Contribution Of A Higher Educational Institution Towards Advancing Sustainability In The West Texas Paso Del Norte Region

Anand Raj
The University of Texas at El Paso

Follow this and additional works at: https://scholarworks.utep.edu/open_etd

Part of the Education Commons, Natural Resources Management and Policy Commons, and the Sustainability Commons

Recommended Citation

This is brought to you for free and open access by ScholarWorks@UTEP. It has been accepted for inclusion in Open Access Theses & Dissertations by an authorized administrator of ScholarWorks@UTEP. For more information, please contact lweber@utep.edu.
CONTRIBUTION OF A HIGHER EDUCATIONAL INSTITUTION
TOWARDS ADVANCING SUSTAINABILITY IN THE
WEST TEXAS PASO DEL NORTE REGION

ANAND RAJ
Doctoral Program in Environmental Science and Engineering

APPROVED:

__________________________________
Peter Golding, Ph.D., Chair

__________________________________
Scott Starks, Ph.D.

__________________________________
Luis Rene Contreras-Sapien, Ph.D.

__________________________________
Luis G. Perez, Ph.D.

__________________________________
Diane Golding, Ph.D.

__________________________________
Stephen L. Crites, Jr., Ph.D.
Dean of the Graduate School
Dedication

I dedicate my work to my teachers, my parents, and my wife.
CONTRIBUTION OF A HIGHER EDUCATIONAL INSTITUTION TOWARDS ADVANCING SUSTAINABILITY IN THE WEST TEXAS PASO DEL NORTE REGION

by

ANAND RAJ, MS

DISSERTATION

Presented to the Faculty of the Graduate School of The University of Texas at El Paso in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

Environmental Science and Engineering Program

THE UNIVERSITY OF TEXAS AT EL PASO

May 2022
Acknowledgments

First of all, I would like to thank the almighty God for giving me the courage and strength to complete my Ph.D. There are several people behind the successful completion of this study. I would start by thanking my advisor Dr. Peter Golding for his continuous guidance and encouragement and believing in me. It would not have been possible without his support. I will forever be grateful to him. I would express my gratitude to my committee members Dr. Luis Perez, Dr. Diane Golding, Dr. Scott Starks, and Dr. Luis Rene Contreras-Sapien, for their invaluable contribution and insights. I want to express my gratefulness to Dr. Annalisa Perez for her most significant support during this crucial time in my doctoral journey. I also thank Dr. Craig Tweedie and Ms. Lina Hamdan for their support during the entire study period. I would acknowledge the contributions of my colleagues and friends Nora Cuvelier, Mary Adu-Gyamfi, Nakul Karle, and Ana Perez for helping me in various ways. Also, many thanks to the person who changed the direction of my life and I joined the Ph.D. program. I would also like to thank everyone else who, in any way, has contributed to my doctoral journey. I am immensely grateful to my parents back home for their absolute love and support. My deepest gratitude to my wife, Rubi, who always believed in me and walked with me during this challenging time. Thank you so much.
Abstract

Sustainability comprises primarily three elements: environmental, social, and economic, which can be considered the keys to humanity’s survival and wellbeing. The pillars can alternately be given informal names: planet, people, and profit. Sustainability is achieved by effectively utilizing available resources through different sustainable development efforts. Generally, groups or entities come together to create sustainable impact in the three primary elements discussed here. City councils, businesses, and higher education institutions are just a few of the entities that engage in sustainability efforts. It is valuable to appraise the role played by a higher education institution in advancing sustainability in the context of ecosystem location, community dynamics, and financing. The University of Texas at El Paso (UTEP) is a case in point, illustrating how a higher education institution impacts sustainability in numerous ways across multiple domains of influence. Six diverse case studies, two independently focused on each of the three sustainability elements – environmental, social, and economic – demonstrate the breadth and depth of UTEP’s role in equitably advancing inclusive excellence in each of the sustainability pillars in the Paso del Norte region. Finally, the arrival of COVID-19 and UTEP’s response to the pandemic is documented in contributing holistically to community wellbeing. Overall, it is clearly demonstrated that UTEP contributes above and beyond the commonly stated mission of increasing access to excellent higher education. UTEP helps bring long-term prosperity to the region through the variety and depth of sustainability efforts.
Table of Contents

Dedication ............................................................................................................................. iii
Acknowledgments .................................................................................................................. v
Abstract .................................................................................................................................. vi
Table of Contents .................................................................................................................... vii
List of Tables .......................................................................................................................... x
List of Figures ........................................................................................................................ xi
List of Illustrations ................................................................................................................ xii

Chapter 1: Introduction ........................................................................................................... 1
  1.1 Need for Sustainability ................................................................................................. 1
  1.2 Sustainability and Sustainable Development ............................................................. 2
  1.3 Origin and History of Sustainability ......................................................................... 3
  1.4 Elements of Sustainability ........................................................................................ 4
    1.4.1 Environmental Sustainability ................................................................................. 7
    1.4.2 Social Sustainability ............................................................................................... 8
    1.4.3 Economic Sustainability ......................................................................................... 9
  1.5 Sustainability in Higher Education ............................................................................ 10
  1.6 Brief History of The University of Texas at El Paso .................................................. 10

Chapter 2: Literature Review ................................................................................................ 12
  2.1 Higher Education Addressing Sustainability ............................................................... 13
    2.1.1 UTEP addressing Sustainability ............................................................................ 14
  2.2 Collaboration in Sustainability .................................................................................. 16
    2.2.1 UTEP’s role in Collaboration in Sustainability .................................................... 17
  2.3 Social activities in Sustainability ............................................................................... 17
    2.3.1 UTEP’s Social Activity in Sustainability ............................................................... 19
  2.4 Economics in Sustainability ....................................................................................... 20
    2.4.1 UTEP’s role in Economics in Sustainability ....................................................... 21

Chapter 3: Methodology ......................................................................................................... 23
  3.1 Statement of Work ....................................................................................................... 23
List of Tables

Table 4.1: Different teams who worked synchronously to complete the Campus Transformation Project ........................................................................................................................................ 54
Table 4.2: ECHS in El Paso, TX, since 2006 till 2022 ......................................................................................................................................................... 63
Table 4.3: Input-Output Matrix (Hewings, 1985) (Oosterhaven, & Hewings, 2021) .......................... 83
Table 4.4: Type II multiplier for the education sector ................................................................................................................................. 89
Table 4.5: Type II multiplier for the construction sector ............................................................................................................................. 89
Table 4.6: The number and wages of UTEP employees and related salary expenditures in 2021 90
Table 4.7: Type II multiplier for the education sector ................................................................................................................................. 91
List of Figures

Figure 1.1: Venn diagram representation of sustainability [Adapted from Purvis et al., 2019] ..... 5
Figure 1.2: Pillar diagram representation of sustainability [Adapted from Purvis et al., 2019] ..... 6
Figure 1.3: Potential complication with Pillar diagram ................................................................. 7
Figure 4.1: Location of Rio Bosque Wetland Park, where it is important to follow the directions
given on the UTEP website rather than enter the park’s address into a GPS. Doing so typically
suggests a route where through access is not feasible at this time. (Adapted from Rio Bosque
Location, n.d.) ................................................................................................................................. 33
Figure 4.2: Water availability pattern at Rio Bosque Wetland Park since 2017 which highlights a
regular supply of water throughout the year (Center for Environmental Resource Management 1,
n.d.) ............................................................................................................................................... 38
Figure 4.3: Basic logic framework model of ECHS (Edmunds et al., 2010) ................................. 62
Figure 4.4: Enrollment of students from ECHS at UTEP from 2010 to 2020, shows the rising
interest among students in ECHS ................................................................................................. 64
Figure 4.5: Retention rate of Fall first-time, full-time undergraduate students who join UTEP
from ECHS Vs. a retention rate of overall Fall first-time, full-time undergraduate students at
UTEP .................................................................................................................................................. 65
Figure 4.6: Enrollment of students from ECHS at UTEP in STEM majors from 2010 to 2020 .. 66
Figure 4.7: Percentage of students enrolled from ECHS at UTEP in STEM Vs. Percentage of
total students at UTEP in STEM ..................................................................................................... 66
Figure 4.8: UTEP UB APRs for 2017-2018 showing approved and attained objectives for EPISD
and YISD ........................................................................................................................................... 75
Figure 4.9: UTEP UB APRs for 2018-2019 showing approved and attained objectives for EPISD
and YISD ........................................................................................................................................... 76
Figure 4.10: UTEP UB APRs for 2019-2020 showing approved and attained objectives for
EPISD and YISD .................................................................................................................................. 76
Figure 4.11: UTEP UB APRs for 2020-2021 showing approved and attained objectives for
EPISD and YISD .................................................................................................................................. 77
Figure 4.12: Percentage of hospital beds in El Paso occupied by COVID-19 patients from June
2020 through September of 2021 (Harper, 2021) ........................................................................ 95
Figure 4.13: Vaccination rates in El Paso compared with the state of Texas during 2021
(Dallasfed1.org., n.d.) .................................................................................................................... 96
Figure 4.14: Share of nonfarm sector stakeholders (Adapted from Dallasfed2.org., n.d.) ......... 97
Figure 4.15: Employment growth by Sector from February 2020 through September 2021
(Adapted from Dallasfed2.org., n.d.) ............................................................................................ 98
Figure 4.16: Credit and Debit card spending in El Paso and in Texas (Dallasfed1.org., n.d.) .... 99
Figure 5.1: A schematic representation of the university and its interconnectedness with the three
elements of sustainability .............................................................................................................. 107
List of Illustrations

Illustration 4.1: Rio Bosque Wetland Park Trail where park users can enjoy the yellow blooms of the annual Forb Bittersweet and spring wildflowers when in bloom (Visit El Paso, n.d.)........ 31
Illustration 4.2: Rio Bosque Wetland Park with mixed vegetation where ducks and other natural inhabitants are found........................................................................................................... 31
Illustration 4.3: Wind-powered water well at Rio Bosque Wetland Park more information ...... 36
Illustration 4.4: Watergate at Rio Bosque Wetland Park to control the flow of water coming from the Roberto Bustamante plant........................................................................................................... 37
Illustration 4.5: Tour of Rio Bosque Wetland Park primarily on the Wetland Loop Trail (Wetland Loop Trail, n.d.)........................................................................................................... 40
Illustration 4.6: Tour of Rio Bosque Wetland Park primarily on the Bosque Loop Trail (Bosque Loop Trail, n.d.)........................................................................................................... 40
Illustration 4.7: Tour of Rio Bosque Wetland Park primarily on the Rio Loop Trail (Rio Loop Trail, n.d.)........................................................................................................... 41
Illustration 4.8: People from the community providing support during the community workday (Park History, n.d.)........................................................................................................... 41
Illustration 4.9: Friends of the Rio Bosque Volunteer providing guided tours to the visitors (Park History, n.d.)........................................................................................................... 42
Illustration 4.10: Students from Summer Bridge Program having a field trip to Rio Bosque Wetland Park to get acquainted with their course research................................................. 43
Illustration 4.11: Image of the area before CTP identifying the free flow of traffic from North Mesa, parking spaces, and limited “green space” (Adapted from UTEP News Archive 2, n.d.). 46
Illustration 4.12: View of the Centennial Plaza after the completion of Campus Transformation Project depicting the green area and amphitheater-style seating (SITES, n.d.)............... 47
Illustration 4.13: Use of recycled concretes and stones adding to the beauty of CTP (SITES, n.d.)........................................................................................................... 49
Illustration 4.14: UTEP’s ECHS students at El Paso International Airport before a study abroad trip to London and Paris. Photo courtesy of Donna Ekal (UTEP News Archive 1, n.d.)......... 68
Illustration 4.15: COVID-19 testing proceeding at a UTEP parking place east of the main campus (Samuels, 2020)........................................................................................................... 101
Chapter 1: Introduction

Humanity's well-being and increasing world population depend on the availability and effective use of natural resources such as energy, water, materials, and land utilization. Demographic and economic development has led to a rapid rise in the consumption of these resources (International Resource Panel, 2011). There has been broad recognition that a focus on sustainability is the key to attaining the long-term prosperity of a region (International Resource Panel, 2011). There were times when economic growth was considered the primary factor for regional development; however, nowadays, environmental and social aspects of sustainability are increasingly recognized to be equally important (Kidd, 1992).

1.1 Need for Sustainability

Sustainability has caught people's attention (Chertow & Esty, 2008). The rise in global problems has disturbed our ecosystem's balance (Kimmins, 1997). The ever-increasing human population and associated demand have reduced natural resources and even fewer resources available for future generations. Furthermore, the unequal distribution of resources, where a small percentage of the population takes a significant share, compounds the situation. Hence, there is a need for movement of actions towards sustainability to help humanity improve the quality of our lives, preserve natural resources for our future generations and protect our ecosystem for harmonious living.

Advancements in sustainability can be achieved through individual and collective efforts by businesses, corporations, educational institutions, government, and non-profit organizations. It is unfair to say that one entity has more responsibility than the other. Everyone in society should put forward conscious efforts towards advancement in sustainability proportionate to their abilities. For instance, government and corporations should work at the national and state level.
Educational institutions and non-profit organizations may focus efforts on a regional level when feasible, while individuals can concentrate at the local and city district levels.

1.2 Sustainability and Sustainable Development

Sustainability is the state of attaining and maintaining balance among various components over a long time without compromising or overusing any of its features (Sustainable Development, 2015). In a broader context, attaining sustainability should not be a short-term target but a long-term goal that, once achieved, continues to evolve. For example, a perfect application of sustainability continuously evolving would be one in which everyone in the society would have a healthy living, access to clean air, healthy food, education, health care, and job opportunities. While this utopian society is not realistically attainable, it should not stop humanity from integrating sustainability into our daily actions.

On the other hand, "sustainable development is the ability to meet the needs of the present generation without affecting the power of future generations to meet their own needs," as stated in the Brundtland Commission Report given by the United Nations World Commission on Environment and Development in 1987. The resources from nature are best utilized in an amount lower than or equal to the amount that nature can gradually replenish in due course of time and will be ready for the future generation for consumption when needed. For instance, sustainable agriculture, implementing crop rotation with different crops planted sequentially on the same land, help optimize nutrition in the soil and help improve its health.

Sustainability can be achieved through sustainable development, a process or pathway towards sustainability (Sustainable Development, 2015). Multiple functions among the various elements of sustainability work in parallel to transition toward attaining an improved state of sustainability. In other words, sustainability is the ultimate goal to achieve, whereas sustainable
development leads toward sustainability. Sustainable development is an unending process; efforts will always be ongoing to improve sustainability continuously.

1.3 Origin and History of Sustainability

The concept of sustainability is not new. However, it has become a buzzword in recent times and today is widely used in different fields of study. Historically, sustainability was concerned with describing the physical environment. The German word "nachhaltigkeit," which means "sustained yield" (Guidotti, T. L., 2015), was first used in a 1713 handbook of forestry, informing the reader never to harvest more than what the forest can regenerate (Grober, U., 2007). Perhaps history shows that the people worked to protect their resources because they understood resources are finite, and if resources become scarce, it would be more challenging for their survival. So they only took what they needed and at the rate that the planet could replenish. This approach also ensured that future generations would have enough for their consumption. There have been several often-quoted examples of sustainability in different cultures worldwide. Two examples are from the remains of Machu Pichu and the Indus Valley Civilization. Inhabitants on Machu Pichu, located on a high mountain ridge in Peru (UNESCO World Heritage Centre, n.d.), used terrace farming on the mountain's slopes which helped prevent the washing away of soil nutrients by the rains. The practice leads to the growth of healthy crops (Wright et al., 1997) (Omondi, 2020). The archaeological findings from the remains of the Indus Valley Civilization, located in the Indian Subcontinent, had a well-structured settlement with a proper drainage system (Khan et al., 2014), which is a perfect example of social sustainability and quality of life.
1.4 Elements of Sustainability

Sustainability can be defined in the context of a community, region, state, or nation (Duić et al., 2015), achieving quality of life within an ecosystem through mindfully establishing a balance among three core elements (Purvis et al., 2019):

• Environmental Sustainability
• Social Sustainability
• Economic Sustainability

It is not surprising that the concept of sustainability began with a focus on the environmental element and remains a common focus. Comparatively, more work has been completed on ecological aspects, in part because social and economic factors have relatively recently begun garnering attention. Before the industrial revolution, society was not depleting natural resources excessively. Humanity was not mindful of the natural resources being used or destroyed with technological advances. The intended use of natural resources took a back seat to economic development as the industrial revolution brought a new way of living and prosperity to many (Senge et al., 2001). As the years progressed, activists began to shed light on the overuse of natural resources and protective, and some restorative steps have proceeded to preserve land, wildlife, and water (Herzog, 1993; Norman, 2017). These activists brought attention to the environment and natural resources, which is easily seen and has become more widely recognized during the past four decades. By comparison, attention focused on social and economic sustainability has increased dramatically at the start of the twenty-second century (McKenzie, 2004).

With the changing times, the definition of sustainability changed. The UN general assembly, 2005 World Summit, introduced the three goals of sustainability: environmental
According to this updated definition, sustainability is achieved with a holistic balance between all three components. In recent research contributions, further descriptors of sustainability include institutional, cultural, or technical (Purvis et al., 2019). However, these can be realized to be a subset of any one of the three core elements of sustainability.

Sustainability can be pictorially represented primarily as a Venn diagram or a Pillar diagram. The Venn diagram representation of sustainability is self-explanatory and easy to understand. Each circle contains one of the sustainability elements, and where all intersect with one another exists sustainability. Figure 1.1, seen below, depicts that sustainability is achieved in the region where the three elements – environmental, social, and economic – coexist, represented as the area of common intersection.

![Figure 1.1: Venn diagram representation of sustainability [Adapted from Purvis et al., 2019]](image)

An alternative view of sustainability is visualized in Figure 1.2: The pillar diagram identifies each element as a pillar supporting overarching sustainability.
The appeal of the representation in Figure 1.2 is that it idealistically presents a sense that each pillar is of equal height and orientation. However, Figure 1.3, seen below, identifies potential complications with using the pillar model.
Even though the three pillars do not align in Figure 1.3, sustainability is in balance is suggested as being supported. This does not satisfy the definition of sustainability, where all the three elements should contribute toward sustainability. Therefore, contrasting these simplistic representations, the Venn diagram is preferred. The three circles intersecting each other is a convenient visual for readers to comprehend the concept of three interdependent elements of sustainability.

