist with the costing of a bioclimatic home, with figures and data from warmer climate countries as there has been a higher quantity of bioclimatic homes built in areas such as Spain and Portugal. It will be important to assess the building features and methods and whether they would be relevant to a home in the United Kingdom.

The research will be an important item of research for mass housing developers to expand knowledge in bioclimatic design and architecture. Although there will be limitation, as mentioned above, it will contribute to the methods of sustainable construction for housing developers. With the ever-changing trends and needs from the consumer, the United Kingdom is lacking in new and up to date methods for mass built homes, with very few incorporating sustainable methods. This research is unlike others written or carried out within the United Kingdom, as existing knowledge is based abroad and irrelevant to British climate and consumer needs. With the weather and rain which is most common, bioclimatic homes need to accommodate for this, rather than the existing data which is based upon hot and sunny climates, not seen often on home soil.

5.0 - Timescale

The research will be completed by September 2021, with the research methodologies being completed by August 2021, giving the Author time to complete the research document. It is planned for the interviews and case studies to be carried out between June and August 2021, which will allow approximately eight weeks to accommodate for the senior member of staff at the housing developers and the member of the Local Authority's own commitments. Prior to then, the Author will be completing a plan for questions to ask both parties, as well as commencing desk (secondary) research.

6.0 - References

- Carme Espinosa Rufat, Arquitectura y Salud, 2020, Bioclimatic Architecture, www.arquitecturaysalud.com/en/bioclimatic/bioclimatic-architecture [Last visited 11/03/21].
- Dania González Couret, Sustainability, Energy and Architecture, 2013, www.sciencedirect.com/topics/engineering/bioclimatic-architecture [Last visited 15/03/21].
- Davis Langdon, Department for Communities and Local Government, Cost of building to the Code for Sustainable Homes, Updated Cost Review, 2011.
- Smarthouses Portugal, 2019, Bioclimatic Architecture, www.ecopassivehouses.com/bioclimatic-house-in-portugal/ [Last visited 11/03/21].
- Veronica Andrea, Stilianos Tampakis, Paraskevi Karanikola and Maria Georgopoulou, 2020, The Citizens' Views on Adaptation to Bioclimatic Housing Design: Case Study from Greece, Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, Greece.