

Individual Project

To what extent is Singapore environmentally conscious?

Exploring whether this is the home of sustainable architecture and the roots for the future.



ATARAXI

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Abstract

In order to discover if Singapore is environmentally conscious, I began researching the architectural history and the adaptations being made to current and new developments, considering the premise of sustainability. This made it clear that action is being taken in Singapore and that there is potential in reaching net-zero structures. I wanted to explore general and professional views on the matter and so I constructed multiple surveys and discovered the tremendous amount of support towards sustainability, as also reflected amongst Singaporean architects. I pursued analysis of secondary sources to discover that the government and architects are working alongside one another to achieve environmental serenity through sustainable building regulations. I found the architectural style to be incredibly successful in Singapore and vastly superior to the UK, despite strong evidence suggesting that it will spread across the globe, given appropriate resources. The findings of the study concluded that sustainable architecture is vital for the future of the world and sustainable architecture is an example of the path we must take, as queried in the title.

Introduction

We are in the midst of a global tragedy. Day by day, the global climate degrades due to the lifestyles and acts of the human race at an accelerating rate; it is no mystery why it is critical that we alter our ways if we wish to maintain living standards on this planet for any longer. This is supported by Greta Thunberg, a popular activist, in describing it as '*the biggest crisis humanity has ever faced*'.¹ Fortunately, there are countless ways of going about the issues such as recycling, 'green' energy sources and electric vehicles yet one area in particular that I would like to focus on is how we can improve environmental standards through architectural methods.

Unfortunately, people in the masses continue to deny this is a real issue and label climate change as nothing more than a myth, leading to further harm and only shortening humanities' time on the Earth. Overall, this project's purpose is to research the procedures taken in constructing sustainable architecture, collecting public opinion and assessing its effectiveness. Concluding this project, I aim to have more evidence against those who oppose the fact of climate change, leading to more awareness and action taken for our planet through architecture as building design plays a crucial role in the quality of life of both humans and nature.

Singapore is the prime example of sustainable architectural development and this highlights a very personal connection for me in not only the subject area, but the setting. Architecture is my dream career path and I find that the architectural styles taken here are incredibly captivating for me, making becoming an architect in Singapore my dream for quite some time. I find myself striving for this future for myself everyday, keeping up to date with current news as well as working with an architecture practice (D2 Architects). Henceforth, this project is truly significant for my future endeavours as well as the weight it carries in improving the planet. My findings may lead to the path which must be taken for the future of our planet's climate, showing how this is far bigger than myself or anyone else.

¹ <https://lithub.com/greta-thunberg-this-is-the-biggest-crisis-humanity-has-ever-faced/>

Aims and Objectives

- Aim 1 -

To understand how Singapore was originally built and the changes being made to existing and future buildings to make them sustainable.

Objective 1a - To investigate the roots of Singapore's architecture and infrastructure since it has been founded.

Objective 1b - To discover the importance of sustainable architecture and why it is necessary.

Objective 1c - To explain the adjustments made to existing property and implementation of sustainable architectural practices on new structures in Singapore.

- Aim 2 -

To collect and analyse public opinion on the implementation of sustainable architecture in Singapore, in addition to its success.

Objective 2a - To collate general and professional views and understanding of sustainable architecture as a whole.

Objective 2b - To collect opinions on the matter of sustainable architecture integration across Singapore.

Objective 2c - To analyse how the topic is being handled by architects and the government and how action is being taken in terms of the environment through architecture in Singapore.

- Aim 3 -

To assess the success of implementing sustainable architecture into Singapore in comparison to other countries and how this may impact the world.

Objective 3a - To evaluate the effectiveness of sustainability through architecture in Singapore.

Objective 3b - To contrast environmental advancements within construction in Singapore and the UK.

Objective 3c - To consider whether other countries around the world (including the UK) may follow Singapore with the environmental aspects of architectural design and how they may do this.

Rationale

Aim 1

In order to understand how Singapore has changed over time from its original style of architecture to what is in place today, I will investigate the past using various secondary sources which have documented the different types of architecture used since Singapore was founded. My first example will be from Wikipedia and I am aware that this is not a very credible source yet given the focus of my project, this is a strong foundational stepping stone and will fulfil its purpose in setting the scene surrounding the topic. Following this I will move onto more specific points from an article explaining the history of Singaporean architecture available on 'Rethinking the Future,' as this is a well known global architectural platform which is respected in the community. Moreover, I will reinforce any claims made by these sources if necessary, with evidence found in supporting bodies who shall also be referenced. I shall investigate and understand what sustainable architecture is as defined by the World Commission on Environment and Development and how it is explained by 'Barker Associates' and how critical it is to our worlds' future by taking statistics into account. I shall move on to study current developments being made in Singapore in transforming existing structures and why it's being done. The sources for this consist of 'Construction Plus Asia' and 'Architect Magazine' which describe how sustainable architecture is currently being achieved in Singapore. All the above are reliable given that professionals within the field have written these and are published by very reputable sources. Ultimately, I aim to discover how sustainable architecture in Singapore is possible through both repurposing old structures and creating new buildings under a set of rules introduced by the government, completing my aim.

Aim 2

For me to collect and analyse public opinion on Singapore's sustainable architecture I will use a variety of different source types. Initially, I will conduct my own primary research with surveys catered to my project's needs, consisting of targeted sample groups from my college and members of the architecture industry for both general and professional views. This will allow me to ask another set of questions (both open and closed), further expanding and increasing my range of research in a truly efficient manner, providing me with qualitative and quantitative data sets. I shall utilise secondary sources of information such as the data hosted on 'OpenAir RGU' in 'An evaluation of sustainable construction perceptions and practises in Singapore' due to its relevance and in-depth responses from its highly educated sample size. I will ensure that I am utilising secondary sources from the Singaporean government website to discover how they are handling the situation, due to its reputability and relevance in documenting the government's approach to sustainable architecture. Furthermore, I will investigate the roles and work of architects in relation to government guidelines in an effort to assess any progress being made, as showcased on architecture firms websites.

Aim 3

As a means of studying the effectiveness of sustainable architecture in Singapore, I will utilise secondary sources which document the carbon emission and footprint changes before and after the implementation of this style of construction. An article from 'The Straits Times' proves to be very promising in the documentation of these statistics as well as a video from 'World Economic Forum Singapore' discussing the effectiveness of the design style. These

sources are very reliable due to the educated authors and reputable sources making the information within extremely valuable in my writing. Following this I will venture into the research of sustainability through architecture across the UK, still having secondary sources accommodate my needs through texts discussing the design's use in the UK. The site 'PBCtoday' hosts a very informative article discussing the implementation of sustainable architecture in the UK which I will analyse and evaluate myself. I will use secondary sources to consider whether the style will be adopted by other countries and spread across the globe by analysing potential issues and means of approaching these. Resources for this area of research consist of a page on 'Eco Warrior Princess,' which documents cases of sustainable architecture already blossoming around the world. This is a very trustworthy source as the entire basis for the organisation is to define living 'green,' making it perfect for the premise of my study.

Findings, Evaluation and Analysis

Aim 1: To understand how Singapore was originally built and the changes being made to existing and future buildings to make them sustainable.

Objective 1a: To investigate the roots of Singapore's architecture and infrastructure since it has been founded.

Despite being a newer country when compared to the rest of the world, there is a great variance of architectural styles since the founding of Singapore. Originally, the architecture style matched the surrounding areas, taking on the Malay's traditional approach with the structure supported by wooden beams which raised it from the surface whether it be water or land. In spite of utilising these structural features consisting of woven bamboo, wooden screens and meranti floorboards, there is evidence to suggest that there were some considerably larger and structurally sound buildings made from sandstone, yet extremely little of either remain today².

Following the colonisation of Singapore by the British in 1819, Sir Stamford Raffles proposed the 'Raffles' Plan of Singapore,' which went into great detail about city planning and building material usage and leaned towards the Malay style yet the Europeans favoured a sturdier approach. This can be seen in the creation of shophouses, many of which stand today, built from tiles and bricks. Furthermore, black and white houses were made available to the wealthy and highly ranking officers as a premium over others. Further European influence may be seen within the 'Arts House,' and the prevalence it still has to this day in the way it almost captures the essence of Greek temples or even the White House. Amongst many others, this architectural style's implementation shows the vast array of buildings in Singapore.

The 1950s brought public housing in the form of highrise buildings to accommodate increasing population and accommodate communities appropriately yet not particularly comfortably. Structures like these lead to great deals of pollution and overcrowding when done incorrectly yet it did not take long for the new replacement to find a balance. The Housing and Development Board brought innovation into public housing, leading to greater hygiene, new technological implementation and ultimately happiness³. These builds also took on more unique designs and brought excitement to the skyline which the prior block flats lacked.

Brutalist architecture⁴ also found itself scattered throughout Singapore, such as in the Gold Mile Complex and the OCBC Centre yet have gradually been phased out of recent projects. In a stark contrast to this style, arguably the most iconic addition to the skyline has been implemented in only the last ten years: the Marina Bay Sands. Whilst this is far from the typical residential building, there are still some sustainable features boasted on their website, leading to a reduction in their carbon footprint by 30% since 2012. Contrastingly, the likes of the School of Arts has adopted a sustainable approach to construction through 'critical regionalism' which we may now see many other buildings embracing in recent years with the increasing concern and prevalence of the environment.

² https://en.wikipedia.org/wiki/Architecture_of_Singapore

³

<https://www.re-thinkingthefuture.com/architectural-styles/a3076-evolution-of-architecture-in-singapore-through-15-structures/>

⁴ <https://www.architecture.com/explore-architecture/brutalism>

A key tourist attraction for anyone in Singapore is the Gardens by the Bay⁵. Once again, whilst this is not a residential location, they demonstrate the countless ways of incorporating sustainable elements in creating structures like never seen before: man made trees accommodating restaurants and viewing platforms. Taking the approach to a tremendously beautiful extreme may be seen through the Changi Airport, bringing together nature and design as one to result in yet another breathtaking architecture icon.

Today, critical regionalism stands as the way forward as this takes the environment into account and caters to a modern, widely appreciated aesthetic through the way it blends traditional tropical Asian design with modernism to find the perfect middle ground. Nevertheless, Singapore's past shines through in some areas, with protected historical buildings and even older public housing that still accommodates thousands, leading to a range of styles yet still having a new way forward.

⁵ <https://www.gardensbythebay.com.sg/en/things-to-do/attractions/supertree-grove.html>

Objective 1b: To discover the importance of sustainable architecture and why it is necessary.

In order to investigate how new building practices are being pursued, we must first understand the motive behind them. This lies in sustainability. Defined by the World Commission on Environment and Development as architecture that 'meets the needs of the present without compromising the ability of future generations to meet their own needs' whilst 'achieving long term energy and resource efficiency.' Barker Associates takes this definition into account with the current global situation and depicts why there is a basis for moving to sustainable developments. Countless benefits arise from utilising sustainable architecture, these include environmental, economic and social aspects as follows:

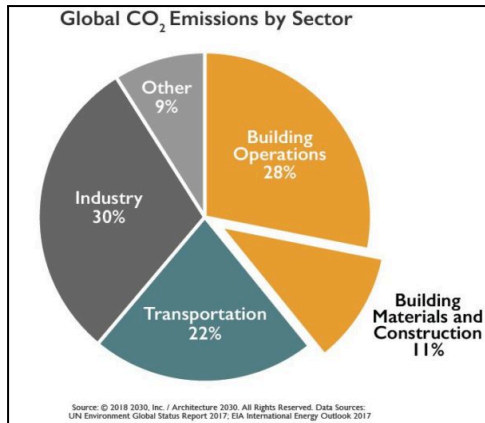
Environmental	Economic	Social
<ul style="list-style-type: none">- Conservation and preservation of natural resources- Reduction in energy consumption and waste- Protection of ecosystems and environmental biodiversity- Improvement of air and water quality	<ul style="list-style-type: none">- Reduction in long-term costs and dependence on traditional energy sources- Improvement in productivity of inhabitants- Upgrade asset and property values- Competitive advantage	<ul style="list-style-type: none">- Improve the living conditions, health and comfort of inhabitants- Improve air and water quality- Minimise demand on local utility infrastructure

[Source](#) - Barker Associates

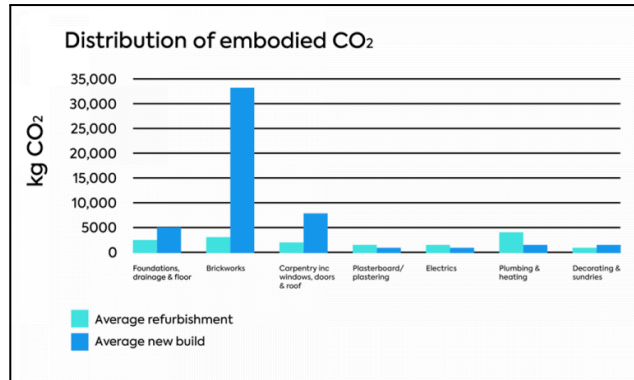
Whilst these are quality of life and financial improvements, I find the environmental aspects to be of highest severity as without consideration for the environment, the need for other benefits are ruled out due to a drastic decrease in the planet's condition as a whole. This leads me back to my research point, the implementation of sustainable architecture is *necessary* because if we continue as we are now, there will be dire and unrecoverable consequences.