1.4.1 Environmental Sustainability

A sustainable environment is achieved when the amount of resources taken from nature is less than or equal to the amount of resources produced or recycled by nature (Heinberg, 2010). In the process of harvesting resources from the environment, human activities that negatively impact or harm the environment should be reduced or minimized. For example, one major component of
protecting the environment is the wise utilization of land. Not all land should be used to fulfill the needs of humans. Space is required for the plethora of plant and animal species to live and flourish (Sustainability Components: Balancing Environmental, Economic, and Social Equity Components, n.d). Also, sustainable agricultural farming methods help maintain the health of the soil, which in turn provides more yield. As a third example, environmental sustainability is consistent with emerging plans to reduce reliance on oil and fossil fuels, and preference should be given to sources that do not cause pollution and contributes towards global warming.

1.4.2 Social Sustainability

Social sustainability incorporates environmental integrity, human wellbeing, resource protection, and literacy, among other fundamental social components of society. According to the three pillars theory, endeavors to promote social sustainability should also focus to promote economic and environmental benefits (Allen, 2021).

In an ideal setting, social sustainability is achieved when the residents of a population region live a substantive quality of life (Social Development for Sustainable Development, n.d.). Substantive quality of life is not easy to define as environmental sustainability. Various organizations, including The United Nations Global Compact, The World Bank, and Science Direct publications, use variations in the meaning of social sustainability and quality of life (UN Global Compact, n.d.) (World Bank, n.d.) (Balaman 2019). A cohesive definition of social sustainability includes the required basic needs and mental peace. Ultimately, quality of life includes access to general necessities and matters important to all residents. Examples of important matters include housing, public and private transportation, educational institutions, meaningful work, viable food, fresh air, clean reticulated water, public spaces and facilities needed for recreational activities, and protection from potential hazards. Social conditions include local
authorities providing equitable support in the community, with all residents having access to public health services and dwelling in a friendly and safe neighborhood. All residents are treated equally irrespective of their differences: diversity, equity, and inclusion are important within social sustainability. Also, strategies to preserve local culture, share talents, and traditional art forms are integrated by the community to achieve social sustainability. (Sustainability Components: Balancing Environmental, Economic, and Social Equity Components, n.d). Social sustainability focuses on the qualitative aspect of life and “addresses how members of a community live their lives and interact with each other” (Social Sustainability, n.d) (Grum & Grum, 2020).

1.4.3 Economic Sustainability

Economic sustainability incorporates creating employment, cost-effectiveness, and optimal cost-benefit analyses. Research findings highlight that higher employment mutually benefits both the economy and people's social welfare through the resource security provided by employment. Thus, the economic drivers requiring companies to need employees and people to need jobs can also promote social sustainability if job offers people security (Allen, 2021).

An economy is considered sustainable if it is solid and resilient, environmentally conscious, and benefits the entire community (Goal 12: Ensure sustainable consumption and production patterns, n.d.). An economy must be diverse to provide stability through economic cycles. Additionally, there must be employment opportunities for a varied and skilled workforce. Revenue collected from government taxes is used to fulfill the needed public service requirements of the population in that region. Also, the economy should have the capacity to grow the base level of businesses and enterprises that export products and generate revenue from imported items. (Sustainability Components: Balancing Environmental, Economic, and Social Equity Components, n.d). Economic sustainability is not simply achieved by employment and revenues
produced but also by the people engaging in everyday activities. The people themselves become empowered by the choices they make. Purchasing from local stores rather than major retail chains or internet behemoths contributes towards economic sustainability (Economic Sustainability, n.d.).

1.5. Sustainability in Higher Education

Higher educational institutions play a crucial role that can substantively impact the advancement of sustainability within a region. In that regard, El Paso, a part of the Paso del Norte (PdN), is a unique region located at the interstices of three states and two nations, and the role played by The University of Texas at El Paso (UTEP) in this locale is special.

This dissertation studies the contribution of UTEP toward the advancements in sustainability in the El Paso region. It is undertaken in the form of case studies where efforts made by UTEP towards the three elements of sustainability are examined. These case studies form the primary tool to evaluate the institution's exemplary actions towards advancing sustainability, which supports providing a healthy and meaningful life for the population of the region.

1.6. Brief History of The University of Texas at El Paso

UTEP was founded as the "State School of Mines and Metallurgy" in 1914, with the primary mission to support the mining industry (Martin & Craver, 1991). It enrolled twenty-seven students during the inaugural year (Martin & Craver, 1991). Gradually, across its first three decades, the institution grew in size and number, and new subjects and courses were introduced. In 1949, the institution was renamed "Texas Western College (TWC)"; by this time, it had established additional programs, responding to the popular need for more than mining curriculums. The TWC programs and stature continued to expand, and in 1967 it was renamed "The University of Texas at El Paso." In 1973, UTEP received approval for its first doctoral program. Since then, many new colleges, departments, and programs have been added to UTEP (Martin & Craver,
In 1991, UTEP became recognized for the first time as a Carnegie classification R1 institution which means top tier research university with very high research activity. (Duran, 2019). Today the university has an annual research spending of more than $106 million and is ranked number five in Texas for federal research expenditure (At a glance, n.d.).
Chapter 2: Literature Review

Higher Education Institutions (HEIs) play a guiding role in sustainable development (Tilbury, 2011); this is true for any region. In addition to education and research (Wals, 2014), HEIs’ collaboration and outreach (Tilbury, 2011) contribute to the advancement of sustainability. Their influence and participation in activities focusing on sustainability regarding ecology, society (Sterling, 2013; Filho et al., 2018), and economics (Boks & Diehl, 2006; Galang, 2010; Lotz-Sisikta, 2011) can be significant towards a sustainable future.

One region of interest regarding sustainability is El Paso, Texas. A border city of the United States, this region is unique when reviewing the advancement of sustainability, particularly the efforts made by UTEP, one of the key HEIs present in the region. In terms of geographic characteristics, the city of El Paso is located in the Chihuahuan desert region; it has a dry climate with scanty rainfall, which contributes to hardy vegetation conducive to the region, such as cactus and yucca, but it lacks in green foliage. Other environmental challenges exist because of the high desert location, such as substantial prevailing winds, occurring mainly in the spring, due to the wind tunnel effect produced by the break between the Franklin Mountains and the Juarez Mountains. The summer is characterized by recurrent high heat temperatures that regularly reach over 38 degrees Celsius during the summer months.

The El Paso region has social and economic challenges, as seen in national literacy and income averages. El Paso lags behind other areas of Texas and the United States. According to the 2013-2017 census, 79% of the people aged 25 and older living in El Paso had at least a high school education (QuickFacts El Paso city, Texas, n.d.). However, this percentage reduces to less than 25% of those living in the region who have a bachelor’s or higher degree compared to the nation’s average of 31% (QuickFacts El Paso city, Texas, n.d.). The median household income in El Paso
from 2013 to 2017 was approximately $44,400, whereas it was roughly $57,600 for the U.S. (QuickFacts El Paso city, Texas, n.d.). Given these indicators and differentiators, the El Paso region provides a valuable case study to evaluate the three main elements of sustainability – environmental, social, and economic – and determine the impact of the university on these parameters.

Now designated as a Carnegie classification R-1 institution, UTEP is a major HEI in El Paso and has played a unique role in the region. For more than 100 years, the university has continuously impacted people’s lives through education and research (Rodriguez, 2017). Through concerted vision and mission implementation, UTEP’s collaboration with the local community, educational institutions, and partners has made headway in addressing the elements of sustainability. At times, UTEP’s endeavors address all aspects simultaneously, whereas other enterprises focus primarily on one of the elements. With UTEP’s efforts, the City of El Paso and the residents benefit from having a sustainable developing community.

2.1 Higher Education Addressing Sustainability

Higher education plays a significant role in changing the mindset required to create a sustainable society (Cortese, 2003). HEIs can be a driving engine for delivering education to the community. Through curriculum and degree plans, HEIs help students develop critical thinking skills (Filho et al., 2018), obtain advanced perspectives toward learning and practice (Cortese, 2003), and promote the importance of sustainability in regional, national and global contexts (Nasibulina, 2015). HEIs often collaborate with different communities and organizations within and outside the region, providing students with first-hand experience with sustainability problems and new solutions (Juárez-Nájera et al., 2006). For instance, “students, faculty, and staff from the University of Michigan, Wayne State University, and Michigan State University engaged in
collaborative research to evaluate and resolve the continuing water crisis challenges in Flint, Michigan (Moore, 2016; Mosier & Ruxton, 2018). Virginia Tech also engaged in similar research with students and faculty addressing the water challenges in Flint, Michigan (The Virginia Tech Research Team, n.d.; Mosier & Ruxton, 2018). Thus, the participatory approach helps students in capacity building (Filho et al., 2018). HEIs are also involved in research that contributes to finding new ways of sustainable development. For instance, Arizona State University’s Global Drylands Center works with students to develop and implement sustainability practices for arid ecosystems (Our signature programs and solutions, n.d.). Involving students in these efforts provides a platform where students appreciate the research and the application of new methods toward sustainable development. Another way HEIs engage in addressing sustainability is by working closely with other institutions towards sustainable development for regions close and far away. For instance, the Clinton Global Initiative (CGI) endeavors toward sustainable development, working primarily with University level students. CGI works to solve the problems people encounter in different parts of the world through much of the human resources provided by University students. One example is their efforts in Haiti, which was devastated by hurricanes in 2008 and the earthquake in 2010. CGI planned a long-term development in Haiti by addressing the challenges in agriculture, education, energy, and health (Haiti Action Network, n.d.). HEIs also play a significant role in the region's economic sustainability. They contribute to economic sustainability by providing direct jobs and through operations by providing indirect jobs to several people.

2.1.1 UTEP addressing Sustainability

UTEP, a key higher education institution in the Paso Del Norte region, contributes directly and indirectly toward sustainable development. Before sustainability became a valued and
popularized matter, UTEP was involved in activities addressing the three elements of sustainability. The university has always been at the forefront in addressing the community’s concerns and has worked in unison with city representatives to address these concerns. UTEP researchers, through their academic work, have addressed issues that are pressing concerns and have begun addressing possible future longer-term challenges for the region. Studies have focused on mitigating environmental problems, such as health issues arising from arsenic and lead poisoning, due to excessive exposure during mining activities that took place in the past (Del Rio, 2015). Another health issue addressed by UTEP includes finding ways to recycle used wastewater to solve low water availability. UTEP’s Center of Inland Desalination System works with students to develop sustainable water treatment solutions through research (Center for Inland Desalination Systems, n.d.). UTEP encourages students to become aware of sustainable development and work towards sustainability through curriculum courses. These courses help strengthen critical thinking skills and motivate students to consider ways to implement sustainability in their daily lives and share their knowledge with the community. UTEP, with its operational and research efforts, provides direct employment and indirect jobs which contribute to economic sustainability for the City of El Paso. The university also supports environmental student-driven endeavors on campus funded through the Green Fund Organization (Green fund, n.d.). Students present their ideas to voting members and receive funds to engage in implementing their sustainable activities, making a difference on campus. A recent example is supporting the purchase of electric mowers and edgers, replacing gas-driven units. Another example is the installation of solar electric safety lighting on the campus.
2.2 Collaboration in Sustainability

HEIs often play a crucial bridging role in their communities (Jacobson, 2001; Cortese, 2003). Many universities, colleges, and schools converge toward a cohesive, common pipeline approach to education based on inter-organizational linkages (Wanzare, 2011). “Education partnerships designed to take advantage of this convergence have the potential to become powerful agents of institutional reform in pursuit of higher academic achievement and better jobs (Atkinson & Benn, 2010)”. Thus, HEIs working with local high schools to improve the academic performance of the entering first-year students is an example of the efforts made towards a common pipeline approach to education. They also collaborate with industry to foster economic development for the community and provide real-life learning experiences for the students (Earth Institute, n.d.; Collective, 2021). Another way HEIs can impact sustainable development is through partnerships with community-based organizations to provide support for students and their families. “Collaboration builds strong educational development chains by improving the coordination of resources and services across schools, colleges, employers, and social service agencies (Jacobson, 2001).” For students, these collaborative efforts, before and after graduation from an HEI, will improve student academic engagement and achievement.

Moreover, these efforts will prepare students to obtain higher-quality employment in modern workplaces by providing extensive and compelling professional development opportunities. HEIs also partner with different regional institutions to channel their efforts towards environmental protection, such as restoring and conserving natural habitats (Carrapatoso & Geck, 2018). For instance, Thomas Moore University collaborates with the Environmental Protection Agency (EPA) to focus on air, energy, water, and chemical safety (Green, 2021). These efforts between the two entities create opportunities in environmental research such as sustainability and
water quality. The collaboration between Thomas Moore University and EPA also provides training and networking opportunities to students with the leading national scientists, which offers these students experiences to enhance their resumes and set long-term career goals.

2.2.1 UTEP’s role in Collaboration in Sustainability

UTEP has embraced the common pipeline approach of collaborating with local secondary schools to ensure entering freshman reach their graduation goals. UTEP works with these schools so that the students may familiarize themselves with the university and create interest on the part of the students. According to Ms. Ivette Savina, UTEP Outreach and Student Access Assistant Vice President, “this endeavor aim for students to envision themselves as future UTEP students and improve their academic performance of the entering freshmen year.” UTEP also engages in summer activities involving STEM programs for middle school students. According to Savina, the university believes reaching these students, strengthening their minds, and creating curiosity at a young age is necessary. This academic characteristic will become a part of the young student’s identity. It may help sway the balance when choosing to get a job out of high school or continuing their education.

2.3 Social activities in Sustainability

Social sustainability is the quality of life that includes nutritious food, adequate housing, proper transportation, good education, and a meaningful job. A meaningful job provides the means to obtain many other social sustainability factors such as housing, food, and personal transportation. The U.S. Bureau of Labor Statistics has indicated that earnings increase and unemployment decreases as educational attainment rises (U.S. Bureau of Labor Statistics, n.d.). Thus, typically higher education affords the possibility of higher-paying employment, which allows for purchases of personal transportation, housing, etc. It is important to highlight that a
university education is not the only means but is the traditional route to obtaining meaningful work. One of HEIs’ roles in contributing to social sustainability is providing skillsets, education, and awarding degrees upon completion of the coursework. Education which helps in long-term career employability, allows individuals to progress and contribute to the country’s growth. As the country progresses, there is an increase in job creation. HEIs’ strength in creating and delivering knowledge is at the center of a country’s future prosperity (Poverty, 2012) by creating qualified individuals who can fulfill the responsibilities set forth by the employment deliverables. Ensuring that students qualify to meet the university admission standards is an important factor for all HEIs. Should this pool diminish, a larger number of applicants will be unable to attend a university, which will affect industry needs. The industry will continue to need new employees as companies and technology grow; however, with those students who did not meet admission standards and were left behind, universities will have fewer qualified graduates to fill those industry positions. This disparity could affect an individual’s growth and, ultimately, a country’s prosperity. Therefore, HEIs, try to reconcile this disparity through education workshops regarding skillsets and abilities needed for university coursework. This outreach assists in preparing students who perhaps would not have met the admission standards before but, with additional skillset preparation, are now eligible for university admission. (Clancy & Goastellec, 2007). HEIs can thus admit a greater number of eligible students (Poverty, 2012).

HEIs also provide the necessary support to students to overcome various challenges while attending the university, such as assisting students with developmental education (Mulvey, 2008). Through scholarships and financial aids, HEIs offer to support students while receiving a higher education. Universities provide certification programs and workshops for secondary education teachers to acquire the necessary skills to share with the students to prepare them for university-
level course work while in high school. Students are better equipped to upgrade their academic success in higher education. For instance, Indiana State University, through its Center for Student Success, works to provide services and programs to help students succeed in their academic journey (Center for Student Success, n.d.).

Furthermore, HEIs, through their outreach program, with the help of their internal (students, faculty) and external stakeholders (community members), work extensively with the community to provide pertinent information and guidance that will help the community become better informed (Gomez, 2014). They conduct workshops and activities to raise consciousness and communicate about the social problems present in society, raising their awareness to participate in solving those issues, sometimes with a partnership with nonprofit organizations (Gomez, 2014). HEIs advocate for diversity, inclusion, and equity and tackle social issues of inequality and prejudice (Social Inclusion, n.d.).

2.3.1 UTEP’s Social Activity in Sustainability

Studies have shown that UTEP has transformed the students’ standard and quality of life. The students receive an education and obtain other necessary support from the university to keep their focus on their studies and maintain their well-being. According to MarketWatch (2019), UTEP is one of the top ten universities in student upward mobility. It means UTEP is very effective in helping students move from a lower quartile income to a higher quartile income range. Furthermore, in 2017, UTEP was ranked number one in both research and social mobility (UTEP among best universities for Social Mobility, n.d.). UTEP offers locations and opportunities for students to gather and socialize in between and after attending classes. Students utilize resources provided such as tutoring services, research, technical assistance in the library, and health and fitness activities at the recreation center. Offering these services and students engaging in these
activities has contributed to creating a bond between UTEP and the students, who take pride in calling themselves “MINERS.” UTEP also provides housing services for students.

On-campus housing helps some students avoid long commute hours. Others experience the independence of living apart from their parents. Others find it a safe haven as their family and loved ones are thousands of miles away. By living on campus, students tend to meet diverse people with various ideas and cultures, which helps them develop strong interpersonal skills. They also get opportunities to participate in other activities such as student athletics and pep rallies, helping toward overall social sustainability development. (Housing and Residence Life, n.d.).

Additionally, it is determined that students living on campus perform better in exams and have higher GPAs (Housing and Residence Life, n.d.), and take lesser time to graduate than those living off-campus. The advantage of on-campus residency motivates them to opt for advanced degrees in their field of education, which addresses the quality of life options made available through higher education discussed earlier. UTEP supports young adults in their education and helps seasoned adults fulfill their educational dreams. Through their Tuition Reduction Program, UTEP charges a lower fee rate for students 55- years or older than other students (Office of Student Financial Aid, n.d.).

