

## **Academic Review of LDEV 671 Sustainable Design – Spring 2018**

### **Introduction**

Sustainability is defined as the avoidance of the depletion of natural resources in order to maintain an ecological balance. This course is designed to teach these practices as they relate to the development of the built environment through many different aspects associated with sustainability and development. Throughout the course, many specific topics of sustainability are discussed and related to development as to show that not only can these two practices work side-by-side, but as well hand-in-hand in order to achieve a lessened negative impact on the environment around us as well as a heightened return on investment for developers. Within the subsections of the course, these aspects are explained in detail and examples of proper use of these practices are provided to present a precedent of proper and improper use of sustainable methods in the built environment. At the junction of environmental, social, and economic factors, the course explains that sustainability stands on these three legs, without which it is unable to enhance anything, failing to provide real estate asset value as it pertains to sustainability, otherwise known as the sustainability dividend.

### **Summary**

At the top of the course, a brief history of sustainable development is presented, introducing the driving factors behind the practice and citing examples of how sustainable development has had and continues to have influence in the different facets of social, economic, and ecological ideals. Moving forward a major section of the course is to introduce the practical applications of sustainable development in today's society, beginning by explaining what the different elements of sustainable development actually is. The aforementioned environmental,

social, and economic triad make up these elements, each having specific enhancements they bring to the playing ground for development. Environmental sustainability focuses on the use of natural resources in an attempt to balance the production and consumption of Earth's resources in construction as well as to monitor the rate at which waste is reabsorbed into the environment so that it is not damaged. Social sustainability is the attempt to work toward a common goal by providing all the necessary needs of individuals through nutrition, shelter, and other aspects of modern living. And lastly, the third portion of the triangle is economic sustainability which combines the first two to create a working economy in order to support the continuation of sustainable development as a whole.

Following the overview, the course moves into breaking down the separate elements of sustainability into its component parts in order to provide detail on the different aspects that are all major contributing factors in creating sustainable development, the first of which being energy, and moreover energy efficiency. This subject was broken down into four component parts included in the Huntsman 2015 Sustainability Report: incoming supply, process management, product innovation, and product delivery (Huntsman Corporation, 2015).

Using advancements in energy production and distribution as a jumping off point, the course moves into innovation and design of sustainability, both small scale elements to large scale developments as a whole. Covering a wide variety of examples, methods of how innovation and sustainability can perform well in unison are taught, leaving a background theme of change being necessary in order to effect the problem for the better.

While the majority of sustainability practices are held in the built environment, a great deal of sustainability is inherent in location and proper usage of the land available as a means to mitigate some of the issues that are present when struggling with sustainability. The course

covers proper land use and ecology of development by presenting a number of factors to think about when creating a new development or continuing to develop in pre-built areas. Two of these elements include thinking about the highest and best use of the land present as well as considering the physical and economic characteristics of land. By acknowledging these elements, the land can begin to reveal the proper use and present the difficulties of developing sustainably based on geography.

Sticking in the same vein of natural aspects of sustainable development, the next topic covered in the course was emissions and air quality. Because buildings account for a large portion of emission issues, it is important to learn about how to mitigate these negative impacts the built environment has on the natural environment around us. Additionally, the impact that a building's indoor air quality has on the people inside them is discussed, with many alarming facts provided about the quality of office and retail space around the world.

Breaking down the sustainability of buildings further, the course moves into discussing materials and how they are used in the construction process of today's built environment. The sourcing, production, and implementation of materials plays a large role in the overall building's performance in its efficiency. Also discussed is the multiple organizations and councils that have been created in order to enhance the use of sustainable materials, in turn attempting to improve the sustainability of buildings overall.

When thinking about the usage of natural resources in the modern built environment, many materials come to mind such as wood for building materials or fossil fuels to create energy, however one that could be overlooked in a modern society is water. The course introduces the topic by explaining the source of water, how it moves through the hydrologic cycle, and how it impacts the quality and quantity of water made by the built environment. In

many advanced countries throughout the world, having and using water is common and until recently have people begun to realize the impact that increased localized population growth has on a regions water supply.

Nearing the end of the course after discussing the various elements that go into creating a sustainable development on any scale, the next topic of discussion is how to transport the model of sustainability around the world in order to gain involvement in the movement and provide a basis on how sustainability should be achieved. Looking at specific examples of how the sustainability model is presented, various solutions to the issue are discussed, opening discourse on which ones are most appropriate and how they are best transported throughout the world.

Closing out the course was discussion on the various benchmarking programs that are present across the public and private sector. As an attempt to show that there is no one correct answer, discussions were held about several benchmarking ventures highlighting the differences between them. This revealed the great amount of miscommunication, lack of true data, and the missing benchmarks that could relate all locations across the globe on the same scale of sustainability.