Already we are facing the effects of climate change, with the United Nations⁶ pointing out temperature rise, loss of natural life and severe droughts leading to countless countries declaring it a global emergency. Evidently, action must be taken immediately. I want to express the countless ways in which we can make a difference through the use of architecture because when you consider the fact that the Earth is covered in man-made homes, they are a big factor to our carbon footprint, as proven by source 1 below.

⁶ <https://www.un.org/en/climatechange/science/key-findings#temperature-rise>



[Source 1](#) - New Buildings Institute



[Source 2](#) - Citu - UK example

It is transparent that refurbishing homes is better for the environment than to make entirely new ones (as indicated by source 2), yet this is rarely an option when taking into account the rising population and demand with the housing crisis. It is said that 300,000 homes a year must be built in the UK alone every year yet when each of these is introducing between '50 to 80 tonnes per build,' we are only leading ourselves towards critical condition. According to the Committee on Climate Change, '40% of UK emissions come from households,' not only in the way that they are constructed, but the lifestyles of the residents.

Energy consumption exploration may be found in appendix 1.

Objective 1c: To explain the adjustments made to existing property and implementation of sustainable architectural practices on new structures in Singapore.

Reflecting on the fact that a good deal of historical architecture remains in Singapore, these have been protected and are highly valuable to the residents whether they live in them or not. There is an emotional attachment to these yet that is unfortunately not enough to warrant continuation of some buildings' current conditions for the government. In January 2017, the country leaders set out to create a protocol to ensure sustainable standards are met. This falls under the 'Legislation on Environmental Sustainability for Buildings' where a large portion of buildings must now consider environmental elements and meet certain requirements otherwise action will be taken accordingly.

Existing buildings may be altered to comply with these standards and this has been visible across the country. An article from ArchitectMagazine comments on how a wide range of buildings are adopting changes consisting of 'shading devices, living walls, personalised ventilation, solar chimneys' and countless others leading to some structures to completely eliminate their carbon output such as the 'Zero Energy Building at the BCA Academy.' More commonly however, developments such as the 'National Gallery Singapore' utilise cooling and power generation technology with a pool of water on top of a glass roof panel to keep temperatures low and vast amounts of solar energy.

Furthermore, some of those who are excluded from the act have still made changes to their home in consideration of the environment and potentially the fact that later laws could come in which would require them to do so. This is a way of people future-proofing their property yet in reality it leads to us being better prepared for the future environmental changes. Small homes and apartments may feature green walls and smaller scale methods for individual occupants but overall have vast systems integrated for the whole build.⁷

Exploration of a prime example of sustainable architecture in Singapore may be seen in appendix 2.

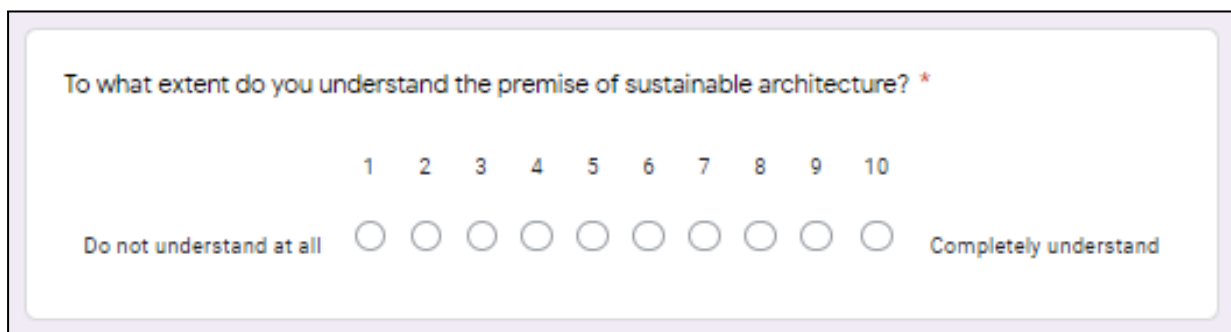
7

https://www.architectmagazine.com/technology/postcard-from-singapore-an-inside-look-at-green-design-in-the-tropics_o

Aim 2: To collect and analyse public opinion on the implementation of sustainable architecture in Singapore, in addition to its success.

Objective 2a: To collate general and professional views and understanding of sustainable architecture as a whole.

Despite sustainable architecture being a necessity for environmental development, there is still the possibility that people have opposing views for various potential reasons, which I have explored by conducting my own primary research. I created two very similar surveys for professional and general respondents, allowing me to draw comparisons between them and what this could mean for the future of sustainable architecture due to people's opinions being of crucial importance. The two surveys may be found in Appendix 3 and 4, alongside an analysis of the data.



The image shows a screenshot of a survey question. The question is "To what extent do you understand the premise of sustainable architecture? *". Below the question is a horizontal scale with numbers 1 through 10. Underneath the numbers are ten circular radio buttons. The text "Do not understand at all" is positioned to the left of the first radio button, and "Completely understand" is positioned to the right of the tenth radio button.

Using the question above, I have utilised the Mann-Whitley test to compare understanding between the general and professional respondents on the premise of sustainable architecture. Ultimately, the test dictates that the difference is significant, supporting my hypothesis, as seen in appendix 4.

There are many reasons as to why the data shows a significant difference - as expected the professionals working in the industry will have immediate and practical working knowledge of the importance of sustainability. In addition to this, my expectation of the general participants was low due to the fact that for the majority of people, this topic would be more of a superficial knowledge - unless they had an invested interest in such, like myself.

Professional respondents provided particularly detailed answers, with technical knowledge being extremely evident and aided in their justification for their beliefs. This is a stark contrast to those who answered the general survey, who often stated that the aesthetic they associate with sustainable architecture wouldn't suit the UK. This is of course entirely opinion based, as others may deem 'green' or modern architecture to be perfect for the area. Therefore, there is further evidence to suggest that the professional respondents' opinions should be taken into account more so than the general public as they tend to have greater knowledge of the topic.

The industry members responded stating that the appearance of a building does not restrict its sustainable potential, meaning that any style can be adopted yet remain environmentally conscious. Additionally, given political and financial issues did not exist, some believe buildings would be built with environmental factors being the priority and that they should be rated on their effectiveness in this regard. All respondents are in full support of the implementation of sustainable architecture, whilst acknowledging that there are limiting factors and hurdles to overcome along the way.

Objective 2b: To collect opinions on the matter of sustainable architecture integration across Singapore.

Utilising research collated from a study hosted on 'OpenAir RGU,' I can unravel views from a professionals from 16 respected companies in the community, with 84.6% being awarded with a 'Green Mark' for sustainability and all having received an EMS Certification, displaying their dedication to sustainability, in turn making them a truly reliable source.

Statements on common myths/perception of sustainability.		Mean	SD	Rank
B1	Sustainability is all about environment only	2.57	1.93	4
B2	Sustainability is a synonym for 'Green'	3.14	1.33	2
B3	Practising sustainability can be expensive	3.14	1.29	2
B4	Sustainability is about Reduce, Reuse and Recycle only	3.29	1.5	1
B5	Sustainability means lowering our standard of living	1.64	1.72	5
B6	New technology is the only solution to sustainability	2.79	2.48	3
B7	Sustainability is a pollution problem (e.g. more people, more wastes are generated)	0.5	2.3	6
Table 1 - Mean and ranking derivation for statements *SD - Standard Deviation				

[Source](#) 1 - Section 4.1

From the results table above, it may be noted that the firms find sustainability to be very expensive and resource intensive yet they can agree that it does not come at the cost of our living conditions. In a perfect scenario, standard deviation would be as low as possible and this is evident in the table in the highest ranking answers, supporting my claim. With results as low as 1.5, 1.33 and 1.29, the highest average answers have very little variance. This indicates that many respondents have very similar views about sustainable aspects, perhaps due to these being some of the key concerns if the style were to be implemented.

General Statements on Awareness of Sustainable Construction and Impact on Environment		Mean	SD	Rank
C1	Sustainable construction can reduce resources.	3.69	1.28	7
C2	Sustainable construction can improve energy efficiency.	3.92	1.04	5
C3	Setting minimum standards through legislative requirements.	3.85	1.14	6
C4	Recycled or environmental friendly materials are 'Green' labelled.	3.85	0.89	6
C5	There are various types of construction waste materials available for recycling.	4.08	0.76	3
C6	Implementation of ISO 14001 EMS for sustainable construction is to achieve better environmental performance.	3.92	0.86	5
C7	Utilisation of high performance insulation protection, water and energy saving equipment etc. are less damaging to the environment, but often increase the capital cost.	4	0.91	4
C8	There will be time impact in practising sustainable/green construction.	3.15	1.09	8
C9	Sustainable construction should begin from design stage rather than construction stage.	4.38	1.12	2
C10	Success of sustainable construction will not be possible without the commitments from stakeholders and consultants.	4.69	1.11	1
C11	There are limited selections of environmental friendly materials.	2.85	1.28	9

Table 2 - Awareness of sustainability and impact on environment
*SD - Standard Deviation

[Source 2](#) - Section 4.1

General Statements on Attitudes of Implementation of Sustainable Construction		Mean	SD	Rank
D1	Raising awareness through education, sharing platform via conferences and exhibitions.	4.15	1.07	3
D2	Specifications and construction methods should consider environmental requirements.	4.13	1.11	4
D3	To reduce material and construction waste.	4	1.08	6
D4	Improvements on quality, health and safety issues when sustainable construction is implemented.	4	1	6
D5	Public sector should take the lead in implementation of green construction.	4.23	1.16	2
D6	Implementation of green construction is enforced by government.	3.31	0.96	10
D7	Adopting green construction should be voluntary.	3.38	1.13	9
D8	Collaborative research & development (R&D) with industry for new and/or improved technologies (e.g. further development on re-application of recycled materials).	4	0.76	6
D9	Sustainable construction should not be limited to contractors alone. Greater success will be achieved with participations and commitments from stakeholders and consultants.	4.31	1.49	1
D10	Attainment of BREEAM, LEED, or Green Mark certification reflect the sustainability achievements throughout the construction process and eventual building life cycle.	3.54	1.05	8
D11	To comply with the statutory and/or client's requirements.	3.23	1.23	11
D12	It can enhance the company's competitiveness in bidding jobs.	3.77	0.72	7
D13	It can enhance the company's public image.	4.08	1.04	5
D14	Lost in competitiveness (i.e. competitors often uses materials which are less environmental friendly and at a lower cost).	3.15	1.34	12

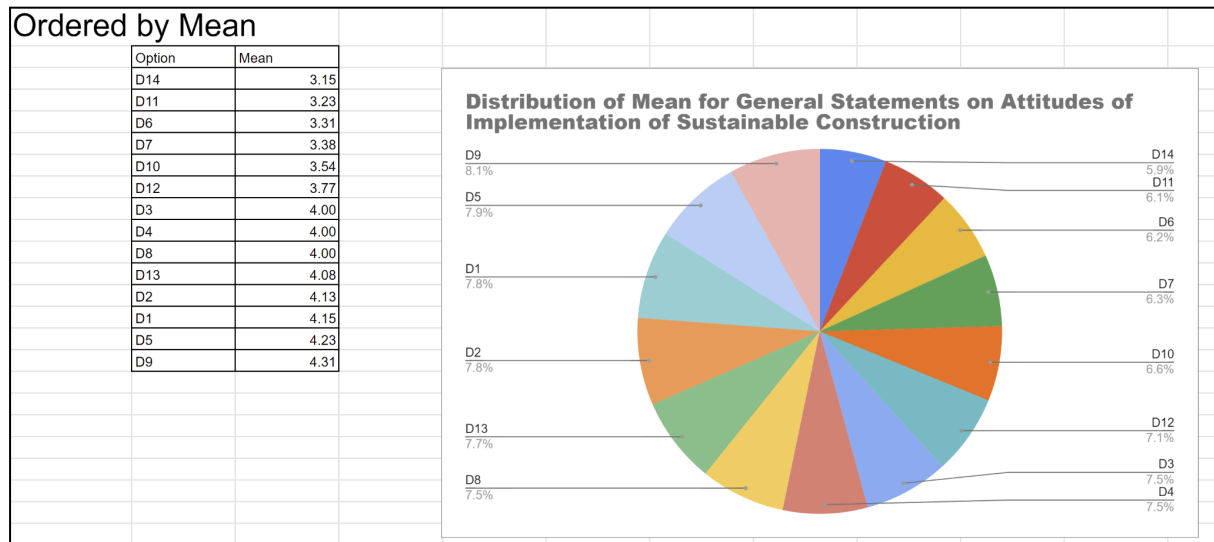
Table 3 - Contractors' attitudes towards sustainable construction practises
*SD - Standard Deviation

[Source 3](#) - Section 4.1

Collectively, there is a concern with funding and political aspects to the design methodology, which is a concerning and limiting factor regarding architecture as an industry. Additionally, sustainability should be considered very early into the building process, as this way the entire design may be catered towards sustainability and work around it as a focal point. It appears that the respondents as well as the surveyor have collectively reached a conclusion that as a planet and designers, they have the physical ability to construct sustainable architecture yet are restricted by laws and financial problems.