2.4 Economics in Sustainability

The economic element of sustainability is recognized as being equally important to the environmental and social aspects of the sustainability of a region. The role played by HEIs has a significant impact on regional economic development. Industry benefits from university graduates and acquires new employees. Industry and the government participate in university career fairs to employ current students and those upcoming or recently graduated. (Career Fairs, n.d.). HEIs produce good employees and entrepreneurs (Blume et al., 2017). Through their incubation hub,
HEIs provide innovative and creative students with a platform to put their ideas into reality (Innovation Center, n.d.). These incubation hubs help students obtain necessary guidance from experts who helps the students with a business plan, discussions with investors, and the skills needed to execute the plan. HEIs are prominent employers in their regions. They employ faculty, staff, administrators, and student employees and directly impact the region’s economy.

Additionally, HEIs utilize part-time assistance and outsource work that assists the university. These are just selected examples of HEIs impacting the region’s economy. Also, the research activities that centers, faculty, and students are engaged in at these educational institutions contribute to the economic impact. Instruments, chemicals, software, etc., are costly and necessary elements of research. HEIs also engage in consulting services (Ziskin et al., 2018) and knowledge transfer with corporations. (Blume et al., 2017) Through collaborations and other agreements, authorized HEI representatives provide insight to corporations who may be creating a new supply and demand product for consumers. Based on their global ranking and academic excellence (Blume et al., 2017), HEIs can create different levels of economic impact. Also, performance-based funding causes HEIs to focus on efficiency and performance, which helps them attain more funding and creates economic impact (Ziskin et al., 2018). For instance, the Pennsylvania State System of Higher Education incorporated performance-based funding into its higher education system to reward its HEIs for meeting or exceeding specific targets (Miao, 2018).

2.4.1 UTEP’s role in Economics in Sustainability

UTEP has contributed economically to the El Paso region as a leading employer providing HEI employment for faculty, staff, and student employees. Additionally, UTEP collaborates with businesses that send their employees to UTEP for work (Hernandez, n.d.). Hence UTEP provides indirect support to these people. UTEP also engages in economic transactions with the companies
buying research equipment and materials, which in turn contributes financial support to those companies, some of which are in the PdN region. Additionally, there are several centers and institutes at UTEP, some of which conduct various research and work with companies dealing with predictions and formulation strategies for business success. These centers and institutes help UTEP generate revenue and support local businesses to succeed and contribute to the region’s economy.

Furthermore, the business incubation center at UTEP provides a platform for the students to bring their ideas to reality, with the possibility of generating employment in the region (Mike Loya center for innovation and Commerce, n.d.). Another way UTEP contributes to the region’s economic impact is by hosting events at the Sun Bowl stadium and the Don Haskins Center, which are popular locations for various reasons: sports, concerts, comedians, and all kinds of entertainment purposes. These events attract large audiences from El Paso and nearby cities, generating considerable economic revenue and contributing to El Paso’s overall economy. Also, the construction, maintenance, and personnel needed to provide these activities create a lot of employment and a sustainable income for local residents.
Chapter 3: Methodology

This work seeks to highlight some successful efforts undertaken by UTEP, which have encompassed one or more of the sustainability elements. These exemplars, which have taken place on and beyond the UTEP campus, are chosen to broadly illustrate UTEP’s efforts' positive impact on the lives of the community within this region. The projects undertaken have a direct effect in a multitude of ways. As one example, they increase awareness of sustainability matters among UTEP campus employees, who share knowledge with family members and friends who may not regularly visit the campus, providing indirect impact. Sustainability endeavors proceed on and off-campus. In summation, the work contributes to the betterment and advancement of the region by providing opportunities to engage in environmental activities and by reaching out to the community to promote higher education. These efforts may have occurred initially without sustainability at the forefront of the endeavor but are an integral part of growing sustainability. This dissertation seeks to discuss a sampling of successful actions and initiatives taken by UTEP, which independently and collectively align with environmental, social, and economic sustainability elements.

3.1 Statement of Work

It is almost an unfair question to ask someone in El Paso, “what has UTEP done towards sustainability,” as the topic of sustainability, albeit vaguely known, is generally unused by society? In all fairness, most citizens in the United States, more than likely, would not be able to answer what sustainable development efforts were taking place in their city. Of course, some discuss sustainability regularly and are sufficiently proficient at responding. Others, however, may not be as confident. When was sustainability last discussed at the family dinner table, with children, a relative, or anyone? Typically, sustainability is not a subject readily discussed, and the three main
elements are less known. Society will not learn about sustainability if those more informed on this topic do not share their knowledge. Sustainability is a communal effort, and one crucial action begins with informing the people. Given exposure and education, the community will understand that sustainability is more than theoretical concepts fitting neatly into three elements, but instead, it is demonstrable action that is already proceeding. The community is more likely to contribute to existing efforts – and possibly create new sustainable ideas – if they are well informed and presented with examples of current initiatives and enterprises.

The El Paso region offers many opportunities for advancing sustainability. Attempts to expand the understanding of sustainability efforts are being taken by the City of El Paso and many El Paso businesses (Livable City Sustainability Plan, n.d.); this research focuses on UTEP’s contributions to the sustainability of the city. The institution’s history being one of the city’s bedrock institutions contributed to the selection of this dissertation topic. Additionally, UTEP has played a significant role in transforming the lives of the people of El Paso through a multitude of efforts and is, therefore, a vital contributor to the region’s sustainable development. By sharing how UTEP has addressed sustainability through these efforts, others may become aware of sustainability endeavors, and become involved in sustainable development, perhaps not as primary contributors but through secondary and tertiary participation.

3.2 Problem Definition and Research Questions

For the world to be a better place to live, it is essential to focus our efforts on development that lead to sustainability. These efforts require people to focus on all three elements of sustainability: environmental, social, and economic. Located at a unique geographic juncture, El Paso has historically faced sustainability challenges, making the study of sustainability crucial for
the betterment of the people living in this region. In this noble cause, UTEP has played a pivotal role in advancing sustainability in the region which needs to be studied and recorded.

Following the pathways toward sustainable development can provide new insights and understanding of the progress achieved by UTEP. To date, a systematic study reviewing the impact of sustainable efforts by a local education institution does not exist. Therefore, this work provides an opportunity to contribute to providing a new awareness and fundamental summary of knowledge for the sustainability subject matter. As such, the following research questions will address the overarching discussion of sustainability in the dissertation:

1. What are the developments UTEP has made in environmental sustainability?
2. What are the different works done at UTEP to promote social advancements?
3. What is UTEP’s impact on advancing economic sustainability in the El Paso region?

3.3 Research Design and Objectives

Using a case study methodology to conduct the dissertation research allows for real-life scenarios and examination of situations first-hand, which helps establishing a deeper understanding of the case (Green et al., 2006). Given that the research conducted is specific to UTEP’s sustainability efforts, the case study methodology is applicable. This methodology is practical when researching a particular entity, and data collection occur from real-life situations (Aaltio & Heilmann, 2010). While many people are involved in UTEP’s sustainability efforts, only a few may have the necessary information to address the purpose of the examination. Thus, using a qualitative case study within the case study methodology is conducive to specific research in a dissertation (Rashid et al., 2019). This is especially important as research results come from those primarily involved, a small source pool with detailed and relevant information. These research observations are helpful when addressing unexpected issues (Aaltio & Heilmann, 2010).
According to Yin (2003), three types of case study can be used, depending upon the research purpose: exploratory, explanatory, and descriptive. While an exploratory case study is used to define questions and hypotheses, and an explanatory case study explores cause and effect relationships. A descriptive case study describes a particular phenomenon within a specific context and is the most appropriate when reviewing UTEP’s efforts concerning sustainability.

According to Green et al. (2006), three basic steps are necessary when conducting a descriptive case study:

• Case definition
• Case design type
• Bounded context

A case definition prepares the groundwork for the study. The groundwork provides a baseline to compare and contrast results yielded during the case study research. In this study of sustainability, the case is the progress made by UTEP in contributing to El Paso in terms of environmental, social, and economic sustainability. Chapter two provides the literature review as a foundation to understand the elements discussed in the various case studies and provides the context of sustainability actions for other institutions.

The dissertation will review each of the three sustainability elements independently. Two sustainable development efforts will be studied and reviewed for each element to exemplify each element's breadth and depth. Overall, a total of six UTEP endeavors and initiatives advancing sustainable development have been examined and will be discussed. For that reason, an embedded sub-case study methodology is used. The particular methodology integrates qualitative and quantitative research methods to complete the main case study (Scholz & Tietje, 2002; Yin, 2003). This format complements the style of research to be conducted for the element’s case studies.
Research parameters are a necessary component to complete an inquiry. The bounded context speaks to binding the research in terms of time and place with a clear understanding of the research objectives, focus, and extent (Creswell, 2007). Setting these parameters ensures the investigation is completed during a reasonable time frame and addresses the research objectives. The research parameters selected to address UTEP's impact on sustainability include but are not limited to endeavors currently occurring or those within the last fifteen years. Understanding that these efforts will not take place in one location, all efforts in which UTEP is involved was allowed for review. The data collection required for each case study consists of analyzing prior publications discussing sustainability. Additionally, one-to-one interviews were conducted to establish the breadth and depth of perspectives. The majority of data collection activities were performed by utilizing existing UTEP resources.

Hence with the above research design, the following research objectives are achieved:

1. Study, qualify, and elaborate on the contributions UTEP has made to advance sustainable development efforts in the three elements of sustainability in El Paso.

2. Complete research and report the impact of sustainability – and evaluate the impact made by UTEP on each element of sustainability.

3.4 Data Sources

To evaluate the six case studies in this dissertation, preliminary research included the identification of characteristics and best methods to collect data. The case studies were chosen to cover the broad spectrum of sustainability impacts. Case studies are comprised of qualitative and quantitative data collected and analyzed to address the objectives. Some of the case studies were best represented through interviews, other case studies were evidenced through statistical data, and others were comprised of both interviews and statistical data. Wherever possible, an on-site visit
was made to become intimately familiar with the environment, the features highlighting sustainability, the problems addressed, and the benefits gained by these efforts.

3.4.1 Interviews

The majority of data collection occurred through one-on-one interviews. The interview participants were experts in their field or a person of contact for UTEP's endeavor and familiar with the subject matter at hand. To ensure confidentiality, the identity of participants is not disclosed unless their positions and name are those that an online search would reasonably reveal. These interviewees provided in-depth information on the subject matter, which cannot be found in published material. Many of the interviewees are subject matter experts with extensive years of experience in their respective fields.

3.4.2 Statistical

Statistical data collection occurred through interviews and traditional research searches. Data obtained from traditional research, such as reviewing published reports, articles, and manuals, helped create interview questions. This information was then validated by those who participated in the interview process. Data obtained from interviews also required the making of appointments with key personnel. This effort entailed multiple attempts to schedule and reschedule the appointments. While greatly appreciative of all those who assisted in this data request, difficulties were present and highlighted a possible need for improved record-keeping and accessibility in terms of sustainability. Furthermore, a rudimentary understanding of statistical applications and economic theory was necessary to understand the information obtained and subsequently begin the writing process.
Chapter 4: Case Studies

This chapter discusses how UTEP addresses the three sustainability elements: environmental, social, and economic sustainability. It does so by presenting two case studies for each of the three elements of sustainability. A combination of case studies both within the boundaries of the UTEP campus and outside the campus are discussed.

Each case study identifies how UTEP’s successful contribution to promoting or developing sustainability. Representing the environmental sustainability element, the case studies review The Rio Bosque Wetland Park and The Campus Transformation Project. The social sustainability case studies highlight the Early College High School and Upward Bound Programs. A more recent and current topic is discussed in the economic sustainability element with two case studies on UTEP’s economic impact and the Impact of COVID-19. UTEP’s response to the pandemic is covered in this section.

4.1 Environmental Sustainability

Without a healthy environment, environmental sustainability efforts fall short and are incomplete. UTEP adheres to this fundamental principle and works towards this endeavor while supporting a healthy environment on all environmental sustainability initiatives, both on and off-campus. The university has engaged in numerous efforts positively conserving the environment and protecting the nature and beauty of the Chihuahuan Desert. Through these endeavors, UTEP is revitalizing beautiful aspects of the nature that were almost forgotten and integrating them with modern-day landscapes. The following two case studies discussed below show the university’s commitment to the region’s environment.
4.1.1 Environmental Sustainability Case Study 1: Rio Bosque Wetlands Park

El Paso, located at the foothills of the Franklin mountains of the Chihuahuan Desert of West Texas, is approximately 4,000 feet above sea level (City of El Paso, n.d.). In the past, the varied species of flora and fauna adapted themselves to live in the prevailing conditions of the wetlands of El Paso. However, the Rio Grande changed its path, which (Paredes, 2017) led to the loss of the wetlands present in this region for centuries (Watts et al., 2002). Water earlier available from the Rio Grande became scarce, leading to the loss of habitat for both plants and animals (Paredes, 2017). Compounding the situation, El Paso has a semi-arid climate with an annual temperature ranging between 23 F to 110 F with an average rainfall of 9.71 inches per year (Weather averages El Paso, Texas, n.d.). Due to the hot and dry climate, this region has limited vegetation, mostly prickly plants such as cacti.

To enhance natural vegetation in the region, it was decided to establish the Rio Bosque, Wetland Park. Several different institutions and organizations joined to support the endeavor to bring back the natural vegetation to the region (Watts et al., 2002).
Illustration 4.1: Rio Bosque Wetland Park Trail where park users can enjoy the yellow blooms of the annual Forb Bittersweet and spring wildflowers when in bloom (Visit El Paso, n.d.)

Illustration 4.2: Rio Bosque Wetland Park with mixed vegetation where ducks and other natural habitants are found
History

The Rio Bosque Wetland Park is the largest park owned by the city of El Paso. In 1973, under the Federal Lands to Park Program, the US Bureau of Outdoor Recreation transferred approximately 277 acres of land to the city of El Paso (Sproul, 2011). Gradually, more land was added, and today it stands at 372 acres. Initially, there was an ambitious plan to develop the Rio Bosque as a mix of a recreational and undeveloped natural area (Sproul, 2011) (Sproul, 2019). However, due to a lack of funds, the park remained as a natural area and wildlife refuge (Sproul, 2011), emphasizing environmental protection and education (Sproul, 2019). This addressed the initial plan to restore the native ecosystem. This allowed the Rio Bosque to carry forward as a natural area to make the park more attractive for recreational activity and public visitation. (Watts et al., 2002) (Sproul, 2019).
Figure 4.1: Location of Rio Bosque Wetland Park, where it is important to follow the directions given on the UTEP website rather than enter the park’s address into a GPS. Doing so typically suggests a route where through access is not feasible at this time.

(Adapted from Rio Bosque Location, n.d.)

Collaboration among institutions

Collaboration is defined as "a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals" (Mattessich et al., 2001). “The relationship includes a commitment to mutual relationships and goals, a jointly developed structure and shared responsibility, mutual authority and accountability for success, and a sharing of
resources and rewards" (Brussalis, 2017). This approach has been used to approach regional issues, particularly the Rio Bosque Wetland Park.

Entities engaged with UTEP working together on this endeavor include the Rio Grande Compact Commission-Texas, Ducks Unlimited, the United States Section of the International Boundary and Water Commission (USIBWC), the United States Fish and Wildlife Service (USFWS), El Paso Water Utilities (EPWU), El Paso County Water Improvement District No. 1 (El Paso #1), the City of El Paso's Parks and Recreation Department and Planning Department, the United States Bureau of Reclamation (USBR) (Sproul, 2011). Alone, these entities may not have been able to undertake this large project. However, collaboratively, they could plan, contribute and incorporate different perspectives according to their particular knowledge and skill set.

Managing the Site

In 1996, the City of El Paso contacted UTEP, requesting assistance with the Rio Bosque Park, and UTEP recognized the park’s potential. It was an excellent site for research, education, recreation, and tourism. UTEP agreed to serve as Rio Bosque Wetland Park’s manager, and then-Mayor Larry Francis (Sproul, 2011) affirmed the city’s readiness and appreciation for UTEP taking up this responsibility. The license agreement between the city and UTEP was for 30 years and was approved by the city council in November of that year (Sproul, 2019). This was a critical step taken in the park’s development and maintenance.

Rio Bosque Wetland Park

In agreeing to the license agreement, UTEP removed a significant hurdle in terms of management and leadership for the Rio Bosque Wetlands Park and other affiliated projects for the City of El Paso. The USIBWC completed the site-preparation work for water distribution in 1997 by rebuilding the old river channel through the park, installing the water-control gates, excavating
the wetland cells, and clearing large areas of the exotic tree salt cedar, which was found throughout the park. This resulted in large areas of the park being cleared of vegetation. Since then, as vegetation has recovered, UTEP has continuously worked towards the recovery of native plants historically found in the river valley. In 2002, UTEP completed the Biological Management Plan for the park, providing a structure for the Rio Bosque Wetland Park (Sproul, 2011) (Sproul, 2019). Furthermore, UTEP reached the overarching goal “to re-create the mosaic of habitats characteristic of the Rio Grande and its floodplain in pre-settlement days” (Sproul, 2011).

*Availability of water at Rio Bosque*

Water supply consistently poses a considerable challenge to park maintenance. Rio Bosque receives water from three sources: (Center for Environmental Resource Management 1, n.d.).

- Ground Water
- Treated wastewater
- Irrigation water from the Rio Grande River

When water is not distributed or resources are low, the park turns to the four wells on the property to pump out the groundwater. Of those four wells, two of the wells are electric-powered, and the other two are wind-powered. While they only supply small quantities of water, they provide sufficient water to sustain minimal operations. (Sproul, 2019).
The Roberto Bustamante Wastewater treatment plant is the primary water source for the Rio Bosque Wetland Park. It provides the treated effluents to the park through the two authorized discharge points. The first discharge point is the Riverside Canal on the east side of the plant. This canal is the largest irrigation canal on the park's east side. The second discharge point is the Riverside Intercepting Drain, located on the west side. Both the canal and the drain are owned by El Paso #1. Every year, during the irrigation season, most of the effluent water from the Bustamante Wastewater Treatment Plant goes to the Riverside Canal. (Sproul, 2019).
Illustration 4.4: Watergate at Rio Bosque Wetland Park to control the flow of water coming from the Roberto Bustamante plant

Approximately 348 acres of Rio Bosque Wetland Park is classified as irrigable land and has the water rights to receive irrigation water from the Rio Grande. This water is supplied by El Paso #1 through the Riverside Canal. This water source depends on the amount of water available for irrigation. It varies throughout the year depending on the volume of water required by the community and the amount of rainfall. (Center for Environmental Resource Management 1, n.d.).
4.1.2 *Rio Bosque Wetland Park Outcome and Conclusions*

The increase in water flow to the park has contributed to vegetation growth, especially in native plants to the region. Native cottonwoods and willows flourish in the park. As the natural habitat is restored, wildlife is also returning. Frogs, raccoons, muskrats, turtles, and birds have returned to the park, and environmental protections were implemented to help the natural vegetation and wildlife continue to grow. With UTEP’s care, the number of bird species increased by twenty percent. In 1997, there were 107 different bird species, of which 20 were water birds, and by 2019, there were 202 species of birds present at the park, of which 78 were water birds (Sproul, 2019; Raj et al., 2020).