### **Analysis**

Learning the history behind sustainable development is important because it highlights the seeming non-concern for the environment throughout history until the very recent past. The players involved and the malpractices committed are important to understand when moving forward, because it provides examples of what should not be done in order to continue to harm the natural environment around us. Looking to a precedent used in class, the building at PNC Place in Washington, D.C., the three elements of the sustainability triad were used in order to create a “green” building in the heart of downtown D.C. The project looks provide the most

practical application of the sustainability model by incorporating the many aspects of sustainability in a modern construction. Moving through the process from conceptualization to implementation, the building employed the use of architects and engineers focused on this goal and calls upon users and management to maintain the effectiveness of the design post construction. As a goal, the building focused on achieving the LEED Platinum certification in order to show their dedication to truly creating a “green” building from the beginning of the process so as to not have any wavering from the end goal by the time the project was completed.

As sustainability pertains to energy production, allocation, and consumption, the Huntsman report does a good job of breaking down each element to better explain why there is an energy problem and how it could be utilized more sustainably. Looking into these sections respectively, the incoming supply should be from sustainable sources, whether solar, wind, or some other method, “...purchasing power from providers that practice energy conservation and efficiency...” should be a major component of any development. When it comes to processing, Huntsman claims that it is important to “continuously look for ways to improve manufacturing processes in order to use less energy.” Inherently, when materials and components that go into buildings are constructed using more sustainable practices, the development overall will be more sustainable. In order to make a change in these processes and the way energy is utilized, it is always important to be continually innovating and updating the way things are done as it clearly wasn’t working in the past. Constantly utilizing, “innovative products and technology enable[s] consumers to use less energy,” aiding in the overall goal of becoming more sustainable through improved energy usage. Lastly, when products are created through improved processes, the distribution of these products plays a large role in energy consumption through transport. Utilizing, “a wide variety of distribution options...and [choosing] the best option with

conservation and efficiency in mind,” architects and developers can help with the negative impact seemingly easily. (Huntsman Corporation, 2015)

On the topic of innovation and design, there are major changes that can be made in order to create a more sustainable built environment. According to course content, “how we plan and design the built environment from here on out will determine whether climate change is manageable or catastrophic (Architecture 2030, 2017).” Through the use of innovative technologies such as some seen in the PNC Place project, architects and developers are able to create buildings that perform much better from an ecological, social, and economic standpoint without having to sacrifice much besides time and thought put into developing and creating new technologies that enhance the project.

Stepping back from the more modern view of innovation, looking at the land can answer many questions that may arise when developing in a project. Following along a narrowing scale from regions, cities, districts, sites, to buildings, the scope of sustainable development can have an impact on all the provided scales. There are many components present in each scale that must be analyzed in order to provide the most reasonable solution to developing sustainably. At the region level, a developer must review flood boundaries, settlement areas, hazard potential, and more in order to properly formulate a plan for proper development. Similarly, a city must look at its heat island impact, a district its residential density, a site its sustainable elements of water and soil, and a building at its façade treatment, to name a few examples of the variety of scales at which elements of sustainability play a part. There are many examples of these varying scales but to name one in specific detail at the city level, Architecture 2030 provides guidelines on the proper use of park space within a city in order to provide social, physical, and recreational opportunities. They state through proper placement, “parks serve entire cities, are bounded by

public rights-of-way, and attached to other public uses such as schools and community centers (Architecture 2030, 2017).” Through the proper use and planning of the land, a large number of benefits can be achieved with minimal degradation to the environment at large.

Concerning emissions and air quality, a major portion of the course discussion was focused on the various studies conducted on the indoor air quality of office spaces around the world. According to a report released by the Smart Building Blog, “indoor air quality is [two and a half] times worse than outside air quality,” leading to, “productivity decreases by [eight to ten percent],” and various health issues associated with diminished air quality in the workplace (Moriarity, 2017). Provided that a large majority of the time is spent indoors, it clear that the quality of indoor air plays a major factor in the sustainability argument provided that it not only effects the environment, but the social and economic aspects of a building as well.

As the base component for buildings, materials play a large role in the manner that buildings perform from a sustainability standpoint. With a wide variety of sustainable materials becoming more rapidly available in today’s construction market, it is becoming easier to create buildings that are inherently more sustainable based on the materials and components they are constructed with. An example of this is the focus toward creating high efficiency windows in order to achieve net-zero energy consuming developments. According to an article released by the National Academy of Engineering, “windows in the United States [alone] cost consumers approximately \$35 billion per year in energy,” and take up in disproportionately high amount of the over building’s energy usage (Tinianov, 2009). Window advancements of the recent past, however, has looked to mitigate these negative effects of windows and with new technology in building materials becoming more popular and readily available, the costs associated with using

higher performing materials is becoming affordable and financially feasible for developers and architects to incorporate into their projects.