Initially, it appears abnormal to have the government be rated so low (as explored in 2C), yet this appears to be due to more pressing issues present as options. These consist of education, reducing waste and not limiting its utility. Interestingly, the highest mean answer tackles restricting who has input to the structural methodology, demonstrating clearly how architects are yearning for the style to be embraced further. For such an ambition to integrate a sustainable approach, architects must regard its importance incredibly high. perhaps due to its importance or success.

Evidently, these tables may be difficult to read due to being ordered in terms of option and not ranking, therefore I have constructed a pie chart (below) of the table utilised in Source 3. The data has been collated directly from the table yet when presented in a different form of data representation, becomes far clearer in just how slim the margins are between the selections. Nevertheless, option D9 prevails with a focus on extensive inclusion in the industry.



[Source](#) - Data ordered by option or mean ranking

Objective 2c: To analyse how the topic is being handled by architects and the government and how action is being taken in terms of the environment through architecture in Singapore.

The Singaporean government has gradually been introducing various legal obligations for property owners and architects in order to bring property up to sustainable conditions. In 2006, the BCA introduced the first 'Green Building Masterplan,' which utilised a range of methods to incentivize sustainable development, through financial aid, training programs, a public outreach programme and a 'Green Mark' certification system. The rating system was highly sought after by property developers due to benefits which accompany it, including additional floor space for owners, given they reach the requirements. Permits are withheld from the owners if the builds do not satisfy the demands of the scheme, as assessed from in-depth property and plan checks.

The masterplan was revisited in 2009 and 2014, leading to tighter restrictions and higher sustainable requirements from builds in an attempt to improve sustainable conditions. Further amendments to the legislation came in 2016, bringing focus to 'climate responsive design, building energy performance, resource stewardship, smart and healthy buildings and advanced green efforts.'⁸ These are in addition to the existing considerations of the legislation and once fully implemented, require buildings to incorporate in their design for 'Green Mark certification'. As a means of not overwhelming owners and developers, the further regulations are tested for a year and industry feedback is received before enforcement.

The process of gaining a green certification features a detailed point system which may be reviewed on the BCA's website where developers can gain points for encouraging occupants to have a healthier lifestyle through design, utilising water features and outdoor garden settings to preserve the natural landscape and embrace natural sunlight and the most efficient means of air quality and temperature control⁹. More points lead to developments falling into higher brackets for certification, which, depending on the level, present additional benefits and funding. Builds that fail to be sustainable are granted less points and are brought up to code or even denied building permits if necessary, with enforcement becoming increasingly strict.

Architects are aiding in the battle for sustainability, with various firms across Singapore boasting their sustainable projects. WOHA¹⁰ has led to the development of the Oasia hotel, Parkroyal Collection Pickering and the Kampung Admiralty, with additional firms like Studio Sklim and Red Bean Architects working on their own builds. There is no shortage of companies with sustainability at their focus in Singapore, with the architects shaping the country around them to what it has become today, working towards clear government guidelines.

⁸

<https://www.eco-business.com/news/singapores-new-green-standards-for-homes-focus-on-people-and-design/>

⁹ https://www.bca.gov.sg/greenmark/others/GM_RB_2016_criteria_pilot.pdf

¹⁰ <https://woha.net/projects/>

Aim 3: To assess the success of implementing sustainable architecture into Singapore in comparison to other countries and how this may impact the world.

Objective 3a: To evaluate the effectiveness of sustainability through architecture in Singapore.

Across Singapore, many structures have adopted sustainable architecture due to various reasons (including government regulations), meaning that there is a vast array of accounts to be analysed in how they have impacted the area around them. Biophilic design is integrated in builds such as the Oasia hotel that, as mentioned prior, improve conditions within the area. This may also be demonstrated through the CDL's Treehouse¹¹, which comprises of the world's largest vertical garden and green wall and many other features to save on power consumption and harmful emissions. Furthermore, benefits extend directly to humanity, as seen in the Khoo Teck Puat Hospital¹² where patients are surrounded by nature, reporting lower stress levels, shorter recovery times and other medical benefits simply from a building's design.

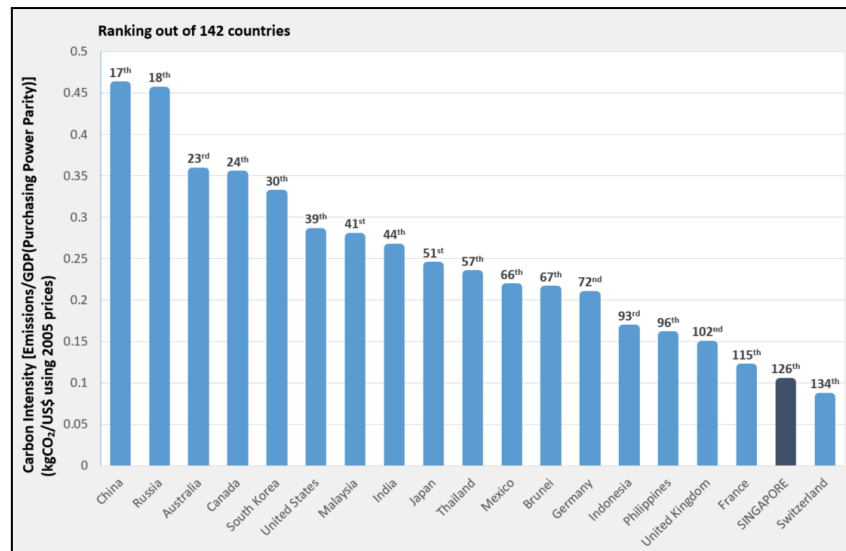
Other examples of success within sustainability may be seen in the various net zero buildings within the country. These consist of the likes of BCA Academy, with over a decade of zero energy consumption, Keppel Bay Tower, Singapore's first 'Green Mark Platinum' commercial building and the NUS SDE4 university building of design and environment. In these cases, no external energy sources are required after their initial construction and any additional energy produced may be stored for later use or to be distributed to surrounding structures.

Singapore's architecture makes up only 20% of total carbon emissions, half of the worldwide average of 40% and vastly contrasting to the extremes of Tokyo's 70%. You could argue that this is because carbon emissions are higher in other aspects of Singapore such as travel or industry so I will take a different approach to this. Singapore is an incredibly small country, meaning using percentages is more equitable for comparison as it is unfair to compare it to incredibly larger countries based on figures of CO₂ alone. Instead, carbon intensity is a better indicator as to how sustainable a country is:

¹¹

<https://inhabitat.com/worlds-largest-vertical-garden-at-the-singapore-tree-house-condominium-sets-new-guinness-record/>

¹² <https://www.youtube.com/watch?v=QCZ8jInO7UY>



[Source](#) - National Climate Change Secretariat

Exploration of the CO₂ Emissions from buildings in Singapore may be found in appendix 7.

Objective 3b: To contrast environmental advancements within construction in Singapore and the UK.

Architecture within the UK dates back thousands of years whereas Singapore is far more recent, meaning that whilst the UK has a larger range of buildings, Singapore is more likely to boast newer technologies and building methods. An online search regarding sustainability in UK architecture presents countless architect firms promoting their sustainable methods yet this is far from the case with Singapore as this has become a national standard due to the input of the government¹³.

Whilst the UK has to meet certain requirements within construction, it is miniscule compared to Singapore. This may be seen in my analysis of a report by 'CoreNet Global,' which details and compares what has been proposed by the law. The UK utilises 'BREEAM' and has done so since 1990, which claims to 'set the standard for best practice in sustainable building design and construction.' The system lays out protocols for buildings to be considered sustainable such as 'to mitigate the life cycle impacts of buildings on the environment' and 'stimulate demand for sustainable buildings,' with structures later going into a rating process. Unfortunately, BREEAM is a voluntary system, meaning that it is most likely overlooked by many architects and building regulators and in turn, hasn't reached its full potential. Whilst sometimes additional funding is provided if a structure exceeds in the rating system, this is very rare and yet again, not required and has caused far less traction for sustainability than what it could have.

Both countries are developed and in a strong place in the current world financially and technologically, yet there is a far inferior abundance of sustainable architecture in the UK when compared to Singapore. This suggests that both are capable of aiding the cause yet there are other limiting factors in play here. The possibility of less sustainable builds being found in the UK due to more relaxed regulations cannot be ignored as with more pressing governments like introducing strict sustainable building regulations in Singapore, great progress is visible. Therefore, the government has a direct impact on the quantity of sustainable builds within their jurisdiction, which whilst it may be logical, if the leaders fail to fund these projects then they become massively sparse, worsening the environment. Moreover, the evaluation process may be deemed an unnecessary inconvenience for some architects that would instead like to progress onto the next project due to the speed of the industry, being another limiting factor.

There have been cases where sustainable architecture is successful in the UK, as seen in appendix 7.

¹³

<https://www1.bca.gov.sg/regulatory-info/legislation-on-environmental-sustainability-for-buildings>

Objective 3c: To consider whether other countries around the world may follow Singapore with the environmental aspects of architectural design.

Sustainable architecture gives a clear guide to the future of design elements which must be incorporated into buildings across the world for a positive impact. Nevertheless, countries may be unable or unwilling to adopt the style for various reasons. Typically, financial issues are what limit development worldwide and already that is reflected in the industry. Budget cuts are extremely common and projects exceeding their predicted cost is conventional within architecture and regrettably, profits are priority for many and there is little room for them to justify spending more on a sustainable project.

There is also a stigma that sustainable buildings must look modern when this is far from the case, as proven in countless property conversions to bring them up to sustainable standards¹⁴. Moreover, the Bullitt Centre in Washington takes a standard visual approach but opts to feature an extended roof to house additional solar panels - not every build must do this. Those embracing the style are mentioned in an article by '[EcoWarriorPrincess](#),' including the breathtaking Shanghai Natural History Museum, One Central Park in Sydney and the numerous green walls across the world which lead to improved environmental conditions. Therefore, the stigmatism may be overlooked.

Yet another hurdle for sustainable architecture lies in the array of developing countries in the world, as explored in appendix 9.

14

<https://www.constructionplusasia.com/my/critical-success-factors-of-adaptive-reuse-in-singapore/>

Conclusion of Aims

Aim 1

The intention of this aim was to understand the background of Singapore's history in architecture and what is being done today in terms of sustainability, giving me a perfect foundation for the project. I discovered the vast array of architectural styles and how they've evolved over time in the country and how current housing is leading to severe damage to our environment such as loss of biodiversity, droughts and global warming. I discovered the definition of sustainable architecture and the ways in which it can benefit the world socially, economically and environmentally. I found Singapore to be a prime example of transforming old buildings into being more sustainable and also how they are perfecting new structures that are capable of net-zero energy readings. Some developments, like the Oasia building, even improve biodiversity and the surrounding environment than prior to being built, demonstrating how successful sustainable architecture has become.

Aim 2

By constructing my own surveys, I discovered that there is a significantly strong proportion of people in support of sustainable architecture than those opposing. Respondents declared a transition to sustainability as a necessity for our planet due to the countless harmful impacts current developments cause. Moreover, there is a slight lean towards additional taxation for funding, yet this is more controversial amongst responders. Professionals within architecture provided extensive answers, further signifying the importance of the matter and how we may go about the integration of it and how it may become standard, despite limiting factors including finances and politics. Moreover, it can be concluded that structures don't have to look a certain way to be sustainable.

Singaporeans generally have a very positive outlook on the style, yet indicated further restrictions to it reaching its full potential, particularly stakeholders. Notwithstanding, the Singaporean government has enforced sustainable regulations for decades, altering them on multiple occasions with architects following accordingly. This demonstrates how Singapore's Building and Construction Authority is ensuring a gradual, yet stringent, move to sustainability, presenting immense success in thousands of structures. Therefore, architects and the government work in harmony to achieve sustainability through architecture with immense support from the public, directly answering my aim.

Aim 3

Despite being one of the most energy efficient countries in the world, Singapore relies primarily on fossil fuels as an energy source, meaning that the impact of sustainable architecture is greatly overshadowed by the negatives of gas power. Whilst sustainable architecture is clearly helping the cause, it must be done in conjunction with other, more substantial factors. Generally, sustainable architecture is on the rise and headed in the right direction, yet there are the outliers that prioritise it and succeed massively. Net zero emission buildings are possible and already exist across Singapore, although there is plenty of room for improvement for remaining structures.