*Ground for Education and Research*

UTEP has consistently promoted environmental development at the park with efforts from university employees and students as well as those from the community. For several years, the
park has served as an ideal location for research and field trips. Various projects have been undertaken, ranging from ecological studies on potentially harmful vectors like mosquitoes and ecologically critical and valuable pollinators like bees, vertebrate presence, and habitat selection. Other studies have been conducted on environmental water quality and its impact on aquatic invertebrate and plant community dynamics. In the last 15 years, nearly ten graduate-level studies have been carried out in different areas of study on Rio Bosque Wetland Park.

Below are some of the many examples of UTEP’s contributions to the park:

- In July 2000, under the direction of Dr. Richard Langford from UTEP’s Geological Sciences Department, thirteen shallow wells were installed to allow for the monitoring of groundwater depth. The research provided insight into the groundwater and feasibility of future use (Park History, n.d.).

- In the spring of 2001, UTEP civil engineering students, working under the direction of Dr. Charles Turner, prepared a feasibility study for constructing a one-half-acre pond at the park. This was the first effort at accessing the park’s groundwater as a supplemental water source (Park History, n.d.).

- In the summer of 2001, a baseline aquatic survey was conducted by UTEP students with direction from Dr. Elizabeth Walsh. Samples were collected at five sites within the park on seven different occasions between May 15th and August 23rd and provided helpful information. Fish and toads, vertebrates, several invertebrates, various protists, and two algal species were identified (Park History, n.d.).

- UTEP began offering public tours at the park in October 1999 by UTEP Center for Environmental Resource Management staff members (Park History, n.d.). Today the tours are separated into three different options, as depicted below:
Illustration 4.5: Tour of Rio Bosque Wetland Park primarily on the Wetland Loop Trail

(Wetland Loop Trail, n.d.)

Illustration 4.6: Tour of Rio Bosque Wetland Park primarily on the Bosque Loop Trail (Bosque Loop Trail, n.d.)
Illustration 4.7: Tour of Rio Bosque Wetland Park primarily on the Rio Loop Trail (Rio Loop Trail, n.d.)

- In March 2000, CERM staff began holding monthly community workdays inviting the community to provide hands-on support with the habitat management (Park History, n.d.).

Illustration 4.8: People from the community providing support during the community workday (Park History, n.d.)
In May of 2002, UTEP, together with the National Park Service’s Rivers and Trails Program, created the Friends of the Rio Bosque volunteer support group, inviting community members to participate and assist with all aspects of the park. (Park History, n.d.)

Illustration 4.9: Friends of the Rio Bosque Volunteer providing guided tours to the visitors (Park History, n.d.)

The park’s development has led to increased visitors and volunteers visiting the park. In the past 15 years, an average of around 375 school groups have visited the park for excursions and field trips. Along with that, nearly 90 scheduled tours and 107 unscheduled tours were conducted every year. The community also found an excellent place to conduct an event. Every year around 57 events have been held in the last 15 years. However, Rio Bosque Wetland Park has been a favorite destination for such events in the last seven years, with an average of 93 events per year. Individual visitors also find the park a preferred location to visit and spend their time close to
nature. During the last 15 years, around 900 visitors have visited the park. This number has continuously grown in the last five years, with an average of 1,551 visitors visiting the park every year. In the development of the park, volunteers have played a crucial role. In the last 15 years, above 177 volunteers have contributed more than 500 work hours every year in different ways to the development of the park. These volunteers are either scheduled or unscheduled visitors or students attending schools interested in nature conservation and participating during their free time.

In 2017, UTEP, in partnership with the El Paso Community College (EPCC), provided a summer bridge program for students focusing on STEM (Science, Technology, Engineering, and Math) (Golding et al., 2020). For the past four summers, students have spent forty hours a week during the summer semester conducting on-site research at Rio Bosque Wetlands. Their field collections and observations at Rio Bosque Wetlands have proven invaluable for understanding local flora and fauna's ecological behavior and relationships. The hands-on experience the students receive while in the field gives them a personal connection to nature and the experience needed to promote sustainable development on future projects.

Illustration 4.10: Students from Summer Bridge Program having a field trip to Rio Bosque Wetland Park to get acquainted with their course research
Many former STEMGrow summer interns continue working under the program as mentors to high school students interested in STEM. As new mentors, they lead field trips, demonstrate field collection practices, and aid students in designing and carrying out their research. Numerous science fair projects have resulted from these valuable experiences at the wetland.

Interactions between students, park and wildlife personnel, the local zoological society members, and other community volunteers have increased awareness of the importance of the park and its contribution to the environment. Students receive an open laboratory, and the community receives a park to help nurture or enjoy.

In discussing environmental sustainability, the increased awareness by the entire community of the offerings of the Rio Bosque Park is seen as exceptionally beneficial. One of the great values of this combined effort is preserving this beautiful and natural habitat. Despite having a dry climate and having limitations in a regular water supply, Rio Bosque Wetland Park partners have been working diligently to bring the natural habitat back to the region. With UTEP leading, the Park has increased its population of plants and animals.

After taking on the role of manager for the Rio Bosque Wetland Park, UTEP proceeded to obtain the required access for the development and maintenance of the park. The UTEP faculty conducted research to find the details necessary for the park’s development, such as identifying the depth of the water table and the water source construction. With UTEP’s attention to the park, CERM staff provided regular maintenance and care. UTEP funded the support needed to implement the initial overall improvement of the park’s condition. The cumulative result in environmental sustainability that UTEP has provided for the community can be seen through regular school field trips, park visits, university research projects, and community involvement. It has become a favorite destination for bird watchers and photographers.
4.1.3 Environmental Sustainability Case Study 2: Campus Transformation Project

The Campus Transformation Project (CTP) at UTEP was an iconic project undertaken to transform the heart of the campus from a dry and rough topography to a well-balanced and appealing landscape. To celebrate the 100th year of service to the Paso del Norte region, UTEP converted the central area of its campus into an inviting pedestrian-friendly multi-use gathering place that reflects the beauty of the Chihuahuan Desert. CTP was a part of the campus master planning process, occurring every ten years and began in 2001. Construction started in 2012 and continued through 2014. The CTP project focused on transforming 11.6 acres of campus territory. The university wanted the new design to reflect the region’s beauty and improve school spirit and community pride. (McNicol, 2020).

Before the construction, the central campus landscape did not always make walkways convenient for pedestrians, nor had much aesthetic appeal in its design. Students, faculty, and staff only had a few areas which would aesthetically serve as “resting spots” or places to recharge. The campus consisted of sloping streets with limited sidewalks, asphalted roads, parking lots, limited green space with few trees, and limited ADA accessibility. Pedestrians, getting from one class to another, had to contend with oncoming traffic. Compounding concerns were stagnant water on the streets after severe rainfalls, which sometimes created a dangerous situation for pedestrians. The CTP was a safety-driven project to ensure pedestrians’ safety.
Illustration 4.11: Image of the area before CTP identifying the free flow of traffic from North Mesa, parking spaces, and limited “green space” (Adapted from UTEP News Archive 2, n.d.)

**Execution of the project**

The CTP project consisted of several aspects, with subset projects to achieve the overarching goal, each subset project large in and of itself. A perfect example was the clearing of parking lots on campus. As seen in the image above, there were many parking lots. It was imperative to identify new parking locations for the vehicles before beginning the renovation. To adequately address the number of vehicles displaced, the first of two parking garages were built—the Sun Bowl parking garage, followed by the Schuster parking garage. When choosing the location of the garages, walking time from the parking to the main campus and classrooms were kept in mind. The university learned, during preliminary research, that people can easily walk for fifteen minutes before becoming overly tired. This bit of information contributed to the selection process in choosing the final locations of the parking garages (McNicol, 2020). Having completed one large subset project, the university focused on alternative routes for through traffic to take upon closing the campus. New routes were constructed around the campus, ensuring smooth traffic
movement. Another challenge the university encountered was the surge of traffic stemming from the new garages. The university found the best solution was to broaden Sun Bowl Drive by two additional lanes in both directions, which required cutting into the mountains on the side of the road. With these subprojects completed, the university was able to initiate the CTP endeavor with one year of planning and two years to execute the new vision.

The core of the CTP includes Centennial Plaza and the Centennial Green. The CTP was to provide a safe walkway for pedestrians and provide a pleasing environment for all on campus to enjoy. Centennial Plaza and Centennial Green provide the campus with outdoor gathering spaces such as a performance lawn, an amphitheater of 130 seating capacity, and conservation of indigenous and drought-resistant vegetation in stone-strewn gardens specifically designed to absorb and channel stormwater (Sustainability Statement, n.d.). There is a diverse collection of native plants and local stones used for campus malls, patios, promontories, and desert gardens that attract students and the community to embrace and enjoy nature (Nieminen, 2017). The CTP replaced the steeply sloped parking lot and provided an inviting and attractive meeting location for anyone to use.

Illustration 4.12: View of the Centennial Plaza after the completion of Campus Transformation Project depicting the green area and amphitheater-style seating (SITES, n.d.)
The CTP also restored a pre-existing, undeveloped hydrological watershed and ecological functions, allowing reconnection and use of the old arroyos (Center for Environmental Resource Management 2, n.d.). Thus, the visible received a transformation, but the hidden and rarely seen portions of campus also benefited from the CTP. For example, the water pipeline, showing wear, was replaced and set beneath the soil.

While refreshing the land, heavy rainfalls brought many problems to the UTEP campus requiring constant repair (McNicol, 2020). The annual rainwater from thunderstorms caused flooding and erosion to existing landscapes and buildings. Water accumulated and flooded the streets, pathways, and sidewalks, making it difficult for pedestrians to walk across campus and enter buildings. The landscape of streets and drainage system was unable to control the flow of the water. The arroyos, too, were unable to offer assistance, and at times, new repairs were needed after a heavy thunderstorm.

To address this issue, the CTP treated stormwater as a precious resource and increased the native plant collection to stage the natural beauty of the Chihuahuan Desert (Center for Environmental Resource Management 2, n.d.). The university developed a new stormwater management system, thus capturing and redirecting nearly half a million gallons of water that previously did not flow down into the arroyos. The new landscape employs soils, vegetation, and green infrastructure, benefiting from the new system. The stormwater collected from the upper portion of the watershed moves slowly down to vegetated arroyo bioswales.

Furthermore, check dams were built using recycled concretes reclaimed from the original landscape to distribute water down the earth. A larger section of land was allocated for green space. This helped retain more water under the soil and provided help for habitats in a desert eco-region. The use of plants native to the Chihuahuan Desert region and drought-resistant vegetation and
water management strategy embraces sustainability. The vegetation area increased by 60% with an ingenious design, which held more water beneath the earth, requiring less water for irrigation. A drip irrigation system was installed that only turns on when water is needed and remains off when rain occurs.

Illustration 4.13: Use of recycled concretes and stones adding to the beauty of CTP (SITES, n.d.).

The CTP has provided an atmosphere of green space, unity, and harmony between nature and campus life. UTEP’s campus in some areas has returned to a pre-development environment topography, and sustainable development has improved infiltration, evaporation, and transpiration in vegetation and soils. The new campus connects people with nature and each other through social and low-water-use spaces nestled in site topography and immersed in the native Chihuahuan Desert habitat.

Constraints and Opportunities

The CTP did have some predesigned limitations. One of the constraints included the sloped topography and extensive bedrock, which provided limited ADA accessibility. However, the situation provided opportunities to reconnect old arroyos, capture stormwater, and increase the indigenous plant palette to reflect the beauty of the Chihuahuan Desert eco-region.
Given that the CTP was the first of its kind in the region, there were not many examples to refer to for ideas or solutions. However, it provided El Paso’s green building market an opportunity to grow and thrive, which set the trend for sustainable construction practices and the procurement of sustainable building materials. Thus, those involved were now looking beyond the traditional and conventional way of building and integrating an advanced sustainable way of construction.

Another constraint was timely and effective announcements about the construction to the pedestrians. Several classes were relocated to different locations, so informing the professors and students about the closures was very important. Using all forms of social media communication provided an immense advantage in informing those affected by the closures with minimal disruption to the faculty and students’ schedules. With construction occurring at the core of the campus, the safety of pedestrians, including ADA routes, was kept in mind. Paydirt Pete, UTEP’s mascot, wearing a construction hat, guided pedestrians to take an alternative route if the main route was closed during the construction period. Additionally, the police, ambulance, and fire departments were kept upraised of the construction process and closures to readily answer emergency calls with the knowledge of which routes were open or closed.

Awards and Recognitions

UTEP’s hard work with the renovation and transformation project opened the door to receiving many awards. The Texas Chapter of the International Society of Arboriculture (Report, 2020) presented UTEP with the 2015 Texas Gold Leaf Award for the work conducted on the CTP project. In April 2016, the Society for College and University Planning (SCUP) awarded UTEP the top award for Excellence in Landscape Architecture. That year, UTEP also received the Sustainable Initiative (SITES) Silver award from the Green Business Certification Institute.
UTEP’s CTP is one of the first and the most significant green infrastructure projects in the El Paso region. It is also one of the projects in the region that displays the diversity and magnificence of water-effective use plants native to the Chihuahuan Desert (SITES, n.d.). Sustainable landscape design techniques include utilizing the green infrastructure that mirrors the role of the natural desert riparian corridors and replacing asphalt with a diverse native plant palette, including new 651 trees, 2,409 shrubs, and 3,337 native perennials (Center for Environmental Resource Management 2, n.d.). UTEP’s CTP became a spot for social interaction for students, professors, and staff to connect with peers and experience the benefits of nature (SITES, n.d.). UTEP’s dedication to this endeavor produced not only a new landscape addressing sustainability but also received a total of seven awards. Three previously mentioned and below are the other four:

- EPA Outstanding Green Infrastructure and Low Impact Development Project Competition “2016 First Place People’s Choice Award.”
- Arbor Foundation “2016 Campus Tree USA Certification.”
- Texas Chapter of the American Society of Landscape Architects (ASLA) “2017 Award of Excellence.”
- Austin Chapter of the American Institute of Architects (AIA) “2017 Design Award” for Campus Master Plan-The University of Texas at El Paso

*Sustainability features and benchmarks*

The stormwater system mirrors the functionalities of a natural desert corridor in the same way as a riverbank. Stormwater is gathered from upper segments of the watershed and moved gradually through a series of vegetated acequia bioswales, arroyo bioswales, and detention basins. (Sustainability Statement, n.d.). The bioswale system reconnects the old arroyos that were filled as the campus was constructed. A watershed analysis extending beyond the project boundary
determines the stormwater volume moving through the site. Along with the impervious surfaces within the project boundary, the arroyo system also managed stormwater coming from the mountains in the north and water collected on the parking and the rooftops outside the Centennial Plaza. (Sustainability Statement, n.d.). The stormwater’s total capacity includes 565,370 gallons or 75,579 cubic feet per day, which exceeds the 95th percentile storm event (Sustainability Statement, n.d.).

UTEP’s CTP is an excellent example in the El Paso area that shows the variety and magnificence of low-water-use plants local to the Chihuahuan Desert. Before development, the project area had roads, parking lots, and turfgrass yards with few trees. The overhauled scene significantly changes the experience for visitors. Concrete roads were replaced with trees, bushes, and perennials that are local or adjusted to the ecosystem of this region. Additionally, the project also used rocks, soils and composts harvested and manufactured within the local region. Around 39 % of the total material costs qualify as regional materials out of the total construction cost. As part of the design requirements, a sustainability consultant from SITES worked with the contractor to develop a Waste Management Plan that spanned demolition and construction. Recycled materials were sorted on-site and placed in recycling bins labeled and kept separate from trash. To be cost-effective, CTP did not discard and send the demolition materials to the landfills but recycled 5000 tons of concrete and rocks, close to 99% of demolition materials. Much of the stones used were gathered on-site during construction and were utilized as mulch.

Overall, the CTP has 641 quiet outdoor spaces for mental restoration and 1884 seats for people to get together and socialize, providing visual and natural access to a plethora of local and adapted vegetation. The spaces are located on the plaza’s edge or outside major pedestrian corridors to reduce noise and distraction. The transformed campus core can serve as a central
location for social events accommodating thousands of people. The two largest grassy areas are the Centennial Plaza and, adjacent to the Geology Green, multifunctional turfgrass lawns attracting students to lounge and organize impromptu recreations. People also can rest at the plaza’s amphitheater and the garden balconies beside the Union Building West and the UTEP Dinner Theatre. A very popular nighttime feature is the ornamental fire pits that the UTEP lights for exclusive occasions and can be reserved by groups for evening events.