Taking a step back to the usage of natural resources in development, the next topic covered, water, has a huge impact on the manner in which we develop today. With many requirements now set forth by local and national governments throughout the world, many criteria must be met in order to reduce both the overall usage of water as well as the pollution of hydrologic flow systems. Clearly in some parts of the world, having enough water is a concern, especially when the supply of water is greatly outweighed by the demand of a large population. In order for the Earth to be able to maintain the current rate of population, especially in localized areas, the way water is used will have to change. An example of extreme measures having to be taken to mitigate this issue and correct a long line of water misuse is Cape Town in South Africa. According to a report released by CNBC, Cape Town is in a state of panic over water and eventually, “the crisis will see the government switching off all the taps and rationing the resource through collection points.” Clearly this is a very aggressive measure to take, however the city has come to that point and not being a localized issue, “cities around the world should prepare for running out of water.” (Wong, 2018)

Looking at the examples of how the sustainability ideal is sold, there are a number of different models that can be employed in order to achieve the overall goal. By properly marketing the sustainability model, an increase in overall usage, consumption, and awareness of the practice can be revealed. Not only does this increase the users experience of the place, but some see it to be a tremendous value added to the economics of a project as well. According to a report released by the Rocky Mountain Institute an average of nine percent increase in operating cash flow, and seventeen percent increase in sale value premium, and an overall nineteen percent



increase in profits can be achieved with only a seven percent increase in the upfront construction costs, showing that minimal upfront changes can lead to an overall increase in profitability (Petersen, 2018).

Although most societies seemingly have an idea of what there is to achieve when concerned with sustainability, however without the proper methods of benchmarking, there is no real way to measure the success of a building's achievement in the practice. The course discussed six or more examples of different measuring and benchmarking tools through a number of simulation, monitoring, and reporting programs. One of these discussed at length was the Global Environmental, Social, and Governance Benchmark (GRESB). Their mission is to, "enhance and protect shareholder value by assessing and empowering sustainability practices in the real estate asset sector (GRESB, 2018)." This reporting and benchmarking system uses various technologies to monitor an asset's performance and sets forth straightforward datasets in order to have ease of comprehension across the globe. However, with so many systems similar to it, they do not have a high adoption rate, but are on the rise. With one global standardized system, comparing the relative sustainability of a project will become much easier, however, it seems that it may not be in the near future that this is accomplished.

### **Response**

Starting with the history and overview of the course topic is the most expected and useful option for course outline, as it provides the important background information needed to understand the importance and necessity of the course's subject material. Moving to the first examples of application of sustainability in the course, the project on PNC Place in Washington D.C. is a good example of a comprehensive project that looked to achieve the goals of sustainability from the beginning and continues to hold this achievement in high regard through

the use of proper property management and maintenance. It is interesting to see how much time and effort required by so many players involved can come together to create a project of this type at this scale, however it does propose a question. Clearly in this project, sustainability was key, however, does this translate to a larger scale in such that everyone is equally concerned both locally and globally about sustainability?

In the energy sector of sustainability, it is not only up to the small scale, individual developments and communities, but up to society as a whole. The United States government has been dedicated to this practice for some time as discussed in a 2017 White House Brief on U.S. Leadership in Renewable Energy. They state, "...top administration officials have affirmed our commitment to utilizing all of the United States' abundant domestic energy resources for good, both here and abroad (Thompson, 2017)." It is clear that with the involvement of the United States that the issue of sustainability will become more important as time goes on and will also influence change on a global scale. However, having the greatest amount of involvement by all the players involved from individuals to entire nations, will be the only way to have effective change.

According to Architecture 2030, innovation and change in development is necessary in order to reduce and redesign the impact placed on the environment around us. They state, "the first step is design; to integrate sustainable and passive design strategies that are low-cost or no-cost (Architecture 2030, 2017)." Although buildings have been designed and constructed essentially since the beginning of human history, there has been a recent pattern followed that only aims to increasing the financial feasibility of a project without much care taken to avoid negative impacts toward the environment. However, changes must be made in order for us to sustain our ability to live on this planet as we have been using our resources much more quickly

than they can be produced. Changes can be simple, though, as with “how you orient the building, shade the glass, incorporate daylighting and passive heating and cooling strategies, and the materials and systems you specify,” are all examples that require almost no difference in the budgeting of a project but can immensely affect the footprint it leaves on the environment (Architecture 2030, 2017).