I believe other countries will follow suit, but not at the intensity or scale that Singapore has, due to various limitations. The UK has various sustainable structures, yet less restrictions than Singapore. This is seen in UK voluntary systems like BREEAM, whereas Singapore has mandatory systems created by the government and BCA. Eventually, we will see a gradual shift towards sustainability in UK buildings. It is crucial I

express that sustainability may be achieved without having a building look a certain way, but in how it is made and the systems within it, as supported by architects and completed projects.

There needs to be more incentive for sustainable architecture to prosper. However, there is little reason for those funding projects to spend more for sustainability, little to encourage the government to provide funding or enforce stricter regulations or urgency to do so when compared to other sectors. The climate is suffering immensely and the world is mostly willing to change, yet it appears sustainable architecture is not yet a priority, despite it being such a crucial factor to carbon emissions.

Overall Conclusion

I feel my project has proposed appropriate findings to support that Singapore is environmentally conscious to a significant extent and is aiding in combating climate change. Sustainable architecture is a clear global requirement yet many limitations and barriers must be overcome before its complete implementation, as supported by the general population and prestigious architects. Singapore is one of the few countries suitable and economically stable enough to utilise the style today, with substantial benefits already being made apparent from doing so.

I believe that in coming years, sustainable architecture will spread immensely due to it being a key factor to combatting degrading climate conditions yet this will require colossal funding and efforts. Nonetheless, we must surpass current restrictions for the greater good of mankind and the planet in which we inhabit, with Singapore being a prime example to follow. Answering my research question, Singapore is extremely environmentally conscious regarding construction and is definitely the foundation for the future of architecture.

Appendix

Appendix 1

Energy consumption is another factor on top of the initial carbon cost for building a new home, with electricity wastage and heat being lost from poor insulation which were produced from harmful energy sources in the first place. I believe it is put best when Citu stated 'building just one new house emits as much CO2 as someone living an average lifestyle does over a decade!' as this truly shows the harm done from just a single build.

Using sustainable methods throughout building, we can cut back on this harm and lead ourselves into a healthier future for the planet. Already, the effects are present in existing buildings utilising these. An example of this would be the Marks and Spencer in Cheshire Oaks which utilises rainwater collection, sustainable materials, solar and other 'green' processes to minimise carbon emissions.

Appendix 2: Sustainable Architecture Example in Singapore

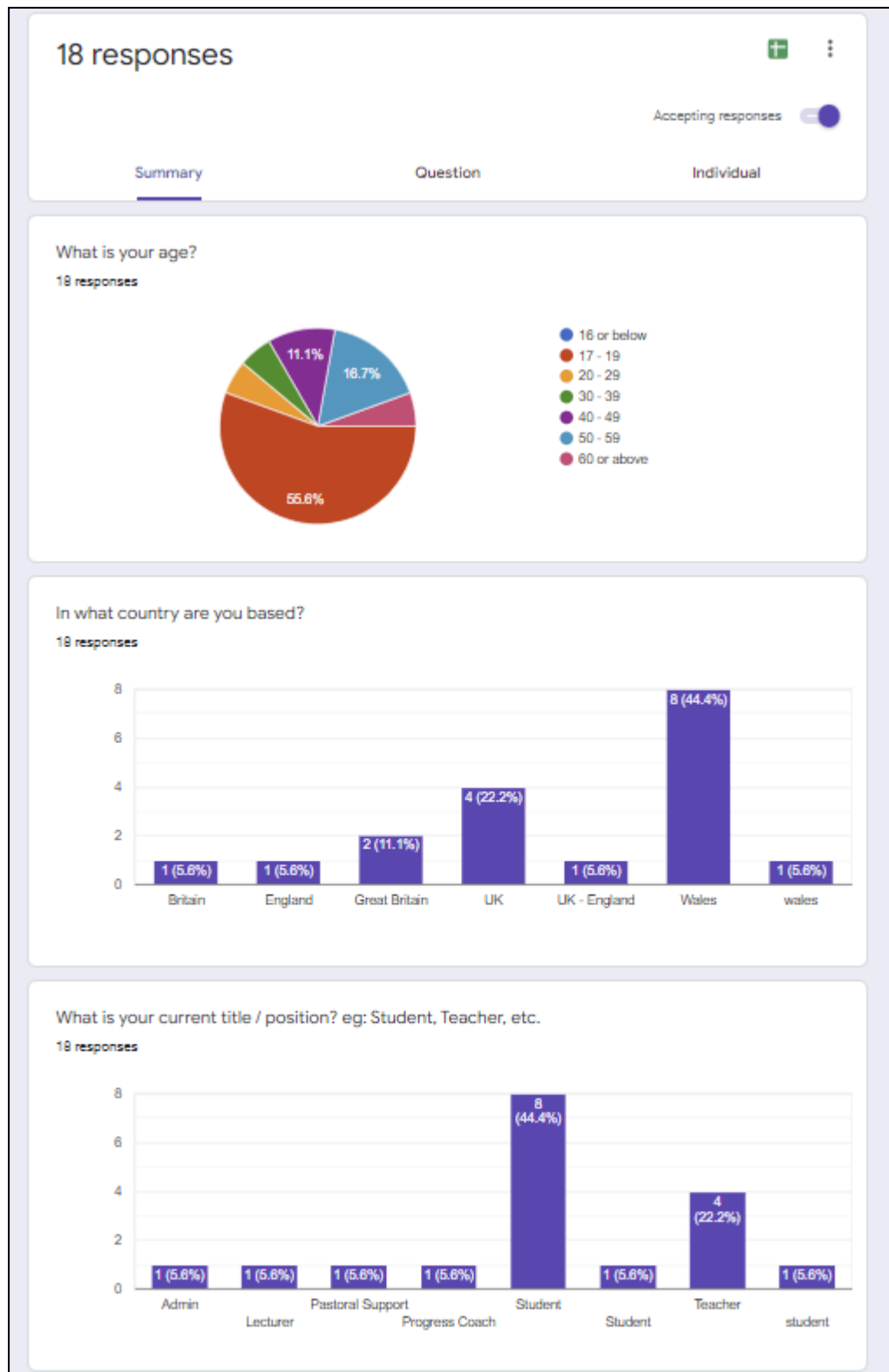
Gradually, the country is coming together in harmony with nature and this is only further highlighted in new building developments. 'InteriorDesign.net' have compiled a list of 8 significant sustainable buildings in Singapore and these feature designs such as the '18 Robinson Building,' which had even been given the 'The Sustainable Future Award' due to accounting for the lost environmental areas following construction. This was achieved in creating 'accessible green space within the building' as described by 'KPF.com.' Whilst this building has accounted for the lost vegetation and replaced it, it hasn't taken it to the extreme like with the Oasia hotel. It must be stated that the biodiversity and volume of greenery has increased drastically due to its construction as it has taken the original plot of land and expanded upon it vertically. In doing this, the hotel is 'home to over 33 species of plants' which is actually an increase to before so yet again there is evidence to suggest that the building is actually an improvement for the environment in this regard. There are of course many other aspects which may be considered for it to become carbon-zero yet a combination of this as a base is an extraordinarily strong foundation for more standard buildings yet there are the unusual outliers such as the Supertrees in the Gardens by the Bay as mentioned prior.

Appendix 3: General Survey

Appendix 3a: General Blank Survey

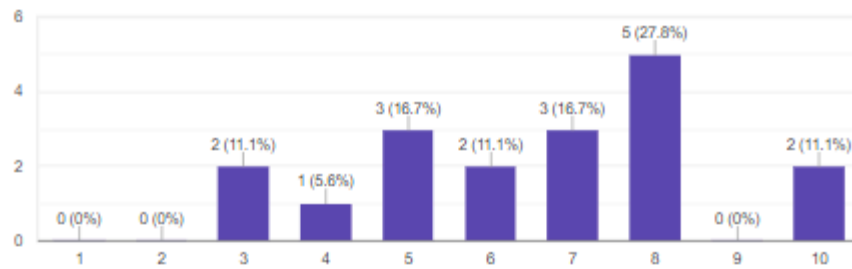
General Outlook on Sustainable Architecture	
Form description	
What is your age? *	
<div><input type="radio"/> 16 or below</div> <div><input type="radio"/> 17 - 19</div> <div><input type="radio"/> 20 - 29</div> <div><input type="radio"/> 30 - 39</div> <div><input type="radio"/> 40 - 49</div> <div><input type="radio"/> 50 - 59</div> <div><input type="radio"/> 60 or above</div>	
In what country are you based? *	
Short-answer text	
What is your current title / position? eg: Student, Teacher, etc. *	
Short-answer text	
To what extent do you understand the premise of sustainable architecture? *	
<div>1 2 3 4 5 6 7 8 9 10</div> <div>Do not understand at all <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Completely understand</div>	
Do you believe sustainable buildings must look a certain way? ("Green") *	
<div><input type="radio"/> Yes</div> <div><input type="radio"/> No</div> <div><input type="radio"/> Not sure</div>	
Would you rather see sustainable buildings or traditional options? *	
<div><input type="radio"/> I would like to see more sustainable buildings</div> <div><input type="radio"/> No preference</div> <div><input type="radio"/> I would not like to see more sustainable buildings</div>	
Please expand upon and explain your answer to the previous question. *	
Long-answer text	
Ignoring political and financial setbacks, what are your thoughts on sustainable architecture? *	
Long-answer text	
How would you feel if additional taxation were to be implemented as a means of funding sustainable processes in your country? *	
<div>1 2 3 4 5 6 7 8 9 10</div> <div>Not at all happy to pay more taxes to support sustainability <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Very happy to pay more taxes to support sustainability</div>	

Appendix 3b: General Survey Responses



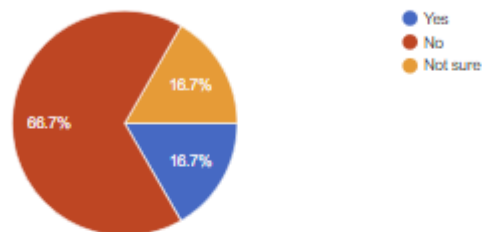
To what extent do you understand the premise of sustainable architecture?

18 responses



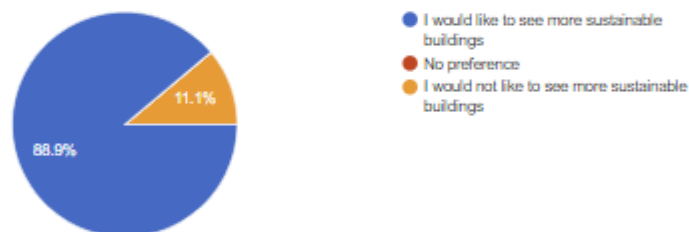
Do you believe sustainable buildings must look a certain way? ("Green")

18 responses



Would you rather see sustainable buildings or traditional options?

18 responses



Please expand upon and explain your answer to the previous question.

18 responses

I presume you mean when new buildings are built - every new build should strive to be sustainable and eco-sympathetic. Obviously don't tear down traditional buildings simply to replace them with sustainable architecture just for the sake of it

I think they are more appealing

We Cannot carry on building with concrete and traditional construction methods. These methods are out dated and un sustainable.

If more buildings were sustainable, the affects on global warming will be reduced

It would be beneficial if new build were sustainable especially with all new technology and design ideas

It'll be better for the environment

I like to see natural products used in construction. More aesthetically pleasing.

Please expand upon and explain your answer to the previous question.

18 responses

If more buildings were sustainable, the affects on global warming will be reduced

not only are they cleaner but they also benefit the environment

Its morally and ethically responsible to consider using sustainable material in everything, including buildings and architecture

We need to see larger corporations taking action to create carbon neutral / sustainable buildings to support the aim of reducing climate change.

I think they are more appealing

It would be great to have more homes with zero carbon emissions and better insulation.

It'll be better for the environment

More sustainable buildings, as it would be better for the environment as compared to more traditional options. Also, sustainable architecture look quite aesthetic with an organic design movement feel.

Ignoring political and financial setbacks, what are your thoughts on sustainable architecture?

18 responses

I support it

creative, uses technology, creates interesting designs in areas where previously traditional building would not allow

Provides more organic feel to a building

Generally looks good compared to older designs, as well as the obvious environmental benefits.

Essential as part of the battle against climate change.

Good for the enviornment but not suitable for the UK, too out of place in our country

Should be promoted and funded / subsidised to encouage it.

it is a good alternative that reduces energy consumption

Thev help will reducina enerav consumption and also waste which is helpful to the environment.