The Centennial Plaza officially opened on April 18, 2015, and served as the crown jewel of UTEP’s Centennial Celebration. The centerpiece of the 11-acre Centennial Plaza project is the large oval of Tifway Bermuda grass which is approximately about two-thirds of the size of a football field. The plaza becomes a diamond at dusk that attracts families, couples, walkers, and others who want to stroll around the 12-foot-wide paseo or sit back and enjoy the free Wi-Fi. The planning, management, and execution of the CTP was a complex task and one of its kind, which had not occurred in the region before. To successfully execute this project, several expert teams worked together cohesively, overcoming any hurdles and obstacles they encountered. A representation of those involved in the CTP is listed below:
Table 4.1: Different teams who worked synchronously to complete the Campus Transformation Project

<table>
<thead>
<tr>
<th>Role</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape Architect</td>
<td>Ten Eyck Landscape Architects</td>
</tr>
<tr>
<td>Architects</td>
<td>Lake Flato Architects</td>
</tr>
<tr>
<td>Civil Engineers</td>
<td>Quantum Consulting Engineers</td>
</tr>
<tr>
<td>Stormwater Management</td>
<td>Biohabitats</td>
</tr>
<tr>
<td>Irrigation Consultant</td>
<td>Aqua Engineering</td>
</tr>
<tr>
<td>Mechanical and Electrical Engineers</td>
<td>EEA Consulting Engineers</td>
</tr>
<tr>
<td>Lighting Consultant</td>
<td>Yarnell Associates</td>
</tr>
<tr>
<td>Structural Engineer</td>
<td>Architectural Engineers Collaborative</td>
</tr>
<tr>
<td>Sustainability Consultant</td>
<td>Regenerative Environmental Design</td>
</tr>
<tr>
<td>General Contractor</td>
<td>Jordan Foster Construction</td>
</tr>
</tbody>
</table>

4.1.4 Campus Transformation Project Outcome and Conclusion

The CTP is a masterpiece project and one of its kind in planning and execution encompassing sustainability. The CTP required immense planning and step-by-step execution, giving importance to details. The planning team took a reverse engineering approach looking at the expected outcome and working backward to find out what should come before that step. The project replicates the beauty of the Chihuahuan Desert region. Furthermore, the planners tried to optimize costs by recycling much of the debris from the old construction. Much emphasis on the use of raw materials sourced locally helped significantly reduce transportation costs, keeping the overall cost low. Plants native to this region or have adapted well to the climatic conditions of the Chihuahuan Desert region were planted. This helped the variety of vegetation planted in the green
area provide a natural environment and attracted a variety of birds, butterflies, and small animals to the campus.

UTEP’s CTP is one of the primary models in the El Paso region, where soils, vegetation, and green framework were utilized to control stormwater showcasing natural, sustainable strategies. It gives knowledge into how stormwater might be utilized as a maintainable asset to increment green space and give natural surroundings in a desert ecosystem. Centennial Plaza has become a hotspot for the community to socialize with family and friends. It is also a location for people to have recreational activities such as yoga while offering a safe environment for children to play. Centennial plaza provides the perfect spot to organize cultural events and university nights, attracting everyone from the community. The CTP is a gem on UTEP’s crown not for awards or cost reduction but for the project’s benefit to the campus and the community.

4.2 Social Sustainability

Post-secondary education is a critical factor in assisting to socially uplift families of low income (Duncheon, 2020). In the last four decades, the median family income of adults with a four-year college degree has increased more than those without a four-year college (Haskins & Rouse, 2013). Research shows that a child from a low-income family has a better opportunity in improving their overall financial situation if they can obtain a college education in comparison to those who are unable to attend a university (Sawhill, 2016). Providing opportunities for children from economically challenged families to attend a university is imperative in addressing the social sustainability factor.

All teens and young adults experience some aspect of self-esteem issues or awareness. Some are overly confident while others are not, and many factors contribute. Some reasons why disadvantaged students may not endeavor to obtain a college education is due to a possible lack of
self-esteem and fear of failure (Mansell & Justice, 2014). Others who are admitted find it challenging to complete the course work as they are not academically prepared. Addressing the education factor of social sustainability at an early part of children’s lives assists in eliminating future obstacles and creates possibilities for the other social factors to fall into place. As such, to prepare students in high school for the challenges they will face in applying to and attending a university will help them to overcome some of these difficulties. Keeping that in mind, the El Paso Collaborative for Academic Excellence (Collaborative) was formed.

*El Paso Collaborative for Academic Excellence*

The Collaborative is a regional leadership council comprised of cross-sector partners. Currently, the collaboration is a 16-member board. The following are the representatives: the UTEP president and representatives, three superintendents from the largest independent school districts in El Paso, the EPCC president, representatives from the business, workforce, and economic development, two CREED representatives, a nonprofit business organization, a Paso del Norte Health Foundation representative from and the executive director for the region Education Service Center Region 19. These individuals represent the necessary fields to meet the collaborative effort. These representatives from the education sector and the workforce and economic development sector, through this cross-sector membership, intend to work on the mission of innovative education and provide pathways for students to pursue careers and their aspirations, especially in the El Paso region (Savina, 2020).

In 1988, Dr. Diana Natalicio was appointed as the president of UTEP. She found that UTEP did not reflect the predominantly Hispanic community of El Paso in the student body. She wanted to make sure that these individuals received opportunities to pursue post-secondary studies. The Collaborative was to be the answer, providing the opportunity to receive an excellent education
and an opportunity for the region to thrive. Around 1992, she enlisted the help of Dr. Susana Navarro, who served as the executive director for two decades. Together, they visualized and created a cross-sector group of business leaders, civic leaders, and educational leaders to create pathways to support these educational aspirations and attainment for the youth. From its inception, the Collaborative has received grants from the Pew Charitable Foundation and the National Science Foundation that allowed efforts to create and strengthen the pipelines to have K-12 education leading up to post-secondary studies.

One of the most successful endeavors the Collaborative has engaged in is the outreach strategies for developing and creating a culture of college graduates. Through the Collaborative’s work, opportunities have been created by the independent school districts and the educational regional service center for students to see themselves as somebody that belongs in a college setting and graduate.

For students to envision themselves as college students, the Collaborative has worked to create opportunities for the students, such as visiting UTEP or El Paso Community College (EPCC) campus for a tour. While visiting, the students learn about the different majors and degrees available to them. Also, different programs and activities are held on the campuses at different times of the year to give students opportunities to be on campus and learn more about the college environment. These visits help the students to visualize themselves as future college students and break down barriers, especially first-generation students that otherwise would not have visited a university campus or live too far for their parents to bring them to the university.

There are many different opportunities through recruitment practices both at EPCC and UTEP. Collaborative works with all the different independent school districts to ensure that students get the necessary support in their application process, financial aid, scholarship, and
information about major and minor concentrations, graduate programs, and Ph.D. programs available in this community. These strategies support 180,000 students in the region, contributing to the possibility that these students may see themselves as college students in the future. The idea is to foster the idea and goal of “College now” and the assistance to follow through with the different steps that they need to take to get there.

UTEP leadership recognized the opportunity to use an existing umbrella, to further the education of the community. Under the Collaborative umbrella, different programs assist students for future collegiate paths. Two such programs are Early College High School and Upward Bound, which serve as the two case studies in this section. These programs assist students from low-income families or are expected to be first-generation college students. These programs assist UTEP to broaden the community’s educational opportunities and lay the foundation for social sustainability factors to be obtainable.

4.2.1 Social Sustainability Case Study 1: Early College High School

In 2002 the Bill and Malinda Gates Foundation started the Early College High School (ECHS) initiative, an innovative and powerful educational model to tackle some of the challenges present in the education system, achieving extraordinary results. This program aims to merge high school education and the first two years of a college education. Students in ECHS simultaneously earn a high school diploma and an associate degree or at least 60 credit hours towards a baccalaureate (Berger et al., 2013). It gives a student an early start to college education, saving a significant amount of college time (Mansell & Justice, 2014). Key advantages of joining this program are that the students do not have to pay tuition to attend the courses to receive their educational credits (Mansell & Justice, 2014). These students receive significant financial savings on their college tuition (Vargas, J., 2019). Since this is an open enrollment program (Texas
Education Agency, 2021), it reduces the admission barriers faced by the students (Edmunds et al., 2010) while advancing for college education. There are five core principles of the ECHS Initiative (Berger et al., 2010; Berger et al., 2013).

- “Early college schools serve underrepresented students in higher education institutions.”
- “Created and sustained by a higher education institution, a local education agency, and the local community, all of whom are jointly accountable for a student’s success in early college school.”
- “Early college schools and their higher education and community partners jointly develop an integrated academic program, so all students earn one to two years of transferable college credit leading to college completion.”
- “Engage students in a comprehensive support system that develops skills required for academic and social advancement along with behaviors and conditions necessary for successful college completion.”
- “Early college schools and their higher education and community partners work together with intermediaries to create conditions and advocate for supportive policies to advance the early college movement (Jobs for the Future, 2008, p. 2).”

ECHS programs predominantly assist students who may be underrepresented, at-risk, or from economically disadvantaged sections of society (Mansell & Justice, 2014). This initiative is aimed to provide a post-secondary education pathway to students from minority communities, low-income families, or first-generation college-going students. The benefits that an ECHS provides are:

- Early experience with college courses and rigor (Mansell & Justice, 2014).
Offers an ideal environment of smaller class sizes that help students academically and socially (Mansell & Justice, 2014).

Preparation to handle the depth and intensity of college work at an early age for average achieving but motivated students (Edmunds et al., 2010).

According to a study by American Institutes for Research (AIR) in 2019, ECHS students were significantly more likely to enroll in college education every year between the fourth year of their high school and six years after their expected high school graduation (Song & Zeiser, 2019). ECHS students graduate high school at a higher rate compared to their counterparts. The research also found that students from ECHS also complete their post-secondary education significantly faster than other students (Siddiqi & Mikolowsky, 2019).

The impact of ECHS continues years after graduating from high school. By completing post-secondary education sooner than traditional high school students, ECHS students are better positioned for a chance to enter the workforce before their counterparts. The students with a post-secondary degree are more prepared to be hired successfully, start a career and increase their lifetime earning potential. Research shows that ECHS students are more likely to get a full-time job ten years after entering high school (Vargas, 2019). According to the findings from various studies on early college graduates (Vargas, 2019):

- “Early college graduates outperform their peers who did not attend early college.”
- “Early college graduates have a higher graduation rate from high school.”
- “Early college graduates complete associate and bachelor’s degrees at significantly higher rates.”
- “Early college graduates have higher chances of being employed full-time ten years after entering high school.”
Also, workforce predictions tell us that many jobs will now require post-secondary education. In the great recession of 2008, when many people in the United States lost their jobs, the job openings available required skilled employees. Because of the skill gap in the US workforce, several unemployed jobseekers could not find well-paid jobs (Vargas, 2019). So, post-secondary education attainment is the most critical goal of the ECHS initiative as it opens the pathways for students to learn the required skillsets needed to get well-paid jobs. Research shows that engaging underrepresented students in rigorous coursework (Siddiqi & Mikolowsky, 2019) while they are in high school and attaining college credits will motivate students and increase their chances to complete their college education.

*Collaboration among different academic institutions*

ECHS initiative would not have been a success without the collaboration among different academic institutions. This educational model is an outcome of a close partnership between two public educational systems, i.e., K-12 and post-secondary education, who share responsibility for students’ academic success (Vargas, 2019). The initiative’s success has resulted from several meetings and discussions between the two educational systems keeping in mind the common aim. While moving towards the common goal, the two educational systems agreed on changing their educational policies. Although their policies changed significantly, they converged on mutual terms such as administration, and governance, to collaborate on the educational model (Kisker, 2006), (Bush, 2017).

The logic framework model, shown below, presents a pictorial representation of the essential components and process flow of ECHS. The flow chart has four core components with three direct connections. The outputs achieved directly correlate with the expected educational model with the inputs and required processes. The exciting aspect of this model is the impact,
which has an indirect connection with the educational model, on students’ lives by increasing the opportunities to have a successful career and thus improving their families’ financial and social situation.

Figure 4.3: Basic logic framework model of ECHS (Edmunds et al., 2010)
ECHS in El Paso, Texas

The first ECHS to start in El Paso was Mission ECHS which began in 2006 in collaboration with the El Paso Community College and the Socorro Independent School District. At that time, the ECHS model of education was at a nascent stage in Texas, with only five ECHS. So, there was not much to refer to for El Paso’s educational institutions that could assure the success of the new ECHS model. Nevertheless, the early success of this educational model led to the start of more ECHS. Today, there are more than 200 ECHS in Texas, with 27 in El Paso.

Table 4.2: ECHS in El Paso, TX, since 2006 till 2022

<table>
<thead>
<tr>
<th>Burges Early College High School</th>
<th>Career Center at Riverside P-TECH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clint HS P-TECH</td>
<td>Clint ISD Early College Academy</td>
</tr>
<tr>
<td>Coronado High School P-TECH</td>
<td>Cotton Valley Early College High School</td>
</tr>
<tr>
<td>El Paso High School P-TECH</td>
<td>Empire Early College</td>
</tr>
<tr>
<td>Fabens P-TECH</td>
<td>Falcon Early College</td>
</tr>
<tr>
<td>Franklin High School P-TECH</td>
<td>Horizon High School P-TECH</td>
</tr>
<tr>
<td>J.M. Hanks Early College High School</td>
<td>Jefferson High School P-TECH</td>
</tr>
<tr>
<td>Mission del Paso Early College High School</td>
<td>Mountain View High School P-TECH</td>
</tr>
<tr>
<td>Northwest Early College High School</td>
<td>Parkland Early College High School</td>
</tr>
<tr>
<td>Pebble Hills Early College</td>
<td>Rams Early College</td>
</tr>
<tr>
<td>San Elizario Early College High School</td>
<td>Socorro Early College</td>
</tr>
<tr>
<td>Torrillo Early College High School</td>
<td>Trailblazers Early College</td>
</tr>
<tr>
<td>Transmountain Early College High School</td>
<td>Valle Verde Early College High School</td>
</tr>
<tr>
<td>Ysleta High School Early College Academy</td>
<td></td>
</tr>
</tbody>
</table>

The enrollment in ECHS over the previous ten years in El Paso, TX, has continuously grown, with minor exceptions. The rise in enrollment of students in the programs is slow, but the rising trend in enrollment shows students’ interest in this program.
Figure 4.4: Enrollment of students from ECHS at UTEP from 2010 to 2020, shows the rising interest among students in ECHS

4.2.2 Early College High School Outcome and Conclusions

UTEP extends admission offers to every ECHS student in El Paso, Texas, upon graduation from high school. While these students are free to attend any university, UTEP provides these students a convenient and cost-effective opportunity to receive a university education with the comfort of family nearby. UTEP has also offered scholarships to the ECHS students, which are also able to apply for financial aid to help the students pay their tuition.

The figure below compares the retention rate of fall first-time, full-time undergraduate students who join UTEP from ECHS with overall fall first-time, full-time undergraduate students at UTEP. From 2011 to 2019, UTEP retained more than 70% of the total number of fall first-time, full-time undergraduate students. However, during the same period, UTEP retained around 10% more fall first-time, full-time undergraduate students who join UTEP from ECHS, averaging more than 80%.
Figure 4.5: Retention rate of Fall first-time, full-time undergraduate students who join UTEP from ECHS Vs. a retention rate of overall Fall first-time, full-time undergraduate students at UTEP

ECHS students at UTEP not only have a better retention rate than the total undergraduate student population at UTEP, but they also have a much better average time to graduation rate. During the academic session of 2019-20, ECHS students took an average time of 3.58 years to complete their undergraduate degrees. In contrast, the average time taken by other undergraduate students to graduate was first-time undergraduate students at UTEP was 5.68 years, and 5.48 years for overall undergraduate students at the university.

Role of STEM Education

Awareness of STEM education is growing nationally, which is creating an inevitable influence on ECHS. Students’ preference for STEM education in early college is gradually increasing. This inclination of ECHS students towards STEM education can be attributed to the growing job requirements in STEM fields. This argument holds its ground and correlates with the increasing enrollment of ECHS students in STEM majors, as seen below in figure 4.6.
The STEM majors at UTEP consist of Engineering, Science, Nursing, and Health Science which includes all the STEM education areas taught at the university. In the past decade, the enrollment of ECHS in STEM undergraduate studies has been a rising trend that aligns with the nationwide observation. Also, a higher percentage of ECHS students at UTEP select a STEM education than the percentage from the traditional high schools.
From 2016 to 2020, almost an average of 60% of ECHS students enrolled in undergraduate courses in STEM education. Whereas during the same period, an average of 50% of the total student at UTEP enrolled in undergraduate studies in STEM education.

Studies show that attaining a university degree helps earn a better paycheck in comparison to paychecks requiring a high school or associate diploma (EMSI, 2015). UTEP has been successful in improving its student’s quality of life and, in turn, the community by providing educational opportunities to the ECHS students. Most of the ECHS students are from low-income families, and research indicates a dollar spent on education increases a person’s lifetime income by $5.60, and $6.60 for a first-generation college graduate. (Impact, n.d.). This results in the tripling of the average income at mid-career for baccalaureates and more for masters and doctorates (Impact, n.d.). UTEP students earn more than a 15.5% rate of return on their education, and first-generation students earn a 17% rate of return. (Impact, n.d.).

UTEP, wishing to actively ensure the success of ECHS students, created the ECHS Academic Success Office, which supports the ECHS student transition to UTEP. UTEP actively serves as a point of contact and resource for the ECHS community (Division of Student Affairs, n.d.). ECHS students receive assistance before college admission and continue after graduation. It also serves ECHS faculty, counselors, and administrators. The goals are (Division of Student Affairs, n.d.):

- To improve the quality of the university experience for ECHS students
- To increase the number of ECHS students attending UTEP
- To prepare ECHS students for a successful transition to graduate studies or career engagement
In 2017, UTEP was awarded a $1.4 million grant from Great Texas Foundation to support ECHS students. It is one of the eight universities to receive the eight-year grant. The grant is intended to provide support through university scholarships and retention programs for ECHS students. From 2018 to 2022, UTEP awarded 40 ECHS students an $800 scholarship each fall and spring semester towards the student’s school costs. (Campus Newsfeed 4, n.d.).

UTEP also provides ECHS students an accelerated scholarship of $500 every semester for up to four semesters and also a one-time $500 to $1000 award for access to practices of high impact such as attending conferences, studying abroad, or internships. These scholarships are meant to provide financial support with timely completion of a bachelor’s degree while doing well in UTEP courses along with getting educationally and professionally ready (Division of Student Affairs 2, n.d.).

Illustration 4.14: UTEP’s ECHS students at El Paso International Airport before a study abroad trip to London and Paris. Photo courtesy of Donna Ekal (UTEP News Archive 1, n.d.)
4.2.3 Social Sustainability Case Study 2: Upward Bound

UTEP Upward Bound (UB) is a part of the Federal Trio Program from the US Department of Education (US Department of Education, n.d.). It is a college readiness program that provides fundamental support for college preparation and getting into college for participants. The expertise gained by the students during their time with UTEP UB helps them get accepted into college, finish the course work, and get a degree.