In examination of land use and ecology, the proper use of land in order to create the built environment can greatly impact the sustainability of a development in a positive manner. In the example provided, parks can provide many benefits to a city’s citizens as well as provide cooling, solar, social, and economic enhancements for the buildings that surround it. Taking a look at all the levels of land use when preparing for a project is key in that at any scale, factors from these levels have an impact on the overall development. Utilizing the knowledge and research available is important as the proper use of land at any level has a major impact on the sustainable performance of the project, showing the effect that it has on the overall sustainability dividend at each level as well.

The issue of indoor air quality is a large topic of discussion as outdoor air quality continues to decrease around the world, people are in the need of access to fresh air, especially in the places that they spend most of their lives. As efforts to improve the built environment’s impact on the world around us, a focus should be placed on improving not only what the building puts into the world but what it takes and provides to users. Increasing the quality of work and social environments indoors not only appeals to the users involved, but also increase the economic benefits of a development as well.

With the accessibility to more affordable, highly efficient building materials, the construction industry is making strides to become more sustainable as a whole and easing the

difficulties associated with doing so. It is important to understand that the building's components have as much pull or more on the overall sustainability of a project, especially since they serve as the building blocks of the development. While this is seemingly a great solution, it is also important to remember the embodied energy that a material or component requires to be sourced, processed, and transported to a site.

As a building block for life, water is essential to maintaining human presence on this planet. Although most major cities have no trouble providing useable water to its inhabitants, population growth coupled with drought status worldwide, water is becoming less available. Now is the time to prepare and be preemptive about the conservation of the resource, before it has gotten out of hand. It is much easier for a community to respond to moderate, passive conservation methods in order to stretch the water supply without having to sacrifice normal everyday life, but if these methods are not taken, there is sure to be a widespread crisis in the near future. Not only does this impact individual users, but also the sustainability dividend as a whole as decreases in supply and usage has an effect on the triad of sustainability a project, city, or region has.

While the individual components play a part in the overall sustainability of a place, the package as a whole is the overarching goal to achieve, a stride to not only be energy efficient or water efficient, but to be sustainable overall. The way this model is marketed is the only way that it will ever take foot. The purpose of increasing awareness, adding value to the practice, and proving that it works is the only way that the global society as a whole will be a part, and in turn the only way that the movement will do any good to the environment in which we live. Because it is relatively new, there is no set practice that is the tried-and-true best practice, so any data at this point could be skewed as it pertains to the actual financial returns that sustainability can have

on a project. There have been successful examples, however, as of right now, there is no one answer to the question of how is it done best.

Speaking on data about sustainability, the final topic covered the measuring techniques utilized throughout the globe in order to attempt to provide an accurate method of calculating and ranking a building's, city's, or region's level of sustainability success. Right now, with the lack of one set standard of measurement, it is nearly impossible to grade a projects sustainability, and in turn link it to the overall sustainability dividend. In the future, on set of benchmarks should be employed in order to accurately measure this data at all scales from local to worldwide.

### **Conclusion**

The triad of environmental, social, and economical concerns that make up the sustainability cubed idea is the root of a successful global sustainability initiative. With the many sectors that go into sustainability, it is important that everyone be on the same page figuratively, in order to achieve the reversion of our built environment's impact on the world around us. The first step is learning how the Earth has been impacted and to look into all the elements that make up such impact on a large scale. Beginning with energy, it is important to understand that, "building energy use currently accounts for over 40% of the total primary energy consumption," not including the embodied energy that goes into constructing the built environment (Xiaodong, 2016). As the built environment continues to grow, the global energy supply cannot sustain the current rate at which energy is being used by today's methods, and a change in the manner by which energy is created and used must occur.

With change in mind, innovation is a major component to achieving the measure of sustainability required in order to reduce negative impacts. Innovation must not only occur in one sector but all ranging from, design, energy, materials, water usage, measurement methods,

and more in order for it to be successful. Additionally, when speaking on materials and construction techniques, an overhaul in current methods is required because taking a step in one direction does no good if not accompanied by proper steps beforehand. Thinking about the way construction materials are created and distributed is just as an important aspect as any when it comes to sustainability.

With innovations being made and many advancements accomplished on a small scale, though, without anyway of properly measuring these details, it is hard to understand what progress is actually taking place. Programs such as LEED attempt to encourage the use of green building practices however, they do not measure and compare the performance of the asset after construction and so no knowledge of ranking is available. Programs such as GRESB attempt to solve this issue, however without proper implementation and participation, success is limited and localized until global change can be achieved.

Elimination of the resistance to change and proper education on the facts associated with sustainability is truly what is necessary in order to achieve the overall goal of the sustainability model. By enhancing the environmental, social, and economic impacts through innovation and participation, the return on the investment placed on sustainability will be able to come to light through means of expressing the sustainability dividend, or the financial return of the practice, as well as showing the decreased negative impact on the world in which we live.

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