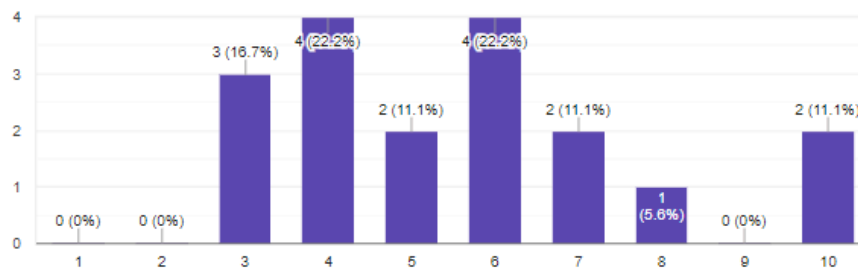
Ignoring political and financial setbacks, what are your thoughts on sustainable architecture?

18 responses

- it is essential given the global population continuing to increase
- I think its a good thing that can benefit society
- More should be used, incorporating into buildings when possible
- Its important and necessary
- A must, it should be a requirement for all new builds.
- They look good and are better for the environment
- It's the way forward - we have to do this for the future of the planet.
- It can look super nice as well as be environmentally friendly
- I believe it would be a good option that should be seen more of in the future, as it aims to reduce environmental impact caused by the building.

How would you feel if additional taxation were to be implemented as a means of funding sustainable processes in your country?

18 responses



Appendix 3c: General Survey Basic Analysis

My general survey has been completed by a varied array of respondents, consisting of a range of ages with all respondents based in the UK. 56% of respondents are students, with the remainder being faculty staff and lecturers.


There is a modal answer of an 8/10 understanding of sustainable architecture yet I believe it is more accurate to go based on the mean here due to the complexity of the topic and qualifications of those who answered, leading to 10/10 responses appearing as anomalies that will still be included in the mean. This results in an average 6.6/10 response, which reflects a more reasonable value.

2/3 of the respondents deemed that sustainable buildings are not required to conform to a certain aesthetic, with the remaining third being unsure or opposing. The vast majority are in support of more sustainable buildings, arguing that it makes you feel that architects are making a change, stating old construction methods are outdated and that sustainable buildings are also an ethical issue. Those combating the style argue that sustainable buildings are out of place in the UK due to their aesthetic (the respondent believes they must look a certain way), and that traditional 'rugged' British architecture utilising stone is more suitable.

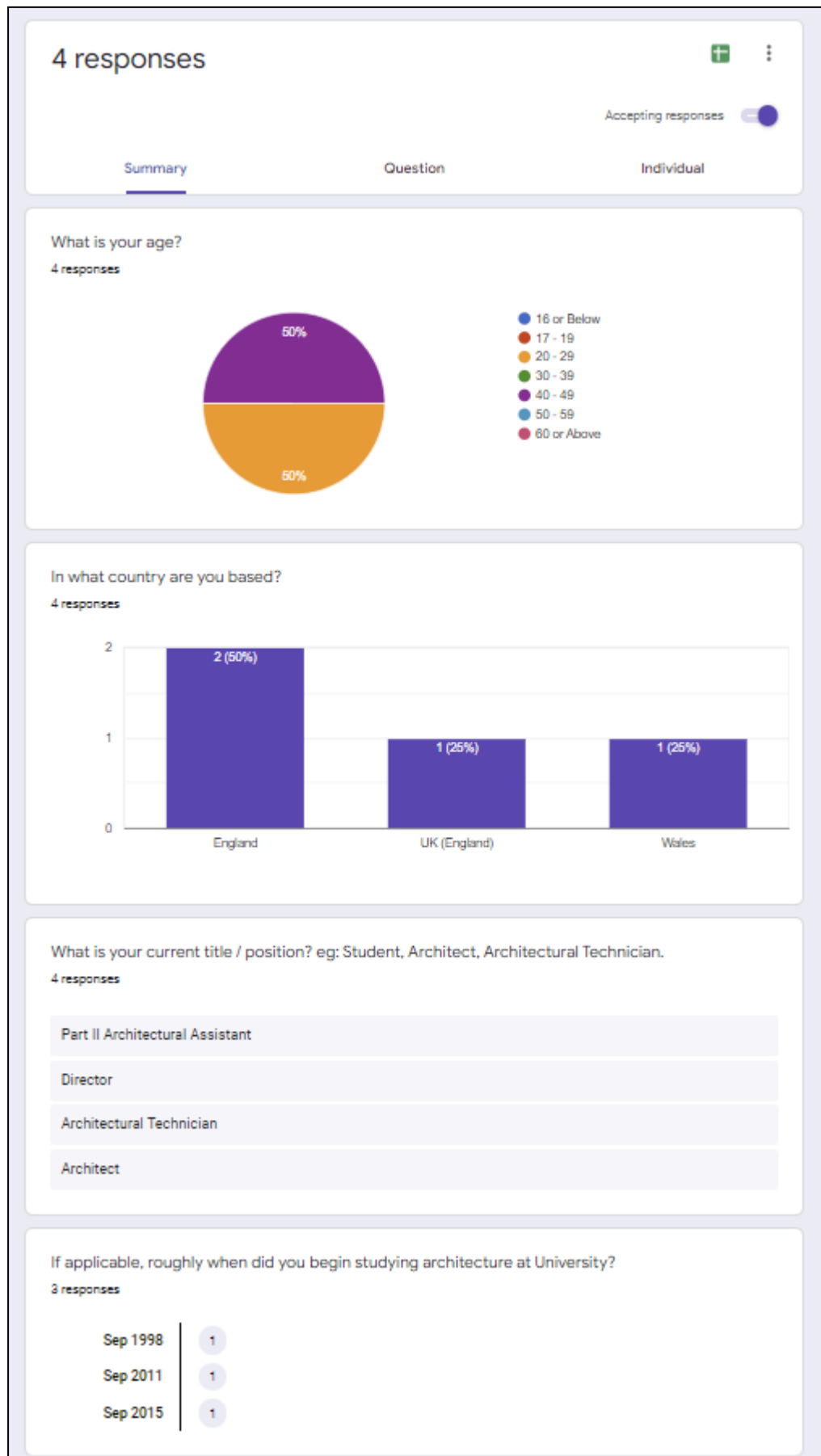
Respondents label sustainable architecture as a 'must,' 'essential as part of the battle against climate change' and deserves 'funding to encourage it.' There was a neutral or even slightly positive response towards additional taxation with a mean of 5.6/10 on a 1-10 scale.

Appendix 4: Professional Survey

Appendix 4a: Professional Blank Survey

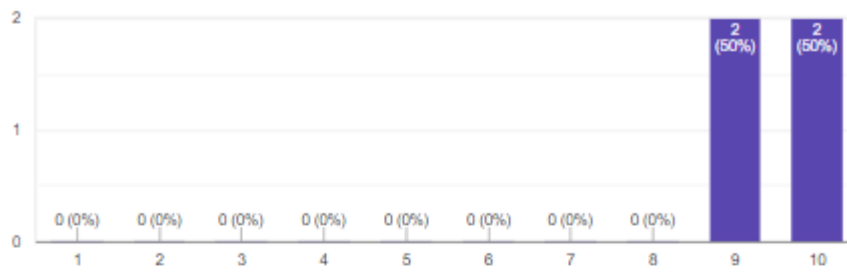
Professional Outlook on Sustainable Architecture	
Form description	
<p>What is your age? *</p> <p><input type="radio"/> 16 or Below</p> <p><input type="radio"/> 17 - 19</p> <p><input type="radio"/> 20 - 29</p> <p><input type="radio"/> 30 - 39</p> <p><input type="radio"/> 40 - 49</p> <p><input type="radio"/> 50 - 59</p> <p><input type="radio"/> 60 or Above</p>	<p>Do you feel adopting sustainable architecture in your design is restricting or freeing? *</p> <p><input type="radio"/> Restricting</p> <p><input type="radio"/> No impact</p> <p><input type="radio"/> Freeing - opens up more opportunities</p>
<p>In what country are you based? *</p> <p>Short-answer text</p>	<p>Do you believe sustainable buildings must look a certain way? ("Green") *</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p><input type="radio"/> Not sure</p>
<p>What is your current title / position? eg: Student, Architect, Architectural Technician. *</p> <p>Short-answer text</p>	<p>Would you rather see sustainable buildings or traditional options? *</p> <p><input type="radio"/> I would like to see more sustainable buildings</p> <p><input type="radio"/> No preference</p> <p><input type="radio"/> I would not like to see more sustainable buildings</p>
<p>If applicable, roughly when did you begin studying architecture at University?</p> <p>Day, month, year </p>	<p>Why? Please expand upon and explain your answer to the previous question. *</p> <p>Long-answer text</p>
<p>To what extent do you understand the premise of sustainable architecture? *</p> <p>1 2 3 4 5 6 7 8 9 10</p> <p>Do not understand at all <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> Completely understand</p>	<p>Ignoring political and financial setbacks, what are your thoughts on sustainable architecture? *</p> <p>Long-answer text</p>

Appendix 4b: Professional Survey Responses



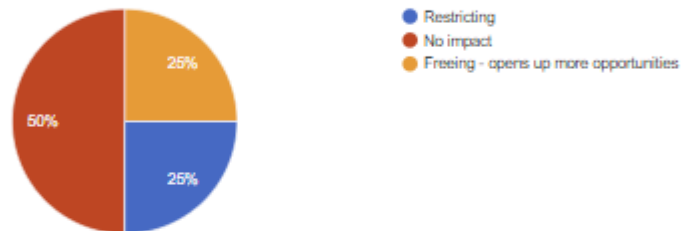
To what extent do you understand the premise of sustainable architecture?

4 responses



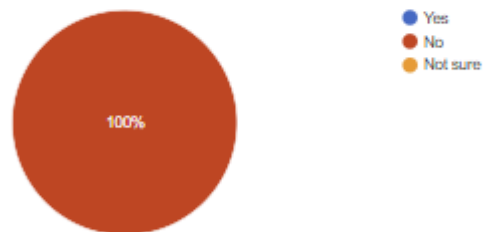
Do you feel adopting sustainable architecture in your design is restricting or freeing?

4 responses



Do you believe sustainable buildings must look a certain way? ("Green")

4 responses



Would you rather see sustainable buildings or traditional options?

4 responses



Why? Please expand upon and explain your answer to the previous question.

4 responses

Although, I would like to see more sustainable buildings, I do believe the use of sustainable technology should be introduced across all styles of architecture.

Sustainable design / buildings are a requirements for the natural and personal environment.

I believe that sustainability is a sliding scale not a yes or no premise. Each building should be as 'green' as possible based upon its own merits and individual circumstances.

Sustainable Technologies can be employed on any buildings no matter their aesthetic. If we are to meet any of the sustainability targets, let alone our own moral responsibility to produce more sustainable, energy-efficient buildings, then we need to embrace green technology and make more of an effort to lower our carbon footprint with the building materials being utilised.

This is especially relevant when it comes to retrofitting and reusing old buildings, as this is commonly accepted to be the most sustainable, and least wasteful, method of creating a new habitable space. Therefore, I would suggest it wasn't a case of sustainable vs. traditional, but a hybrid of the two where they work hand in hand.

Ignoring political and financial setbacks, what are your thoughts on sustainable architecture?

4 responses

Without the restrictions of politics and finances, I believe sustainable architecture should be the countries priority in order produce energy and reduce the amount of energy we require.

Architectural environment should continually develop and progress with technology. The research can demonstrate sustainable architecture is beneficial to the environment and well being of the users.

As technology progresses there are usually financial gains to utilising sustainable technologies and therefore higher levels of sustainability will become the norm. For example the levels of insulation used in housing now compared to 20 or 50 years ago.

If money were no object, then every design should be measured against the highest sustainability rating. Financial setbacks are the only reason electronic heat pumps, PV panels, and heat recovery systems are not on every new building site in the country, along with the highest efficiency insulation and airtightness.

However, there does need to be some level of education to go along with these new technologies such as the principle of not opening any windows on a passive house, and builders would also need to get up to speed with the latest construction techniques.

Appendix 4c: Professional Survey Basic Analysis

The survey was completed by 4 qualified members of the architectural industry within the company 'D2 Architects,' where I have regular work experience. Despite forwarding my survey to 36 total firms in London and Singapore, none replied. This may be due to time constraints or potentially being marked as spam, leading to an unfortunate outcome of only a small number of respondents. Nevertheless, my results were bountiful in data.

Respondents' ages fall into the ranges of 20-29 and 40-49 with a variety of titles consisting of 'Part II Architectural Assistant,' 'Director,' 'Architectural technician' and 'Architect.' As expected, there is an extremely high average of 9.5/10 understanding of the topic. Conversely to my assumptions, there are multiple views towards how freeing the style is, perhaps due to different workplace roles. 100% Agreement in sustainable builds being aesthetically unaffected and 100% support of more 'green' structures.

Respondents stated 'sustainability is a sliding scale, not a yes or no premise,' implying the complexity associated with the topic. Respondents believe 'sustainable architecture should be the country's priority' and 'every design should be measured against the highest sustainability rating.' The architects elucidate how money is not the only limiting factor due to additional education for builders. Additionally, they suggest sustainable technologies should continue to progress and become standard, as seen in insulation over the years.