UTEP UB program primarily reaches students starting their freshman year in high school through their senior year and helps them get into college. UTEP UB remains apprised of the students for six years after they graduate from high school to obtain graduation statistics.

UTEP UB program started approximately 40 years ago with the grant implementation under the administration of former US president Lyndon B Johnson. (Macias, 2021) It has an excellent track record of approximately four decades at UTEP. (Macias, 2021) Currently, two UTEP UB grants are in place; one works with the El Paso Independent School District (EPISD), and the other with the Ysleta Independent School District (YISD) (Macias, 2021).

The UTEP UB program starts from freshman year till the senior year in high school. UTEP UB has two components: a summer component and an academic component. The summer component is a six-week program for the UB participants when the major work happens. The participants attend UTEP five days a week for six weeks, and they are offered different kinds of courses. Some are the courses are required by the US Department of Education, such as English literature, math, science, history, and foreign language. However, the delivery of course content is the creativity of UB instructors because much content has to be delivered in a limited time (Macias, 2021).
The academic component, i.e., fall and spring, has more leeway about how UTEP UB offers the courses. Generally, UB provides services on Saturdays, anywhere from one to three Saturdays per month. However, students are unable to participate in UTEP UB as students participate in school sports activities that occur on Saturdays. As such, UTEP UB is starting to move away from only using Saturdays. In the future, students will utilize a hybrid program, where they can attend online UTEP UB classes during the week and occasional classes on a few Saturdays. While online classes will be made possible, it is important to highlight the difference between other classes that promote college and UTEP UB. UTEP UB intentionally provides classes on the university campus to help the students become comfortable with the setting.

The money the university receives from grants is intended to specifically serve UTEP UB participants enrolled in the program while attending high school. The only exception allowed is under the current UTEP UB grant cycle to capture bridge students, students who are about to graduate and have not yet entered college. The UTEP UB program works in collaboration with other programs at the university, such as UTEP Prep and Yes, She Can, to serve this purpose.

A small percentage of students, who initially joined the UTEP UB program, was unable to continue with the program. During the fall and spring academic semesters of the UTEP UB program, the students have a 90-day probation period. This allows students to try the program for 90 days, and then they decide if they want to continue or not. On day 90, the students officially enter the program, and their progress becomes reportable, and their names are put into the annual performance review. Upon the 90th day and entrance into the program, UTEP UB becomes accountable for tracking the student six years after graduating from high school. The first 90 days allowed UTEP UB bound to review the student’s grades, academic performances, and behavior in
UTEP UB courses and know whether their goals match the UTEP UB purpose. The summer semester has the same approach, but the probation period changes to ten days.

However, a few factors explain why students are not remaining in the program. Students, after passing the probationary time frame and enrolling in the program in their senior year of high school, suddenly stop attending the program. These students are statistically part of the program for another six years but are physically no longer present and regretfully fill a spot in the program without reaping the benefit of the UTEP UB program. Furthermore, this is a disservice to another student who could have possibly used that spot to excel in college.

UTEP UB program received two grants which helped to serve students enrolled in the program from EPISD and YISD. EPISD requires 92 students, while YISD requires 78 students. Typically, the new UTEP UB semester at UTEP starts in the fall. The UTEP UB coordinators start the recruitment of eighth-graders in the spring. The students are informed about the program, and applications are gathered in the summer. In September, UTEP UB orientation takes place, and students are welcomed to the UTEP campus to learn about the program expectations and requirements. Additionally, the 90-day probationary period begins in October through December. A student who passes the probation period stays in the program in the spring and participates in Saturday courses through the summer. The first summer occurs between the freshmen and sophomore year. If a student decides to drop out of the program, depending on the seats available, new recruitment is selected from the waitlist of the students who were not selected during the first round. UTEP UB is required to have at least the minimum number of students. So, retention of students during the summer semester is difficult with only a ten-day probationary period. As such, UTEP prefers to have new admittance to the program mainly in the fall rather than to use the summer semester as well.
Since the UTEP UB program keeps the students from freshman through senior year, the cohort typically depends on the number of seniors graduating. So, for example, if 32 seniors graduate, then the following cohort will be 32. A cohort does not necessarily mean specifically incoming first-year students; any student from any grade level, from freshman through senior, can be allowed into the cohort. The goal is typically to accept freshmen into the program because they can receive the most service from the UTEP UB program as they benefit from the program for a longer time. However, anyone who applies and meets the eligibility criteria can join the program. So, a cohort can have a mix of students from all grade levels, ranging from freshmen to seniors.

To be eligible to apply for the UTEP UB program, students come from low-income families and are considered to be first-generation college students. Two-thirds of the recruited students should satisfy both the eligibility criteria. One-third can be either from a low-income family, a first-generation college student, or a high risk of academic failure.

When the cohort is a mix of students, the UTEP UB program makes accommodations to ensure that the course offerings vary depending on grade level, maturity level, knowledge level, and experience level. One approach included a general workshop format where all the students were together, but the lessons were dependent on their education level. So, the activities offered have different levels of challenges. Some of the activities are more rigorous than others so that the students can accomplish the challenge or learn the skills needed to think through a problem and help prepare them for the next level.

UTEP UB program consists of students from the EPISD and YISD. The objectives for each district are the same, but the participation percentage varies and is dependent on the number listed in their respective grants. There are six campuses under EPISD (Andress, Austin, Bowie, El Paso, Irvin, and Jefferson) and five campuses under YISD (Bel Air, Del Valle, Parkland, Riverside, and
Ysleta). They are considered target schools because only these campuses met the criteria and agreed to join the program. Only students from these schools are eligible for the program. The eighth-grade students from the feeder patterns of these 11 campuses are asked to submit their applications. If the students meet the eligibility criteria, they are selected for the program. In case, after joining the program, a student decides to move to another campus that is not a part of the UTEP UB program, the student remains eligible to stay in the program.

**UTEP UB Project Objectives:**

1. **Academic Performance-Grade Point Average (GPA):** Participants served during the project year will have a cumulative GPA of 2.5 or better on a four-point scale at the end of the school year.

2. **Academic Performance on Standardized Test:** UTEP UB seniors served during the project year will have proficiency on state assessments in reading/language arts and math.

3. **Secondary School Retention and Graduation:** Project participants served during the project year will continue in school for the next academic year, at the next grade level, or will have graduated from secondary school with a regular secondary school diploma.

4. **Secondary School Graduation (Rigorous Secondary School Program of Study):** All current and prior-year UTEP UB participants who graduated from high school during the school year with a regular secondary school diploma will complete a rigorous secondary school program of study.

5. **Post-secondary Enrollment:** All current and prior-year UTEP UB participants who graduated from high school during the school year with a regular secondary school diploma will enroll in a program of post-secondary education by the fall term immediately following high school graduation or will have received notification by the fall term immediately following high school graduation.
school from an institution of higher education of acceptance but deferred enrollment until the next academic semester (e.g., spring semester).

6. Post-secondary Completion: Participants who enrolled in a program of post-secondary education by the fall term immediately following high school graduation or by the next academic term (e.g., spring term) as a result of acceptance but deferred enrollment will attain either an associate or bachelor’s degree within six years following graduation from high school.

4.2.4 Upward Bound Outcome and Conclusions

UTEP UB program has adapted itself according to the needs of the present. In the UB program, apart from making wise choices and doing well in post-secondary education, a student also learns the art of surviving in a higher education environment that is crucial and different from a high school environment. The students learn to network and develop their skillsets to find an area of their interest. UTEP UB helps students see possibilities and, develop their mindsets, understand that while attending college, they must have a plan set upon graduation. If they want to get a job, they need to prepare for it while in college, and the same approach applies if they want to pursue graduate studies. The students learn to plan and be proactive in their approach and know their options. The students learn the interdisciplinary nature of current job requirements and learn how to practice and improve the skills needed to excel. They acquire the tools to be confident in their work. UTEP UB focuses on teaching students to have a growth mindset, be adaptive to the situation, and be lifelong learners. Through their internships in the labs at UTEP, students develop interests in post-secondary education. Students develop a sense of commitment to work hard and are among the few students to receive a Dell Scholarship of $20000 to help cover their school and living expenses.
The following graphs depict the EPISD and YISD attained rates for the UTEP UB program starting with 2017:

Figure 4.8: UTEP UB APRs for 2017-2018 showing approved and attained objectives for EPISD and YISD

For the 2017-2018-time frame, the only EPISD’s UB objective short of reaching the approval rate is post-secondary completion. As mentioned above, UTEP UB tracks a student for six years after graduating from high school. So, the students who enrolled in 2012 for postsecondary education were tracked for six years, and in 2017-2018 EPISD’s UB could attain 38% as against 40% of the approved rate. For YISD’s UB, the three objectives short of reaching their approval rates were academic performance, standardized test academic performance, and post-secondary completion. In academic performance, YISD’s UB fell short of 1% to the approved rate of 95%, whereas they could achieve 89% in standardized test academic performance and 22% in postsecondary completion.
Figure 4.9: UTEP UB APRs for 2018-2019 showing approved and attained objectives for EPISD and YISD

For the 2018-2019-time frame, the only objective short of reaching the approval rate for both EPISD and YISD was post-secondary completion. EPISD’s UB could achieve 26%, whereas YISD’s UB could achieve 33% of the postsecondary completion objective.

Figure 4.10: UTEP UB APRs for 2019-2020 showing approved and attained objectives for EPISD and YISD
For the 2019-2020-time frame, the EPISD objectives short of reaching the approval rates were post-secondary enrollment and post-secondary completion. The actual attained rate for postsecondary enrollment was 64%, and postsecondary completion was 17%. For YISD, the only objective short of reaching their approval rate was post-secondary completion which was 32%.

![Figure 4.11: UTEP UB APRs for 2020-2021 showing approved and attained objectives for EPISD and YISD](image)

For the 2020-2021-time frame, the EPISD’s UB objective, short of reaching the approval rate, was post-secondary enrollment which was 79%. For YISD’s UB, the objectives short of reaching its approval rates were academic performance at 94% and post-secondary enrollment at 79%.

In the future, the UTEP UB program plans to increase the number of participating students in the program so that more students can benefit from the program. In the next ten years, both EPISD and YISD student requirements will have more than 100 students participating in the program, and more school districts in the El Paso region will be added to the UTEP UB program.
Overall, UTEP UB works with the students to ensure they will be able to obtain all social sustainability factors in the future by preparing the foundation for a good education. Not only helping the students navigate through high school, UTEP prepares the students by developing the skills needed to succeed in college. UTEP also provides professional development through interactions with other students, providing workshop opportunities and lectures for the students.

4.2.5 Mini Social Sustainability Case Study: UTEP Social Response to COVID-19

The COVID-19 pandemic occurred during the research and development of this dissertation. As such, addressing how UTEP responded to this pandemic is another way to show the impact UTEP has made on the community. While a full case study of the economic impact is reviewed in the next section’s case study, a mini case study addressing UTEP’s social sustainability response is reviewed below.

COVID-19 has presented an unprecedented situation for the world, and many people faced an extremely tough time in terms of meeting basic social sustainability factors. Food and shelter are some of these basic social sustainability factors for survival. The impact of COVID-19 was so severe that some of these basic necessities of life became a luxury for many (Cuevas, 2021). This awful situation occurred everywhere, including in El Paso, and UTEP students found themselves in need of assistance (UTEP CARES, n.d.).

As COVID-19 broke out in El Paso and cases started to rise, UTEP promptly responded to the situation by immediately closing the campus and forming a COVID-19 task force that included representatives from different departments. The primary job of the task force was to come up with plans and strategies to tackle COVID-19 on campus as well as continue the semester (Diaz, n.d.). UTEP transferred face-to-face classes to virtual education to ensure the semester continued with a seamless transition. International students faced a difficult time maintaining their student status
with the implementation of COVID-19 rules by the government. As such, UTEP provided a hybrid mode of education, allowing the international students to meet the government requirements and continue with their studies.

Many students had to face difficulties meeting their basic requirements of food and shelter. UTEP, through its food pantry, provided support to its students who were facing food insecurity (UTEP CARES, n.d.). Also, UTEP provided assistance to students who encountered difficulty finding a shelter. UTEP, through its “Foster Homeless Adopted Resources” program, helped students without shelter and connected them with people who welcomed, fostered, and adopted the students (UTEP CARES, n.d.).

Solving the basic requirements was important, but it was crucial for UTEP to protect its students, faculty, and staff from the highly infectious COVID-19 virus. So, to fight against COVID-19, UTEP opened multiple COVID-19 testing sites for its students, faculty, and staff. These COVID-19 tests provided fast results, which immediately helped those who tested positive to quarantine, thus keeping the cases low. This effort also helped raise awareness among the students, staff, and faculty against the infectious virus. UTEP vigorously promoted the ways to protect against COVID-19 and strictly enforced it on campus, with reminders of safety protocols.

There were concerns of depression and anxiety among students due to social isolation. UTEP’s counseling center provided different workshops and therapy sessions to address these concerns.

UTEP also collaborated with city administration and provided space to city health officials to set up testing locations for the city. UTEP again partnered with the city to use UTEP’s resources and expertise to identify the areas within El Paso which were facing the most food shortage (Campus Newsfeed 2, n.d.). This allowed the city to provide timely assistance to the people and reduce the concern of those with little to no food available.
The manner in which UTEP addressed COVID-19 serves as an excellent example of social sustainability efforts. Where students needed assistance to meet government regulations, UTEP found the path to make that possible and continue to obtain an education. Where students needed assistance with basic social sustainability factors, UTEP provided the resources for students to obtain their basic needs and mental health assistance. Where the community is in need, and social sustainability argues that a helping hand to meet the basic needs should be provided, UTEP did just that and worked with the city to ensure testing sites were available, and other basic resources were obtainable.

4.3 Economic Sustainability

UTEP is among El Paso’s leading institutions, including Fort Bliss and El Paso Electric, with UTEP contributing more than 5% to the region’s overall economy (EMSI, 2015). It is one of the top five employers in the region, providing direct and indirect employment to thousands of people in El Paso. UTEP, through a host of activities such as construction and recreational events, directly and indirectly, adds significantly to El Paso’s annual GDP. Overall, it is estimated that UTEP adds of the order of $1.4 billion to the economy of El Paso (EMSI, 2015). Additionally, UTEP adds significantly to economic impact in other ways; for example, during the COVID-19 pandemic, the proactive measures taken by UTEP have indirectly contributed to sustaining the region’s financial health. This impact is discussed in this section of the dissertation.

4.3.1 Economic Sustainability Case Study 1: UTEP Economic Impact

UTEP plays a crucial role in advancing the economy of El Paso. Being the only public university in far west Texas, it attracts many students from nearby places, which creates a positive economic impact in the El Paso region (EMSI, 2015). It is a major educational institution and a significant direct employer of this region. It is also a prominent buyer of goods and services available in this
region, providing indirect employment to several people in the El Paso region. Because of the university, many of the day-to-day operations, research activities, and expenditure of students and people from outside the region occurs, which adds funds to the region’s economy. UTEP builds students’ knowledge and skills and prepares them to contribute to the region’s economy in different ways.

For the purpose of this economic study, Input-Output modeling is used. The origin and credit for the Input-Output model goes to Wassily Wassilyevich Leontief, a Soviet-American economist who showed how the changes in one economic sector might affect other sectors. For developing the associated theory for input-output analysis and input-output table, he was awarded the Nobel Prize in Economics in 1973 (Grossman, 1984).

**Input-Output**

The Input-Output model is a quantitative economics model that shows the interdependency of different sectors of the economy to the others and vice versa (Oosterhaven, & Hewings, 2021). In this model, considering that the final demand remains the same, the production flow is traced among the various industry sectors of the economy.

In any regional economy, there are two types of activities:

- Basic activities ($E_b$)
- Nonbasic activities ($E_{nb}$)

The primary sectors carry out basic activities. These activities are essential and play a vital role in the region’s economy. It can be said to provide reasons for the existence of the region. They are also called exogenous or city-forming activities. In contrast, nonbasic sectors carry out nonbasic activities. These activities exist because of the basic activities. They are also called endogenous or city-filling activities and support existing basic activities. It is assumed that
• The basic sectors only sell outside the region
• The nonbasic sectors sell within themselves and to the basic sector.
• No transaction happens within the basic sector.

Let us assume that basic activities generate employment \( E_b \); nonbasic activities generate employment \( E_{nb} \), and total employment generated is \( E_t \).

Equation 1 presents a distinct view of the economic development and growth process, mainly that the growth is driven by the demand generated outside the region.

\[
E_t = E_b + E_{nb}
\]

\[
a = \frac{E_{nb}}{E_t}
\]

\[
E_t = (1 - a)^{-1} E_b \quad \text{-------------------Equation 1}
\]

Since \((1 - a)^{-1}\) will always be greater than 1, basic activities will always positively impact the total activity in the regional economy. \((1 - a)^{-1}\) is called the economic base multiplier. Hence this phenomenon is called the multiplier effect. Also called the Input-Output multiplier. It assesses the industry’s impact on the economy. Input-Output multipliers are particularly suitable for evaluating regional industry and the impact assessment of broad policy instruments at the regional level. It provides an estimate of the economy’s dependency on a specific industry sector. There are two types of income multipliers:

• Type 1 (Direct and Indirect)
• Type 2 (Direct, Indirect, and Induced)

*Input-Output Matrix*

The input-output matrix records the economic accounting data representing how different industries trade with one another. It also describes the contribution made through consumption, investment, and government activities. The input-output matrix is most often constructed from
economic data for a specific geographical region. However, it is mainly used for regional economic accounting (Hewings, 1985).

Table 4.3: Input-Output Matrix (Hewings, 1985) (Oosterhaven, & Hewings, 2021)

<table>
<thead>
<tr>
<th>Products</th>
<th>Transportation</th>
<th>Agriculture</th>
<th>Mining</th>
<th>Manufacturing</th>
<th>Construction</th>
<th>Trade</th>
<th>Consumption</th>
<th>Investment</th>
<th>Government</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value Added</th>
<th>Employees’ Salaries &amp; Wages</th>
<th>Business Profits</th>
<th>Government Imports</th>
</tr>
</thead>
</table>

Leontief Inverse Matrix or Matrix Multiplier

The Leontief Inverse matrix is a simplified version of the ripple effect in an economy where industries are interconnected (Grossman, 1984). It means that generally, each industry has an impact on every other industry. Practically there can be any number of industries ranging from a few to hundreds or thousands industries.