Appendix 5: Mann-Whitney U Test

Mann-Whitney U Test Calculator

The value of U is 27.

You'll notice below that we have calculated a critical value for U based on alpha level and whether your hypothesis is one or two tailed. We have also calculated a value for Z and its associated *p*-value. Results in blue reach significance. Results in red do not.

Sample 1

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Sample 2

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Significance Level:

☐ .01

☒ .05

1 or 2-tailed hypothesis?:

☐ One-tailed

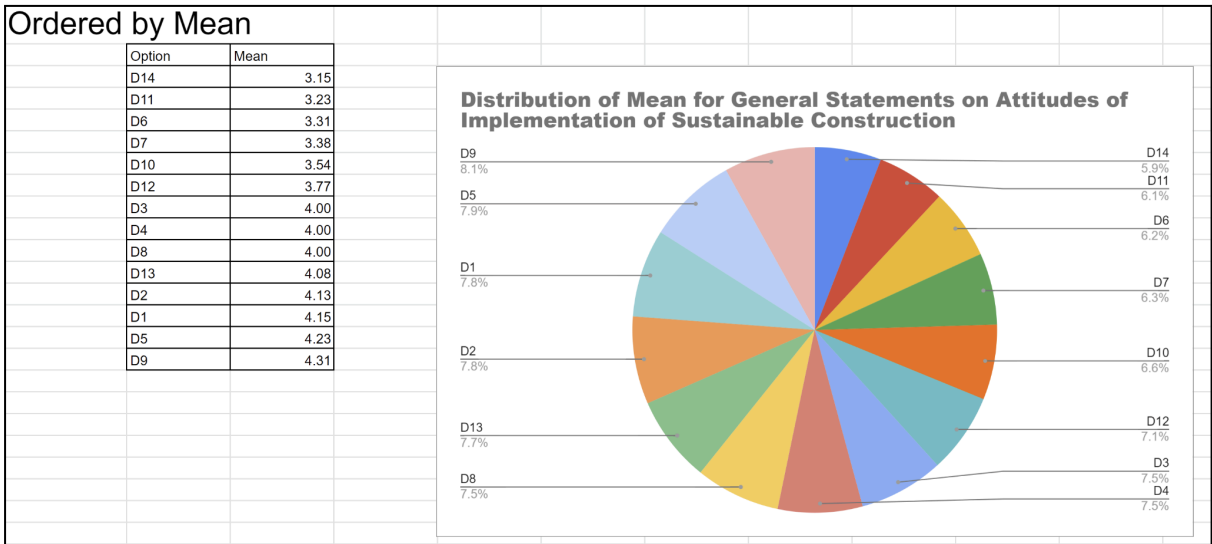
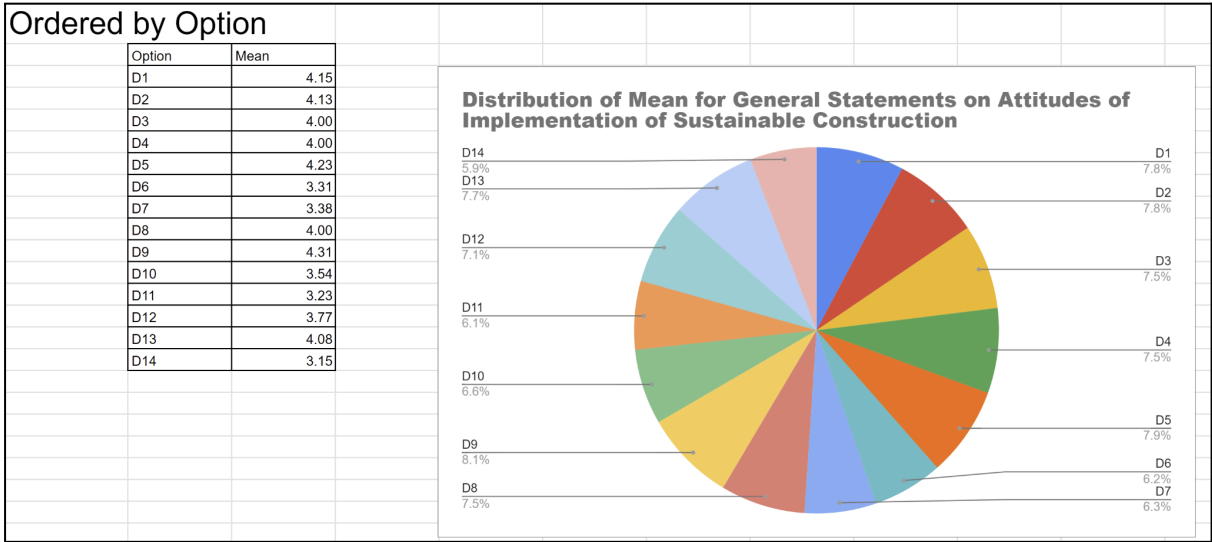
☒ Two-tailed

The z-score is -4.25539. The *p*-value is < .00001. The result is significant at *p* < .05.

Important Note

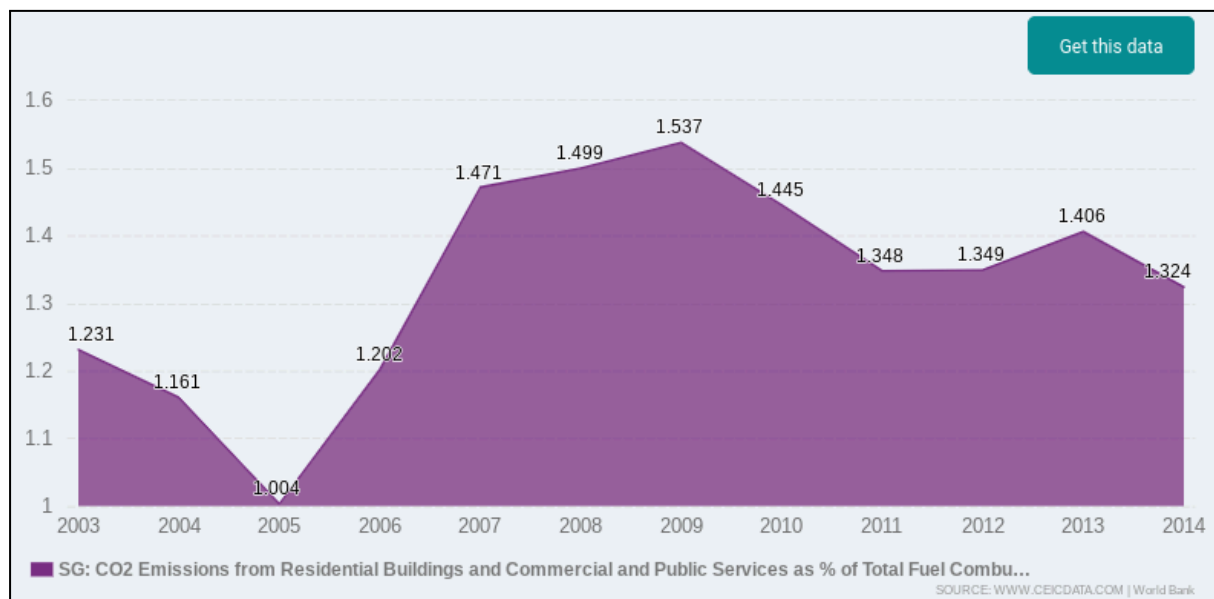
If you want full details about how the U-value was calculated, including rank order data, descriptive statistics and an explanation of the result, please click the "Calculation Details" button below.

Appendix 6: Survey Data Interpretation - Attitudes of Implementation of Sustainable Construction Pie Charts



Appendix 7: CO2 Emissions from Buildings in Singapore

Considering Singapore relies heavily (98% dependant, according to Power Engineering International as of July 2021) on fossil fuels such as gas which contribute massively towards carbon emissions, they continue to be one of the lowest countries in the world for carbon intensity. Evidently, the system is functioning as intended and is reaping bountiful benefits. Nonetheless, architecture is the focus of my study and the success of Singapore in this regard is no doubt due to the '43% green coverage' of the country, as mentioned by [The Straits Times](#). Generally, carbon emissions from buildings have been decreasing ever since the tightening of enforcement regarding 'green buildings' as seen in the chart below.



[Source](#) - CEIC Data

Unfortunately there is little data purely for architectural developments due to the complexity of collating this. Nevertheless, correlations may be spotted in data and key points. 2006 brought the introduction of the BCA Green Mark scheme and ever since, it has been becoming increasingly strict to combat what was originally a drastic increase in CO2 emissions. Consequently the curve for CO2 emissions from buildings is decreasing steadily, which could prove that the regulations surrounding sustainability are succeeding. Despite this, the emissions are still higher in 2014 than in 2003 and this can be attributed to the vast increase in construction over this period.

Appendix 8: Successful Cases of Sustainable Architecture in the UK

Admittedly, there is significantly less sustainable development within the UK than in Singapore, there are cases where the design style has been implemented and lead to some truly successful fabrications. PBCtoday host an article documenting accounts of these such as the Bloomberg HQ, deemed the most sustainable office building in the world through methods including alternative lighting methods for less energy consumption, 4,000 integrating ceiling panels which 'combine heating cooling, lighting and acoustic functions' as well as water collection systems that are utilised throughout the build. Accordingly, the structure was awarded with the highest BREEAM rating of 98.5%. The National Trust HQ is another member of the British sustainable family thanks to the 65% decrease in carbon emissions accompanied by a construction consisting of eco-friendly materials and a home for upcycled products.

Appendix 9: Sustainable Architecture in Developing Countries

Globally, we are not at the same stage in our development both financially and technologically, leading to countries being seemingly left years behind from the rest. A research paper produced by an assistant professor in the Department of Architecture, Assiut University, explores this very premise and presents intriguing points. Dr Reffat suggests that it is not purely due to a lack of resources, but 'the lack of coordination to manage them in a more efficient way,' perhaps as a result of poor infrastructure and education. Additionally to Reffat's claims, developing countries typically have more pressing issues which are considered to be of far higher importance than making architecture environmentally conscious, putting it on the backburner for years to come.

Conversely, technology and materials may be limited in less successful countries yet there are alternatives constantly in development as mentioned in the 'UCL Press Fabricate Series' in conjunction with the Dr's claims. Even with limited resources, bio-materiality allows sustainability to be achieved in environments originally deemed incapable of doing so, such as by constructing compounds from bamboo and sugar-cane straw panels. As long as there is a foundation of sustainability with new builds that is maintained throughout the years, buildings will evolve to shape a cleaner future. Take the complete opposite, the industrial revolution, for example; a harmful beginning can tarnish the world of tomorrow.

Appendix 10: Evaluation of Sources

1. <https://lithub.com/greta-thunberg-this-is-the-biggest-crisis-humanity-has-ever-faced/>

Despite only using the article for the quote present in the title, the article is simply a speech from Greta Thunberg herself, hosted on the website. Therefore, there has been no interference with what she has said due to the page being directly quoted from Greta herself. This leads to a great deal of reliability in the source as it only acts as a messenger between myself and the original source / author. Moreover, the article was published in November 2019 shortly after the speech. This is still fairly recent and similar to the climate issues of today.

2. https://en.wikipedia.org/wiki/Architecture_of_Singapore

Wikipedia is always subject to criticism regarding the validity and reliability of their claims. This is due to the fact that anybody may edit posted articles, subjecting them to incorrect information being hosted. Despite this, the history of Singapore has been accurately catalogued with an immense amount of references and sources listed. Despite this, in the event the data is still incorrect, the points collated provided a perfect foundation for the remainder of the project.

3. <https://www.re-thinkingthefuture.com/architectural-styles/a3076-evolution-of-architecture-in-singapore-through-15-structures/>

Described as 'a platform that encourages and promotes excellence in architecture on a global scale,' RethinkingTheFuture takes pride in encouraging higher structural standards and practices. Moreover, they have provided intricate details surrounding the history of architectural styles in Singapore and with their reputable status in the industry, can be taken as fact.

4. <https://www.architecture.com/explore-architecture/brutalism>

This is perhaps the most reliable possible source of information for this topic area due to being run by the RIBA (the Royal Institute of British Architects), presenting a clear definition and explanation of the brutalist approach to architecture. Moreover, various examples and trends within the style are presented, along with prevalent designers from the industry who embraced it. This source is incredibly useful and tremendously reliable when it comes to understanding brutalism in architecture.

5. <https://constructionglobal.com/construction-projects/gardens-by-the-bay-singapore-br-eaks-new-ground-in-sustainable-building>

Construction Global boasts being a leader in distributing construction-related news and analysing trends, by engaging with many large members of the industry, leading to them being a very reliable source of information. This is further supported by those featured in their articles. Nonetheless, this particular article documents and discusses the great success of the Gardens by the Bay, yet simplifies it for the average reader. The article has been written on May 16th of 2020, making it recent and consistent with the expected statistics and conditions of today.