Leontief Inverse matrix = (I - R)^\(-1\) (Oosterhaven, & Hewings, 2021)

I = Identity Matrix

R = Rounds of spending taking place in the economy

Gross regional product & Income impact
The Gross regional product (GRP) is defined as an economic estimate of the market value of all final goods and services produced in a region in a given time interval. Income impact can be defined as an equivalent of the number of jobs required to support the change in income, and it is also called job equivalents. Income impact can be divided into labor income impact and non-labor income impact.

- Labor income impact evaluates the variation in income of an employee.
- Non-labor income impact evaluates the change in income profit of a business.

The impact measures can be further broken down into initial effect and multiplier effect in terms of the analysis.

- The initial spending of money causes the initial effect. This currency can be added to the economy through various sources such as payment of goods and services, salaries, and operating expenses. In other words, it is the first time when money is pushed into the economy by any means.

- The multiplier effect is caused by the initial round of spending, which adds more money to the economy. It can be further broken down into direct, indirect, and induced effects.
  - Organizations and people affected by the initial effect spent money to purchase goods and services, thus creating economic activity referred to as the direct effect.
  - The entities of initial effect create more activities, not directly but through their interlinked entities, thus adding more money to the economy. This is known as the indirect effect.
  - When the activities of initial effect, direct effect, and indirect effect create jobs and hire more people, this leads to adding more money to the household to contribute to the economy. This is known as the induced effect.
RIMS II

RIMS stands for Regional Input-Output Modeling System, provided by the Bureau of Economic Analysis (BEA) in the early 1970s (RIMS II, n.d.). It is a tabulation of highly reliable data (McLeod, 1987) to analyze the potential impact of economic activity on regional economics. RIMS II provides a collection of the multipliers (Type 1 and Type II) (Bess & Ambargis, 2011) dataset to analyze for users, which includes researchers, planners, students, and others. The type I multipliers account for the direct and indirect impacts based on how goods and services are supplied within a region. In contrast, Type II multipliers account for direct, indirect, and induced impacts based on employee purchases.

RIMS II has a wide range of applications. Government agencies use it to study the impact of its regulations on different projects and industries. Local economic agencies use it to analyze the economic impact of a particular event in a region. Furthermore, businesses use the multiplier data to carry out a study to learn about the effects of business investment in the area. The calculated economic impact can be in different forms, such as total earnings and employment.

Several assumptions need to be considered while conducting an economic impact study using RIMS II (RIMS II, n.d.):

- Backward linkages – In an Input-Output model, the impact of an industry’s production over another industry can be measured as forward or backward linkage. In forward linkage, an increase in the supply of input results in a rise in output. However, in backward linkage, the demand for the output will increase the input supply. RIMS II makes use of the backward linkages while evaluating the economic impact.

- Fixed purchase patterns - In an Input-Output model, it is considered that industries follow a fixed pattern and do not change their inputs to get the same output. So an equal proportion
of the increase in the input will result in an exact equal proportion to the rise in output. It also includes the number of people working on getting a certain production level. It means that if there is an increase in production, more people have been working to increase production.

- **Industry homogeneity** - Input-Output model assumes that the production process is homogeneous across businesses in a particular industry. Suppose a business is affected by a change in economic activity and has a production process inconsistent with the industry’s production process in the national Input-Output accounting. In that case, the RIMS II multiplier will not yield accurate impact estimates.

- **No supply constraints** - Input-Output model assumes that the prices do not change and always remain fixed, and any fluctuation in supply does not affect the price. In other words, businesses can use any number of units of inputs without worrying about the price change.

- **No regional feedback** – RIMS II considers only the study region and does not consider any influence from other regions. Suppose a project carried out in another region requires input from the study region. In that case, the economic impact created by this transaction will not be accounted for to calculate the impact estimate using multipliers for the study region. It can be done by considering a larger study region encompassing the region where the economic activity occurred.

- **No time dimension** – No time dimension is considered in an Input-Output model. The length of time in which any economic activity is carried out in a region is not accounted for while calculating economic impact in a region using RIMS II multipliers.

- **Local supply conditions** – RIMS II lies on national Input-Output relationships, which are adjusted to account for the local supply conditions. At times local businesses could not
provide all the required inputs to produce the region’s output, and purchases of intermediate inputs had to be made from outside the region to continue production. These purchases lead money to flow out of the region’s economy and are called leakages. RIMS II considers each industry’s presence in a region relative to its nationwide presence to account for these leakages.

There are several types of multipliers; however, this research requires only specific multipliers, which are discussed below. Multipliers are classified broadly into two major categories Final-demand multipliers and Direct-effect multipliers (RIMS II, n.d.).

- Final-demand multipliers estimate the impact created by the change in the final demand on regional industries in terms of output, earning, employment, and value-added. These multipliers are based on local area personal income estimates and national Input-Output accounts. Final-demand multipliers are of four types:
  - Final-demand output multiplier measures the total change in local output per dollar of final demand change.
  - Final-demand earnings multiplier measures the total change in local household earnings per dollar of final demand change.
  - Final-demand employment multiplier measures the total change in the number of local jobs per dollar of final-demand change.
  - Final-demand value-added multiplier measures the total change in local value added per dollar of final-demand change.

- Direct-effect multipliers estimate the impact of every unit change in the direct industry on the regional economy. There are two types of Direct-effect multipliers:
➢ Direct-effect earning multiplier measures the total change in local household earnings per dollar of change in household earnings in the final-demand industry.
➢ Direct-effect employment multiplier measures the total change in local jobs per change in employment in the final-demand industry.

Sub-case study 1: UTEP Interdisciplinary Research Building

The interdisciplinary research building was constructed by Hensel Phelps, which started in April 2017 and was completed in May 2020. The total cost incurred to date is $85 million, and 125 people worked during its construction. It is estimated that the building will house 220 people, including faculty, staff, and students. The total wages estimated to fund the building when it is operational are $7 million per year. The research contracts and related services for research and development are anticipated to generate a revenue of $45 million per year by 2025.

The interdisciplinary research building falls under the category of the education industry. However, when the construction took place, it immensely contributed to El Paso’s economy falling under the construction sector. So, the interdisciplinary research building created two separate categories of impacts.

Type II multipliers are used for the analysis because they account for the interindustry effect, the sum of direct and indirect effects, and the induced impact of a final-demand change.

Calculation:

Revenue generated = $45 million
Wages and salaries = $7 million
Employees count = 220
Table 4.4: Type II multiplier for the education sector

<table>
<thead>
<tr>
<th>Final-demand Output</th>
<th>Final-demand Earnings</th>
<th>Final-demand Employment/million</th>
<th>Final-demand Value-added</th>
<th>Direct-effect Earnings</th>
<th>Direct-effect Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.7155</td>
<td>0.6717</td>
<td>19.0709</td>
<td>1.1178</td>
<td>1.4222</td>
</tr>
</tbody>
</table>

Total Final-demand Output = 45*1.7155 = $77.20 million
Total Final-demand Earnings = 45*0.6717 = $30.23 million
Total Final-demand Employment = 45*19.0709 = 858.19 jobs ~ 858 jobs
Total Final-demand Value-added = 45*1.1178 = $50.30 million
Total Direct-effect Earnings = 7*1.4222 = $9.96 million
Total Direct-effect Employment = 220*1.3553 = 298.17 jobs ~ 298 jobs

Therefore, it is estimated that the interdisciplinary research building contributes to El Paso’s economy, total revenue of $77.2 million and earnings of $30.23 million which are labor income to workers and proprietors. It generates 858 new jobs in the region and adds a value of $50.3 million, including earnings, returns on investments, property income, and indirect tax payments. It adds around $10 million to the direct earnings of the region and generates direct employment of 298 jobs.

People involved in the construction =125 jobs

The total cost incurred to date = $85 million

Table 4.5: Type II multiplier for the construction sector

<table>
<thead>
<tr>
<th>Final-demand Output</th>
<th>Final-demand Earnings</th>
<th>Final-demand Employment</th>
<th>Final-demand Value-added</th>
<th>Direct-effect Earnings</th>
<th>Direct-effect Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.81</td>
<td>0.6099</td>
<td>11.5356</td>
<td>0.9631</td>
<td>1.5855</td>
</tr>
</tbody>
</table>

Total Final-demand Output = 85*1.81 = $153.85 million
Total Final-demand Earnings = 85 * 0.6099 = $51.84 million
Total Final-demand Employment = 85*11.5356 = 980.53 jobs ~ 980 jobs
Total Final-demand Value-added = 85*0.9631 = $81.86 million
Total Direct-effect Earnings = $51.84 million
Total Direct-effect Employment = 125*1.8257 = 228.21 jobs ~ 228 jobs

The interdisciplinary research building contributes to El Paso’s economy, total revenue of around $154 million with greater than $52 million in earnings. It generates 980 new jobs in the region and adds a value of nearly $82 million. Since we do not know the earnings of the 125 people involved in constructing the interdisciplinary research building, we assume that the entire $52 million directly contributed to the region’s earnings. It generates direct employment of 228 jobs.

Sub-case study 2: UTEP Faculty and Staff Salaries

UTEP is one of the top employers in the El Paso region. In 2021, it employed over 2,000 full-time employees and paid them wages and salaries, which created an economic impact on the region.

Table 4.6: The number and wages of UTEP employees and related salary expenditures in 2021

<table>
<thead>
<tr>
<th>Full-time Employee</th>
<th>Employee Count</th>
<th>Total Wages (in $)</th>
<th>0.8*Total Wages (in $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>766</td>
<td>74.68 million</td>
<td>59.74 million</td>
</tr>
<tr>
<td>Staff</td>
<td>1363</td>
<td>80.53 million</td>
<td>64.42 million</td>
</tr>
<tr>
<td>Grand Total</td>
<td>2129</td>
<td>155.21 million</td>
<td>124.16 million</td>
</tr>
</tbody>
</table>

Note that the total wage shown above excludes taxes and benefits, and for the purposes of this calculation, it is assumed that all the employees at UTEP live in El Paso and they save or invest 20% of their income. According to 50/30/20 rule, at least 20% of the income should go towards saving (TIAA, n.d.) and rest of the income is spent, which contributes to the economic impact in the region.

Type II multipliers for the education sector are used to calculate the economic impact of UTEP.
Calculation

Table 4.7: Type II multiplier for the education sector

<table>
<thead>
<tr>
<th>Final-demand Output</th>
<th>Final-demand Earnings</th>
<th>Final-demand Employment/million</th>
<th>Final-demand Value-added</th>
<th>Direct-effect Earnings</th>
<th>Direct-effect Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7155</td>
<td>0.6717</td>
<td>19.0709</td>
<td>1.1178</td>
<td>1.4222</td>
<td>1.3553</td>
</tr>
</tbody>
</table>

Calculation of economic impact created by faculty.

Total Direct-effect Earnings = 59.74*1.4222 = 84.96 million

Total Direct-effect Employment = 766*1.3553 = 1,038.16 jobs ~ 1,038 jobs

Total Final-demand Output = 126.49*1.7155 = $216.99 million

Total Final-demand Earnings = $84.96 million

Total Final-demand Employment = 126.49*19.0709 = 2,412.28 jobs ~ 2,412 jobs

Total Final-demand Value-added = 126.49*1.1178 = 141.39 million

The 766 faculty employed at UTEP, create a total direct-effect employment of 1,038 jobs. That means an additional 272 direct jobs, whereas a total direct-effect earning of $84.96 million, is the same as the total final demand earnings, which is the total earning in the economy per $1 change in the final demand. Hence the demand output is ($84.96/0.6717) million, i.e., $126.49 million, which creates an overall impact of $216.99 million in the El Paso’s economy generating 2,412 jobs and adds a total final demand value of $141.39 million.

Calculation of economic impact created by the staff.

Total Direct-effect Earnings = 64.42*1.4222 = 91.62 million

Total Direct-effect Employment = 1363*1.3553 = 1847.28 jobs ~ 1,847 jobs

Total Final-demand Output = 136.40*1.7155 = $233.99 million

Total Final-demand Earnings = $91.62 million

Total Final-demand Employment = 136.40*19.0709 = 2601.27 jobs ~ 2,601 jobs
Total Final-demand Value-added = 136.40*1.1178 = 152.47 million

There are 1,363 staff employed at UTEP, creating total direct-effect employment of 1,847 jobs and a total direct-effect earning of $91.62 million, the same as the total final demand earning. The demand output created is ($91.62/0.6717) million, i.e., $136.40 million. This creates an overall impact of nearly $234 million in the El Paso’s economy, generating 2,601 jobs and adds a total final demand value of $152.47 million.

Summing the data calculated for employee and staff with a total strength of 2,129

Total Final-demand Output = 216.99+233.99 = $450.98 million
Total Final-demand Earnings = 84.96+91.62 = $176.58 million
Total Final-demand Employment = 2412.28+2601.27 = 5013.55 jobs ~ 5,013 jobs
Total Final-demand Value-added = 141.39+152.47 = $293.86 million
Total Direct-effect Earnings = 84.96+91.62 = $176.58 million
Total Direct-effect Employment = 1038.16+1847.28 = 2885.44 ~ 2,885 jobs

Considering information for both faculty and staff, it is found that UTEP adds around $451 million to the region’s GDP and creates 5013 jobs in the region with a total earning of $176.58 million.

According to a report published in 2015, UTEP spent $167.1 million on salaries and benefits in the financial year 2013, which created a total impact of $363.9 million on El Paso’s economy and generated 5,417 jobs (EMSI, 2015). For 2021, if the same approach is used, which includes total salaries and benefits and does not consider 20% of savings, UTEP spent $200.2 million in salaries and benefits. This will add a total of $727.17 million to the economy of El Paso and generate 8,084 jobs in the region.
4.3.2 UTEP Economic Impact Outcome and Conclusions

UTEP’s newly constructed interdisciplinary research building costing $85 million, has created an impact of around $154 million, which means every dollar spent on the construction of the building has created an additional $69 million for the economy of El Paso. This has added a value of around $82 million, in which nearly $52 million is the earning creating close to 980 jobs. The 125 people involved in the construction of the building have directly created a total of 228 jobs with direct earnings of around $52 million. The $45 million generated by the interdisciplinary research building will add another $32 million to the region’s economy with a value addition of $50 million and creating earnings of $30 million for 858 people in El Paso. The wages and salaries of $7 million paid to 220 people working in the interdisciplinary research building will create 298 direct jobs and earnings of nearly $10 million.

UTEP faculty and staff massively impact the economy of El Paso. Collectively they create a total final demand output of around $451 million in the economy and generate total earnings of $177 million with a total value addition of $294 million. This, in turn, creates a total of 5,013 jobs in the economy. The 2,129 employees create a direct earning of $177 million for 2,885 jobs.

The total economic impacts caused by the different activities in UTEP benefits El Paso's economy by creating a ripple effect in the region’s financial system. This leads to money flow from one sector to another, creating numerous jobs, which eventually continue until the money exits the economy.

4.3.3 Economic Sustainability Case Study 2: Impact of COVID-19 and UTEP Economic Response

Before 2020, most of us had only read books or published documents about pandemics and their devastating effects on human lives. However, Covid-19 has made us experience the hardship
it can bring to our life. COVID-19, which stands for Coronavirus Disease 2019, is a respiratory disease caused by a Ribonucleic Acid (RNA) virus whose infections range from mild to fatal (Gupta et al., 2020). It is an infectious disease that spreads from human to human. This spread can be significantly controlled by avoiding contact with a person with COVID-19 disease, which helps break the transmission chain.

COVID-19 gradually became more fatal than mild, transmitted to almost every corner of the world, infecting millions of people and several thousand who had to lose their lives. An enormous number of people had to be hospitalized to get the cure. Seeing the severity of the disease, governments worldwide had to close their borders and impose travel restrictions in their respective countries. People were advised to stay indoors to protect themselves from getting infected for safety. Seeing the gravity of the prevailing condition, governments ordered a complete lockdown that had to be enforced on people, affecting them economically and socially. Corporations and institutions with a work from home option adapted to the situation. They managed their business to some extent, but smaller companies and local businesses that had no work from home option had to shut down, economically affecting them badly. Some of them had to go out of business, leading to unemployment.

Governments had to cut their spending to channel that money toward finding the cure for COVID-19. Researchers from several institutions, with support from the government, worked towards developing vaccines and medicines for the disease. Along with them were the medical professionals such as doctors, nurses, and lab technicians who played a crucial role, risking their lives to fight this deadly disease and help society come to normal.
El Paso’s Scenario

El Paso, Tx, went through a very challenging phase; like many other cities in the U.S., it once had a bleak situation during the several stages and mutation of the virus of COVID-19 disease. At one point, early on in the pandemic, it had one of the highest numbers of hospitalization per thousand people in Texas. According to a healthcare expert, reasons for the higher hospitalization rates due to COVID-19 included

- Lack of access to quality healthcare in the region.
- The high number of the essential workforce affected.
- Being uninformed about the usefulness of wearing face masks.
- Lack of access to health insurance (Samuels, 2020)

![Graph showing hospital bed occupancy in El Paso and statewide from June 2020 to September 2021](image)

Figure 4.12: Percentage of hospital beds in El Paso occupied by COVID-19 patients from June 2020 through September of 2021 (Harper, 2021)

However, after April 2021, El Paso did not see a sharp rise in the hospitalization of patients, and the hospitalization rate in El Paso remained much lower compared to Texas. Even with the
outbreak of the Delta variant of the virus in July and August 2021, other urban and rural locations of Texas saw a rise in the hospitalization rate; El Paso managed to avoid high hospitalization rates during the second phase of the pandemic and has proven resilient in proceeding to carefully return back to normal. The lowering of impact could be attributed to the sincere vaccination efforts that took place in El Paso, with one of the highest vaccination rates for COVID-19 in Texas. Another reason could be the closure of the El Paso-Juarez border, which restricted the incoming travel for people from Mexico.

![Graph showing vaccination rates] Figure 4.13: Vaccination rates in El Paso compared with the state of Texas during 2021 (Dallasfed1.org., n.d.)