6. <https://www.gardensbythebay.com.sg/en/things-to-do/attractions/supertree-grove.htm>

This source discusses the Supertrees found in Singapore, yet is hosted by the official website of the Gardens by the Bay. This may lead to some bias towards the positivity /

success of the Supertrees, in case the owners (also authors) would exaggerate them in order to increase sales and interest in them. There is a clear 'sales-pitch' attitude within the writing as you feel you are simply being persuaded to visit yet there is also information present which I found to be useful to mention within my research. I find it extremely unlikely that these points would be incorrect due to the risk of causing harm to the owners of the sites, making them reliable.

7. <https://www.marinabaysands.com/sustainability.html>

Due to the nature of this source, it runs the risk of being overly self-promotional and exaggeration yet professionalism prevails. It is made clear what the priorities of the build are and support for their claims is available through recent reports and building assessments. These would have been conducted by qualified regulators, likely from the government, making the source extremely reliable. Additionally, the page is updated regularly following building assessments, only solidifying the trust between the reader and authors.

8. <https://www.barker-associates.co.uk/service/architecture/what-is-sustainable-architecture>

Barker Associates are a well-known architectural practice, which clearly define sustainable architecture and reinforce the importance of the premise. The claims made are supported by the likes of the UN (see next source) and even reference Singapore's efforts for the cause. They even offer professional advice if required, demonstrating their eagerness for the style and aiding others in achieving sustainability.

9. <https://www.un.org/en/climatechange/science/key-findings#temperature-rise>

The United Nations is perhaps one of the most reputable sources for the cause, consisting of many governments across the world, addressing countless security, environmental and social issues. The UN was founded in 1945 and has since been given many awards and nominations, demonstrating their global respect and importance.

10. <https://www.theccc.org.uk/wp-content/uploads/2016/07/5CB-Infographic-FINAL-.pdf>

The Committee on Climate Change aspires to aid in the decarbonisation of our world and has done just that in this informative infographic on UK homes and climate change. A variety of sources have been used and referenced to create the page, demonstrating transparency of the company, increasing the overall trust and reliability of the source. Moreover, the figures stated may be found in countless other areas with reputable statuses, further supporting what is being said.

11. <https://citu.co.uk/citu-live/what-is-the-carbon-footprint-of-a-house>

Citu ensures that sustainable developments can be integrated into our homes and may be seamlessly integrated, comfortable and gradually become part of our infrastructure. They consist of many experienced and respected professionals with a great awareness of the carbon output of our homes as well as how we can adapt them accordingly. This is demonstrated in the source linked above, which I made use of in my research to solidify the immense environmental issues that come from the construction of even a single home.

12. <https://corporate.marksandspencer.com/stories/blog/mands-cheshire-oaks-store>

Yet again, a source is exposed to the risks of self promotion in regards to sustainable features and it can become clouded in regards to whether a company has made a particular

decision out of genuine care for the environment or simply for publicity. Nevertheless, the Marks and Spencer Cheshire Oaks building has implemented sustainable practices for a number of years now and continues to be a successful case in the UK, as I mentioned in my research. The source is nearing 10 years of age, yet presents a clear list of environmentally conscious features and is ultimately very reliable.

13. <https://www1.bca.gov.sg/regulatory-info/legislation-on-environmental-sustainability-for-buildings>

With this source coming directly from the Building and Construction Authority of Singapore's government, there is a great favour towards the reliability of any claims. Despite this, the source simply provides the legislation and requirements which buildings must adhere to to be deemed sustainable within Singapore. Due to being a document originating from the government, I find this to be particularly reliable and gives a perfect insight into the regulations process being utilised in the construction industry in the country.

14. <https://www.mse.gov.sg/>

The Ministry of Sustainability and the Environment of Singapore focuses on these exact areas within the country, putting emphasis on the importance of considering the environment with our lives. Therefore, any statements and claims from them can be taken with great trust due to their specialisation in the area, as well as regards to links to the government.

15. <https://www.ura.gov.sg/Corporate/Planning/Master-Plan>

Yet another government source is used here, with discussion on the 'Master Plan' which is being implemented in Singapore to ensure long-term sustainable benefits for the country. The attention being given to the matter as well as communication with citizens and builders leads to great respect for their efforts. This is emphasised when compared to other world leaders who appear somewhat careless in these areas. Nonetheless, the source is extremely reliable as it discusses exactly what is being done by the government in particular areas in a clear and concise manner.

16. <https://www.constructionplusasia.com/my/critical-success-factors-of-adaptive-reuse-in-singapore/>

The company provides insights and updates on the construction industry within Asia and has an extensive range of contacts to draw assessments and conduct research on. This makes it particularly useful when documenting the amendments being made to older structures within Singapore and to what extent they're successful and environmentally conscious. The article was published in October of 2020 and explains why certain changes are being made and how effective they are, being particularly useful in the research of Objective 1C in my project.

17. https://www.architectmagazine.com/technology/postcard-from-singapore-an-inside-look-at-green-design-in-the-tropics_o

ArchitectMagazine is perhaps the most well known and read architecture media platform, with articles being released everyday for all things architecture. Therefore, it was inevitable for them to discuss the sustainable efforts of Singapore. Despite their reputation, the article was published back in July of 2016, potentially risking data to be outdated. Despite this, the article brought attention to some very interesting features that remain today and with the reputation of the company, leads to a fairly reliable and useful source of information today.

18. <https://www.kpf.com/current/news/18-robinson-wins-sustainable-future-award>

The KPF is an architectural firm, with a focus on buildings making contributions to the environment in which they are located, across the world. They have produced an article on the 18 Robinson Building receiving an award, commenting on how and why, with links directly to the source of those giving the award, AIA. This demonstrates the transparency of the company, granting them additional respect from the reader.

19. <https://www.youtube.com/watch?v=pvmeXSJIS8w>

This video proved to be very helpful in providing a prime example of sustainable architecture being implemented successfully. The video producer, Far East Organisation, is the largest leasing group of real estate in Singapore, making them reputable in the country. They have toured many developments and have immense experience in the industry and what is usually found in buildings in Singapore. Therefore, they are a reliable source of information due to their experience, professionals employed and were incredibly useful in providing an insight into success in sustainability.

20. General Survey

The survey was sent to a large number of people within my college and was responded to by a total of 18 individuals. When reviewing the results, it should be considered that due to the general population being less experienced than professionals, there may be some inconsistencies in the answers. Henceforth, respondents may deem themselves to have a higher understanding of the topic than they really do, due to being unaware of the depth of the subject. Therefore, they make them less reliable than as initially expected, yet the vast majority of questions should be appropriately answered.

21. Professional Survey

It must be noted that the respondents had very similar views on the matter and this may be due to various factors. Perhaps this is the general view of the industry (most likely) or there is a bias present. All who answered work in the same small firm, so they may share similar views simply due to being within close proximity and influence from one another. In cases like this, the flaws of small sample sizes shine through yet there was little opportunity to combat this.

22. <https://interiordesign.net/projects/8-sustainably-designed-and-architecturally-significant-buildings-in-singapore/>

As expected, the source of the article typically focuses primarily on interior design, yet they no doubt have great contact with respected architects and designers. Therefore, they are certainly very capable of constructing a reliable article on sustainability in Singapore. They have included many builds that are mentioned in other sources, directly supporting the claims of others and implying accuracy. Written in 2019, the article may certainly be considered reliable thanks to being up to date and written by someone in frequent contact and rich in experience of the subject matter.

23. <https://newbuildings.org/embodied-carbon-conundrum-solving-for-all-emission-sources-from-the-built-environment/>

New Buildings Institute are a prime example of those who are fighting for net-zero buildings in the industry. Overall, the non-profit company prioritises the protection of people and the planet through construction and energy consumption of commercial buildings. A pie chart is

featured on the page, originating from the UN, which as already established, is incredibly reliable. By featuring data from them and fighting for improved structures, their goals are clear and provide great transparency, making them trustworthy.

24. https://www.architectmagazine.com/design/buildings/sustainable-stays_o?o=1

Returning to Architect Magazine, they have provided an article on various different areas which have sustainable vacation venues. No doubt, immense progress has been made in regards to sustainability since the article was published in 2012, meaning that potential systems used here could be outdated and less efficient. This is of course contrary to some complete net-zero buildings present today yet the source provides a reliable avenue to demonstrate environmental awareness as long as 10 years ago, making it very useful in showing the scale the issue extends to.

25. <https://www.sciencedirect.com/science/article/pii/S2095263519300974>

Science Direct serves as a platform for scientific research in countless sectors, including sustainability within construction. This particular source overall investigates quality and surveys respondents on vertical gardens and facades within Singapore. There are of course regulations as to who can post to the site, similar to the publishing of a book. Therefore, there are levels of reviewing done before the research is released, likely after being approved by highly ranking professionals. Therefore, for this paper to be released, it is most likely very reputable.

26. <https://rgu-repository.worktribe.com/output/247116/an-evaluation-of-sustainable-construction-perceptions-and-practices-in-singapore>

This site hosts data collected from a range of scientists and researchers from the Robert Gordon University. In particular, this source was completed by 4 individuals and surveyed a large range of respondents for very accurate results, utilising mathematical analysis techniques such as standard deviation and mean. Additionally, the research was collated in 2018, which is fairly recent but once the advancements made in sustainable architecture and global conditions over recent years have been considered, it loses a little strength in its claims as they may differ from if the survey was conducted today.

27. <https://www.ceicdata.com/en/singapore/environment-pollution/sq-co2-emissions-from-residential-buildings-and-commercial-and-public-services--of-total-fuel-combustion>

CEIC Data hosts a vast amount of data regarding countless factors such as economy and environment from countries around the world. This is deliberate in their aim to aid analysts to draw conclusions for various pieces of research. The data collated in this particular link considers data from 1971 - 2014, which is now becoming rather out of date, especially due to the regulations being introduced in more severity in years following the end of the dates listed here. Consequently, the source is very reliable but has trouble maintaining validity in the current global climate.

28. <https://www.pinsentmasons.com/out-law/analysis/how-singapore-decarbonise-construction>

This source has been written by a particular reputable individual, Ian Laing, Head of Infrastructure and Asia in regards to Pinsent Masons. Therefore, with such a respected and educated writer, what is within the article can be taken with a great deal of trust thanks to his immense experience and career position.

29. <https://www.eco-business.com/news/singapores-new-green-standards-for-homes-focus-on-people-and-design/>

This article simply documents and explains the latest alternations that had been made to the Singapore sustainable building regulations at the time. Any factual information or defining claims are simply being repeated from the official publications of the BCA and the Government, making Eco Business simply act as a messenger or a means of quickly having the new changes be explained to the public, without delving into analysing the government documentation. Therefore, they are extremely reliable in this case, as they are only expanding upon what has been done by the leaders.

30. https://www.bca.gov.sg/greenmark/others/GM_RB_2016_criteria_pilot.pdf

The BCA (Building and Construction Authority) is Singapore based and is dedicated to improving the living environment in the country. This source depicts the criteria which must be met for buildings to receive certain Green Mark certifications as of 2016. No doubt there are newer iterations which should also be considered yet they are not documented here, harming the validity somewhat yet still ensuring sustainable standards are met and recognised. Furthermore, the BCA is incredibly reputable, due to its prevalence in the building sector and the government, meaning the points within must be considered with great respect and trust.

31. <https://www.re-thinkingthefuture.com/top-architects/architects-in-singapore-top-architecture-firms-in-singapore/4/>

The margin for potential bias here is immense, due to ranking the architects firms of Singapore in a way that is not explained to the reader. Therefore there is a sense of mistrust surrounding the article, making it less reliable. Despite this, I used the article as a means of discovering firms prioritising sustainability, no matter their supposed 'ranking.' Therefore, I found it to serve its purpose very well and lead me to discover the work of various companies to aid in my research.

32. <https://www.luxuo.com/properties/best-asian-eco-forward-architectural-firms.html>

This is yet another case of me using an unregulated / mysterious 'ranking system' as a means to find environmentally-conscious architecture companies within Singapore. Therefore, my utility of this source led me to two other sites which will undergo additional evaluation. Moreover, sites with ranking systems that are not disclosed to the reader on how they are compared leads to a lack of trust between the reader and the provider.

33. <https://woha.net/projects/>

WOHA have completed a range of sustainable projects across the world and some of the most iconic structures in Singapore and take the style to the extremes in regards to increasing biodiversity. The firm has incredible ratings and awards to commemorate their progress for the cause and meeting client needs. Overall, they are one of the most highly-regarded building institutions in the country, with global recognition keeping them in the eyes of not only the public, but also potential clients. Therefore, they are a prime example in the steps that must be taken towards a more sustainable future in architecture.

34. <https://www.straitstimes.com/singapore/environment/green-buildings-reaching-beyond-energy-efficiency-to-tackle-embodied-carbon#>

The Straits Times is a Singaporean broadsheet newspaper, which already bodes well for its respect as a contrary to those who are tabloid due to broadsheets typical extensive care for detail and statistical analysis. Additionally, the article is rather recent, being written in August 2021 and covers an extensive range of issues and ways architects can help, signifying a great deal of knowledge by the author, increasing my faith in their validity.

35. <https://www.ukgbc.org/climate-change-2/>

UKGBC stands for UK Green Building Council and they ensure development of 'green' architectural processes being integrated in the UK. Their work is substantial to the extent where they aim to 'radically transform' the way in which buildings are made in the UK for the good of the environment. Therefore, they are a very knowledgeable and trustworthy source for my research.

36. https://www.designingbuildings.co.uk/wiki/Sustainability_in_building_design_and_construction

Surrey Hills creates management plans to aid in preserving the natural world without compromising construction, essentially ensuring sustainable architecture. This makes them a reliable source on its own, yet many architecture firms in the UK have utilised their services and are working towards a greater implementation of sustainable architecture. Conclusively, this source is particularly reliable for sustainable architecture in the UK, especially with the article being written as recent as June 2021.

37. <https://www.pbctoday.co.uk/news/planning-construction-news/uk-eco-buildings/40160/>

This source discusses what the author deems to be the most impressive sustainable buildings in the UK, yet instantly, it becomes apparent that there is great potential for opinion based bias instead of factual points. This puts the source at risk of losing a great deal of validity yet I used it to only provide some examples of the UK's potential in bringing architecture like this from around the world to our doorstep. Therefore, there has not been a large impact on my work whatsoever, despite the uncertainty surrounding the source. Moreover, it was written in April 2018, meaning there could be far more builds worthy of a place in this article, meaning it could be somewhat out of date.

38. <https://ecowarriorprincess.net/2016/06/5-outstanding-examples-of-sustainable-design-around-the-world/>

Immediately, the name of the publisher of this source brought scepticism to me as it appears to resemble a lifestyle magazine that is unusually branching out into sustainable matters. Nonetheless, the article is of very high quality and discusses many crucial factors to ensuring sustainability in construction across the globe. Henceforth, the source was particularly useful for my research in whether the style would spread across the world, despite being written in 2016, as this even aids my claim that the process has already begun many years ago.

39. https://www.youtube.com/watch?v=fsWr0LfM_uQ

In this video, the YouTube channel 'Going Green' discusses the most sustainable cities in the world, considering countless parts such as energy efficiency and generation, construction and lifestyles. This indicates a broad range of expertise and research from the

presenters of the content and that they can be trusted with completing suitable studies, increasing their reliability as a whole.

40. <https://www.youtube.com/watch?v=QCZ8jlnO7UY>

World Economic Forum engage in a range of media and content types, as seen in how they created this YouTube video as well as their own well-known website. They intend to 'directly influence global agendas and decision making,' and even the fact that they are considering Singapore's sustainable processes and are sharing them with the world indicate their efforts in informing and potentially spreading this type of building across the world. This brings a great amount of respect to them in addition to their already high status, meaning that they are truly very reliable.

41. <https://inhabitat.com/worlds-largest-vertical-garden-at-the-singapore-tree-house-condominium-sets-new-guinness-record/>

Working directly against my project's question, this source demonstrates the extent to which efforts are being made to ensure sustainability through architecture in Singapore. This example in particular covers the largest vertical gardens at the Treehouse building, yet with the article being published in 2014, the question arises as to whether it is still the largest in the world as there has been a great amount of time between then and the time of writing this. Despite this, the website where this may be found is primarily focused on sustainability across countless areas, ranging from construction (as seen in the article) to fashion design, implying the extent of sustainability. As a result of this, the source is particularly trustworthy and a valid asset to my project.

42. https://issuu.com/sgbc/docs/sgbc_ggb1

ISSUU is a publishing platform for digital documents, yet this of course opens up the risk to unknown / inexperienced people uploading incorrect information, similar to Wikipedia. Nonetheless, the article in this source is property of the Singapore Green Building Council and is a 28 page long booklet, acting as a guide to green architecture in the country. Therefore, despite the unusual upload location, the source holds great validity due to the status and importance of the company who made it.

43. https://www.google.com/url?q=https://www.mdpi.com/2071-1050/9/6/919/pdf&sa=D&source=docs&ust=1643798042155916&usq=AOvVaw20AS_jxzppUwuT4FzAR2xK

MDPI offers online digital publication services, granting users access to many free scientific reports, similar to the one linked above. As seen on the first page, there were 3 authors and there was an extensive editorial, acceptance and publication phase that the paper went through before finally being published on the 31st May 2017. There are a total of 81 references in the bibliography, showing the extent to what effort was inputted into the project. This grants the project great respect and status, giving any claims strong support and reliability.

44. <https://www.reutersevents.com/sustainability/singapore-leads-way-asian-developers-wake-climate-risk>

Labelling themselves as a sustainable business, Reuters Events states that Singapore is in fact leading the way forward as an example to other Asian countries as to what to do in regards to sustainability. A great deal of detail on air conditioning energy consumption factors and even draws comparisons to other areas like Hong Kong. Consequently, the

source was particularly useful for me and holds a good deal of reliability for inclusion in my project.

45. <https://architecture2030.org/why-the-building-sector/>

This website's main focus is the state of global architecture by the year 2030 and what we can do to ensure progress and improvement in environmental factors. Some graphs are present with data routing back to various respected sources, supporting the validity of this source as a whole. It shows that if they are willing to work with data from reputable sources, then they are more than likely to be reputable themselves, making them more reliable.

46. <https://www.nccs.gov.sg/singapores-climate-action/singapore-emissions-profile/>

The National Climate Change Secretariat regards Singapore as being very environmentally conscious in the building sector, ranking very highly ahead of many countries. It must be noted that the site is associated with Singapore's government agency, making them very reliable. Although, with so many sources linking back to the government, if they were to lie then all of these sources would follow suit and the typical analyst wouldn't know, compromising their validity. However, this is of course incredibly unlikely.

47. <https://climateactiontracker.org/countries/singapore/>

Climate Action Tracker provides access to data on many countries throughout recent years and assesses their energy ratings and efficiency. In-depth explanations are given for a country's particular rating and each region's profile consists of many different areas depending on their targets and progress. Ultimately, this site is a great tool for seeing how Singapore has progressed and why it is at the rating it is, supported by data from many sources, making this site very reliable and useful.

48. <https://wedocs.unep.org/bitstream/handle/20.500.11822/34976/SGB.pdf>

The source is a 6 page segment of a far larger source that is not included in full, yet the section linked here discusses the green buildings of Singapore. There is an extensive range of references available in the last pages, which acts as a supporting factor to what has been said in the pages prior. Generally, this is a particularly reliable source, due to the immense number of references for such a small sector.

49. <https://www.channelnewsasia.com/singapore/net-zero-buildings-sustainability-energy-design-2134106>

ChannelNewsAsia provides news coverage about Asia as well as global issues, meaning that respected and experienced journalists and fact checkers work amongst them in writing articles and discussing current affairs. Consequently, their article on the net-zero buildings in Singapore can be taken as very reliable, supported by the various interviews and facts and figures present within.

50. <https://news.nus.edu.sg/nus-sde4-is-first-in-southeast-asia-to-achieve-ilfi-zero-energy-certification/>

The National University of Singapore reported that one of their structures was the first to achieve a certain outstanding energy certification, yet there is of course the risk of self promotion blinding them from the facts. This is definitely the case in some sources available, but I find it extremely unlikely that this is occurring here as this would risk the universities reputation and go against their morals and aims in combating climate change. Therefore, I

believe the source to be trustworthy and a prime example of what can be done given correct funding, time and care.

51. https://www.arup.com/-/media/arup/files/publications/i/international_sustainability_systems_report.pdf

CoreNet Global is a non-profit organisation surrounding residential matters, with a truly strong array of employees coming from Forbes Global in 2000. Despite this, yet again there is a large gap in time from the source creation to today. Despite this, it presents the different regulations incredibly clearly, unlike any other source. This made it extremely helpful to compare the work of different countries, just as desired, making the source very useful with reliable points being considered throughout.

52. <https://www.powerengineeringint.com/coal-fired/singapore-relies-on-fossil-fuels-more-than-any-other-country-study/>

Power Engineering International conducts reports on countless engineering projects and global issues, including Singapore. They brought to light the dependence Singapore has on fossil fuels and provide a great deal of statistical information to support this from another well-known industry name, Utility Bidder. With the report being published as recent as late July 2021, it is incredibly likely that the figures are extremely similar today and that helps the overall article in being reliable.

53. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.733.3117&rep=rep1&type=pdf>

The source had been written by the reputable assistant professor, Dr. Rabee M. Reffat of Assiut University within Egypt. This implies a great deal of experience and knowledge as a basis for the report, solidifying any potential claims as being more reliable. Whilst the report is rather old due to being written in 2004, yet issues such as resource and manpower remain true to this day, leading it to being a great help in my research.

54. <https://www.uclpress.co.uk/collections/series-fabricate/products/154646#>

For years UCLpress has demonstrated their capabilities in innovation in sustainable matters, especially in developing countries. They are well known amongst architects and their work is often covered in universities for architecture courses, giving them a strong foundation and position in the industry. Due to their substantial efforts and progress, they have a very reliable status, as regarded by many.

Appendix 11: Self Evaluation

I feel that completing this project has allowed me to greatly improve my skills in various areas. My literacy abilities were challenged and have ultimately become superior to how they were prior, as I find myself utilising new words from a thesaurus frequently and creating clear and concise pieces of writing. Additionally, I have been proofreading my work to ensure clarity, becoming proficient in doing so. My paragraph structures and overall writing process have become fluid to how they once were as a direct result of this work.

Whilst I feel I have always been comfortable with my numeracy skills, completing this project pushed me to utilising what I have learnt in college in real scenarios such as the Mann-Whitney test. Despite being comfortable with the calculation process, it was extremely helpful to adapt this to a certain context and see how it can aid in research and analysis, which will certainly assist me in the future. I had definitely been taken out of my comfort zone in this case, yet found it to only refine my numeracy skills further than what I typically use regarding data analysis like means, ranges and modal values.

Similarly to my numeracy skills, I am proficient in utilising technology for various applications, yet the project led me to delving into new means of expanding my knowledge. I constructed multiple online surveys to discover contrasting general and professional viewpoints on my topic, and utilised Google Sheets to present my findings in a helpful visual manner. This allowed me to combine my graphing capabilities with computing to assess data in multiple beneficial ways. Furthermore, the complete document is particularly larger than what I usually work on, opening me up to new formatting methods such as page breaks, appropriate headings and methods of displaying images alongside my text without disrupting the flow of the writing.

I feel that strict deadlines are critical to a projects' progression and I implemented that system here. Time management with allocated times of the week allowed me to frequently add to my work, gradually building up to completion. Admittedly, time management has not been perfect, as some days I would complete less than desired but on occasion I would make immense progress. I set out at the beginning of the project to construct a plan with what will be done to complete each area in a separate document, which I would always have open during my writing to refer to. This proved to be very helpful and had undergone great changes and multiple versions throughout the course of the project. Moreover, I collated every single one of my source links and short descriptions of them in another document, making referencing far easier than had I not done that.

Similarly to planning, I believe care for organisation can allow me to stay on track and make great progress, writing and presenting information in a clear manner. Before writing the main body of my project, I constructed a layout of bold and underlined headings, page breaks and consistent font and presentation techniques, with all titles detailed in the contents page. I found my formatting to be of great help in the organisation of my project, yet I feel utilising the contents page coding with different text types to automatically apply the page numbers to the contents pages could have saved me time due to not needing to do this manually. Nonetheless, my project maintained an appropriate structure that I found easy to navigate and work upon.

I ensured critical thinking perpetuated throughout my work, enabling me to take various approaches to different topics. This has been particularly useful in analysis and proposing potential solutions to problems and what issues could arise from these fixes, demonstrating the complexity of the subject at hand. Despite the depth of the issue, I ensured to think creatively to counter problems and explain my reasoning. This has taught me a great deal about the subject as well as how I can dissect my problems and take them

one piece at a time. I feel that my critical thinking skills have improved a great deal due to the topic itself, as well as the way I have presented my findings, making the project be truly beneficial to me.

Problems commonly arise with any piece of work and this was no exception. Frequently, I would need to alter my descriptions of certain work or return to them at a later date for extra analysis. Nonetheless, referring to my plans and staying organised allowed me to combat these problems logically, keeping my mind at ease. In conjunction with critical thinking, I found problem solving to be a large aspect of my work, especially when considering word count regulations and ensuring concise explanations as opposed to unnecessarily long and complex ones.

Conclusively, I believe the project was extremely beneficial in developing my skill set as a means of aiding me for any future endeavours in analytical work. I feel that every single area of my skills have been improved upon here, as I have explored individually in the paragraphs above. I look forward to completing additional projects like this in the future to potentially expand my capabilities even more.

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