Like any other city, the pandemic had a devastating economic impact on El Paso. Small businesses, especially those providing non-essential services, were forced to remain closed or go out of business. Businesses considered to be essential services were allowed to function but with restrictions. Many restaurants stopped their dine-in service and only provided take-away service. Restaurants that allowed dine-in service functioned only at fifty-percent capacity. Also, the regular business hours were cut short, and people were not allowed to go out without reason. Stores were short on products because of panic buying from the customers. Stores could not restock because
of the supply chain issues as the borders were closed. Numerous small businesses had to temporarily shut down and asked their employees to leave as they could not pay them anymore. Many had to go out of business, and several local businesses filed for bankruptcy.

![Figure 4.14: Share of nonfarm sector stakeholders (Adapted from Dallasfed2.org., n.d.)](image)

The figure above shows the share of each nonfarming sector. The major shareholder is government, trade, transportation and utilities, education and health services, professional and business services, and leisure and hospitality.
Among the most affected were the leisure and hospitality, government, and education and health sectors which have a higher share of nonfarming employment (Dallasfed2.org., n.d.). In September 2021, El Paso’s annual employment rose by 1.8%, which was primarily because of an increase in employment in trade, transportation and utilities, education and health services, and leisure and hospitality sectors but over the last 20 months, from February 2020 to September 2021 El Paso’s payroll fell to minus 2.2% (Dallasfed2.org., n.d.). Overall, the economic impact of the pandemic on El Paso was severe (Best Neighbourhood, n.d.). To help businesses and families tackle the financial crisis, the government gave relief packages. One of them was The Coronavirus State and Local Fiscal Recovery Funds (SLFRF) program, a part of the American Rescue Plan. This provided state, local, and Tribal governments a $350 billion to fight COVID-19 by maintaining essential public services and providing economic assistance to struggling businesses and families (U.S. Department of the Treasury, 2022). The goal was to have a resilient and robust
recovery that could support long-term growth. As a result, we see an increasing trend in credit and debit card spending.

During the start of the pandemic in March 2020, which created panic among the people, there was a sudden drop in spending in El Paso, which was lower than overall Texas. Since then, the government and the local community have taken several measures, resulting in a steady recovery of the economy, bringing it back on track. This took nearly a year, and since March 2021, the credit and debit card spending of the people of El Paso has been at par and gradually exceeded that of Texas.

**UTEP’s Response**

The first case of COVID-19 in the U.S., as confirmed by the Center for Disease Control and Prevention (CDC), was on January 18, 2020, and nearly two months later, on March 13, 2020, El Paso got the first COVID-19 case. UTEP’s spring break was from March 14, 2020, till March 18, 2020. However, the outbreak of the COVID-19 pandemic occurred during the spring break of 2020; the campus did not officially resume its face-to-face on-campus service. Because of the
contagious nature of the pandemic, UTEP, for the safety of its students, faculty, and staff, immediately closed its campus.

The leadership of UTEP was proactive in dealing with the pandemic and created the Covid-19 recovery plan task force that had representatives from different departments to assist with a plan to deal with the pandemic. The focus of the Covid-19 recovery plan task force was to guide the university to resume campus operations and keep the university open for later academic semesters (Diaz, n.d.). It was decided to shift to the virtual mode of teaching to protect the students, faculty, and staff from the dangerous virus and, at the same time, continue to give education. For research work, research scholars with prior approval from the department were given restricted admission to the labs but under the condition to follow COVID-19 safety protocols. Only a few staff considered essential, who were required to maintain the campus, had permission to visit the campus at any time. All the offices and institutions within UTEP worked remotely. Students who, for some reason, had to avail the library services were allowed to do so but had to follow the safety protocols.

Amidst complex and changing restrictions, UTEP faculty and staff worked tirelessly to cope with the pressure to move to a virtual platform in between the semester. Faculty were provided with the necessary tools such as high-resolution webcams and better laptops and support such as added Blackboard training, and enterprise software like Zoom and Microsoft Teams to assist a move of educational content to the virtual platform. Students who had challenges accessing technology were provided support from the university to purchase a laptop.

Additionally, students received financial support from UTEP’s Higher Education Emergency Relief Fund and additional aid through CARES and CRRSA acts to cope with their financial crisis, housing, and food insecurity (Carreon, 2021). Via the American Rescue Plan Act
Fund, UTEP provided grants to students directly affected by COVID-19 (Carreon, 2021). These funds were distributed in multiple phases to thousands of eligible students. Under the Higher Education Emergency Relief Fund, UTEP distributed around $60 million (Office of Student Financial Aid 1, n.d.) during the first round of funding received from the government, $22.5 million during the second round (Office of Student Financial Aid 2, n.d.), and $87 million during the third award (Office of Student Financial Aid 3, n.d.) to provide emergency financial assistance to students. For students coming from a family having a gross income of up to $50,000 were provided support through Paydirt Promise, which covers tuition and mandatory expenses (UTEP CARES, n.d.). Also, the Paydirt emergency loan, a short-term no-interest loan, helped students stay enrolled in classes (UTEP CARES, n.d.).

![Illustration 4.15: COVID-19 testing proceeding at a UTEP parking place east of the main campus (Samuels, 2020)](image)

UTEP provided students, faculty, and staff with unlimited COVID-19 testing. In collaboration with the city, UTEP provided its’ locations for the COVID-19 testing for the people
of El Paso. At the time when the vaccine was made available by the government, UTEP volunteered to provide the vaccines first to its front-line workers and high-risk people at UTEP. Then it provided its students, faculty, and staff with two free doses of vaccines. Later, it was made available to students, faculty, and staff, and all their families.

Several researchers from UTEP were involved in different kinds of research targeting the COVID-19 pandemic. UTEP partnered with Texas Tech to produce low-cost 3D printed ventilators for hospitals (Dalton, 2020). UTEP, in collaboration with the University of New Mexico, worked on an online platform that can accelerate the drug therapies for COVID 19 disease (Campus Newsfeed 3). A UTEP professor also received NSF funding to support his research to develop an antiviral drug targeting COVID-19 (Campus Newsfeed 1, n.d.). UTEP researchers, by making use of geospatial and statistical analysis, identified patterns and trends in emergency food assistance in the region and found the areas and zip codes that need the most assistance (Campus Newsfeed 2, n.d.).

International students at UTEP faced a tough time during the pandemic. International students were unable to go to their home country due to travel restrictions, and also, it was difficult because of higher ticket prices and limited flight options; plus, there was an increased likelihood of the students becoming susceptible to COVID-19 infection. For those who did travel long distances, a change in the time zones added uncertainty to their education. Laboratory work was also impacted, especially for graduate students conducting lab research. However, sending international students to their home country was an option; UTEP realized the economic burden and risk students would have because of the travel. Thus, by offering hybrid courses, UTEP allowed them to be in the U.S. and continue their education while meeting government regulations.
4.3.4 Impact of COVID-19 and UTEP Economic Response Outcome and Conclusions

COVID-19 has had a devastating impact worldwide, leading to millions of losses of life and unprecedented challenges to the economy, food, and public health, which was no different in El Paso. Since there was no flow in the business economy, it had a sharp fall leading to all-time high unemployment. People had challenges even getting the basic requirements of life, i.e., food and shelter. Medical services exhausted all their resources were short of ventilators, ICUs, and oxygen supplies, and could not support new patients. Community and people with surplus resources such as food, clothing, and money had to donate to charitable organizations to be given to the people. Because of the supply chain collapse, businesses were short of resources like the housing sector could not construct houses on time, and people had to look for rented accommodation. The leisure and hospitality industries were the worst hit because of the lockdown imposed that restricted traveling.

UTEP tried to absorb the COVID-19 shock but could not go unaffected. Because they had to stay indoors and were socially isolated, students developed increased psychological issues such as depression and anxiety. Also, students were worried about their academic advancements and academic future. The counseling services at UTEP supported the students by providing workshops and counseling sessions by telling them ways to stay healthy during this difficult time. Also, the food pantry provided a handy solution to some of the food challenges faced by students. UTEP tried to cut its operational costs and diverted that money to fight COVID-19. UTEP kept updating its students, faculty, and staff with the most updated information about COVID-19 through email and social media. Also, the in-campus testing sites provided the students, faculty, and staff with a handy solution to the COVID-19 testing problem. During the pandemic, most of UTEP’s activities went online, and to some extent, it continues to do so because the system required to sustain it is
now in place, enabling some students to continue the use of the online and hybrid modes for classes, continuing their education.
Chapter 5: Conclusions and Recommendations

Sustainability is the future of human existence where an equilibrium must be maintained between nature, society, and currency. Failing to achieve the balance will have adverse impacts on our future presence. The melting of ice in the arctic, the harsh lives of indigenous peoples living in the forests of the Amazon, and the poverty prevalent across much of the African continent are all examples of human behaviors leading to a condition of unbalanced sustainability. The reasons for uneven sustainability range from wealthy nations' insatiable consumption of limited natural resources to poverty-stricken countries struggling to survive and citizens struggling to have access to healthy living and the basic necessities for living safely and peacefully. We have now reached the limits of sustainable existence, and some would suggest we have surpassed them. In this age and time, it is crucial for us to collectively understand and act on the importance and need for sustainability before it gets too late for there to be resolutions and no turning back.

5.1 Final Insights

The role of higher education institutions in the advancement of sustainability cannot be underestimated, especially in their influencing the region of their locales, which the six case studies illustrate. Each case study targets a specific element of sustainability; however, it also impacts other elements of sustainability. The case studies on Rio Bosque wetland park and UTEP’s Campus Transformation Project (CTP) show they impact the environment. However, they also contribute to the social sustainability of the community of El Paso. People from all pockets of El Paso enjoy the natural beauty of the Rio Bosque wetland park. It can be in different forms, such as taking your pet for a walk or enjoying a family outing during the weekend. The CTP gives a glimpse of the magnificence of the Chihuahuan Desert that this region's people admire. The case study on ECHS and UB perfectly demonstrates the impact UTEP has on the social element of
sustainability. It can also be found to have an economic impact in the region as the students and staff of ECHS and UB contribute to the region’s economy by spending money for their needs. The case studies on Economic aspects have social aspects attached to them. The financial contributions of UTEP help fulfill the social requirements such as having a family vacation or donating to a social cause. It will be appropriate to say that any effort toward sustainability contributes to the different pillars of sustainability.

The case study on Rio Bosque wetland park teaches us the importance of collaboration between different entities sharing a common goal and guiding their efforts based on their expertise and individually contributing towards environmental sustainability. The work on the CTP is an exceptional example of reverse engineering in strategic planning and step-by-step execution to solve problems of various kinds, overall leading to sustainability. Through the work done by the El Paso Collaborative of Academic Excellence, we learn how a visionary can identify the region’s needs and offer different solutions to different needs, each contributing to sustainability. With the intention of inclusiveness, ECHS and UB program provides solutions for two different kinds of problems, both contributing to sustainability. UTEP’s economic impact includes information on the economic importance of various activities in which a university can be directly engaged. In contrast, the case study on the effects of COVID-19 and UTEP’s response suggests that universities help provide financial sustainability to the region although contributing indirectly.
Figure 5.1: A schematic representation of the university and its interconnectedness with the three elements of sustainability

The case studies show that a university contributes to the three elements of sustainability through different activities. It will be appropriate to say that the university’s efforts revolve around the three elements of sustainability, and these efforts help a region move closer to sustainability. In other words, for a region, a university acts as a focal point for the community’s sustainability needs and sets a guiding example for other institutions to contribute to sustainability.

In 2016, under the chairmanship of Dr. Luis Perez, UTEP submitted its first STARS self-assessment of sustainability to the American Association of Sustainability in Higher Education (AASHE), which is a valuable work reporting UTEP’s effort toward sustainability. The work is beyond the scope of this discussion, so it has been included in Appendix 1.

5.2 Concluding Commentary

UTEP accepted a role managing Rio Bosque Wetland Park in November 1996 and has continued to do so for 30 years through a licensing agreement between the city of El Paso and UTEP, working with eight other organizations to develop the park. It managed to increase the
availability of water to the park through different means, which has resulted in the increase in flora and fauna found therein. In 1997, 107 species of birds were found in the park, out of which 20 were water birds. In 2019, the number of different species of birds found in Rio Bosque Wetland Park nearly doubled, to 202 species, out of which 78 were water birds. Apart from that, frogs, raccoons, muskrats, and turtles, some of which are not native to this region, are now found in Rio Bosque Wetland Park.

UTEP’s Central Campus Transformation Project (CTP), whose planning began during the creation of the 2001 master plan, cost $15 million to complete. The CPT took one year to plan and two years to construct, with the project being completed in late 2014. CTP includes the Centennial Plaza and the Centennial Green providing a rich, detailed outdoor gathering space such as a performance lawn and an amphitheater of 130 seating capacity. It increased the vegetation area by 60%, including planting 651 new trees, 2,409 shrubs, and 3,337 native perennials, aligned with reestablishing and mimicking the beauty of the Chihuahuan Desert region. It solved the flooding issues expected following thunderstorms and collected 565,370 gallons or 75,579 cubic feet of stormwater per day, exceeding the 95th percentile storm event. It recycled 5,000 tons of concrete and rocks, equating to 99% of demolition materials. CTP was awarded seven different awards (McNicol, 2020).

The El Paso Collaborative of Academic Excellence is a regional leadership council consisting of a board of 16 members, including superintendents from the three largest independent school districts, the UTEP president and representatives, the president of EPCC, representatives from El Paso business, workforce, and economic development, two representatives from the Council on Regional Economic Expansion and Educational Development (CREEED), a nonprofit business organization, and a representative from Paso del Norte Health Foundation, and the
executive director for the region Education Service Center Region 19. The El Paso Collaborative of Academic Excellence (EPCAE) aims to motivate students for post-secondary education. It targets the Paso del Norte’s 180,000 students through different programs and activities held at UTEP, including ECHS and UB.

Early College High School (ECHS) is an innovative and powerful educational model that helps students earn a high school diploma and an associate degree or at least 60 semester credit hours toward a baccalaureate degree. The first ECHS was Mission ECHS, which commenced in 2006 as a collaboration between the El Paso Community College (EPCC) and the Socorro Independent School District (SISD). As of 2022, there are now 27 ECHS in El Paso. The enrollment of the ECHS students, which at UTEP was 85 in 2010 - 2011, has increased more than six-fold in 10 years through 2020, with UTEP retaining more than 80% of students coming from across all the early college high school campuses. ECHS students at UTEP have taken an average of 3.58 years to graduate, in contrast to regular undergraduate students taking on average 5.68 years to graduate.

UTEP’s Upward Bound (UB) program is a 40-year-old program that currently targets six high schools in El Paso Independent School District (EPISD) and five in Ysleta Independent School District (YISD), serving 92 and 78 students, respectively. UB provides service to students starting from the end of their eighth-grade year till their senior year in high school.

UTEP is one of the top five employers in El Paso and contributes nearly 5.5% to the region’s GDP and contributes $1.4 billion to El Paso’s economy. UTEP indirectly and directly employs more than 3000 people. UTEP’s Interdisciplinary Research Building (IRB) commenced construction in April 2017 and employed 125 people for construction, and was completed in May 2020 at the cost of $85million. It is calculated that this cost is effectively an investment that has
created a total revenue of around $156 million and nearly $52 million in earnings with the creation of 980 jobs. The interdisciplinary research building is anticipated to house 220 employees, whose wages will be a total of $7 million per annum and generate annual revenue of $45 million. This will create a subsequent impact of more than $77 million within the region and support employment to some 858 people, with their earnings being more than $30 million. For 2021 UTEP employed 2129 full-time employees and paid them $155.2 million in salaries and wages, which added a total of $451 million to the economy of El Paso. This created some 5,014 jobs and earnings of around $177 million.

COVID-19 had a harsh impact on El Paso. In November 2020, more than 40% of the hospital beds were occupied by COVID-19 patients, which was the highest in Texas. However, it was controlled once the vaccination drive started. By June 2021, nearly 63% of El Paso’s population was vaccinated, whereas, during the same time in Texas, this figure stands at 48.2%. UTEP had a major role in helping the UTEP community and the people of El Paso tackle COVID-19. It regularly had 4 COVID testing sites at UTEP and provided a total of 3 sites for COVID-19 testing for the El Paso community. UTEP provided vaccines to all its students, faculty, and staff, which would be more than 25,000 in number, also providing vaccinations for family members.

5.3 Limitations

Research methods and practices always have limitations, and the current study has been no different. Since the research required copious interviews to collect the required insights and information, one repeated challenge was establishing interviewee availability. This was because the high-profile interview participants maintained hectic schedules and were oftentimes busy; even scheduling an appointment for an interview often took several weeks. On numerous occasions, there were no responses to correspondence, phone calls, and return emails. It proved
effective to knock on doors directly. Also, the accessibility of past data was a challenge and often required detective work, and the use of alternative approaches to access the data. Also, the lack of documentation of sustainability efforts was a frequent issue, which was oftentimes overcome by gathering appropriate information during the interviews. Appreciation is expressed to the many contributors, whose insider understanding made documenting the impact of sustainability possible.

5.4 Outlook (Future Efforts and Recommendations)

The topic of sustainability studies has much potential for future work, especially in the El Paso region. It will be interesting to conduct a study on how partnership impacts social sustainability, incorporating culture, diversity, equity, and inclusion, which aligns with UTEP’s strategic goals. Also, conducting a holistic economic impact study considering all the different financial aspects of UTEP can help us get a better idea of the detailed contribution of UTEP to the GDP of El Paso, which is also part of UTEP’s mission. A holistic study of different environmental works that have been completed or are proceeding currently can help to complete a comprehensive synopsis of UTEP’s contribution to environmental sustainability in this region.

Since sustainability is vital to UTEP and to our region, future research should include ongoing sustainability studies and undergraduate and graduate class offerings.

It is recommended that UTEP regain membership in the American Association of Sustainability in Higher Education (AASHE), which provides a valuable benchmark community for reporting UTEP’s efforts toward sustainability.
References


Center for Inland Desalination Systems (n.d.). UTEP. Retrieved February 26, 2022, from https://www.utep.edu/engineering/cids/

Center for Student Success (n.d.). Indiana State University. Retrieved March 6, 2022, from https://www.indstate.edu/services/student-success/cfss


Division of Student Affairs 1. (n.d.). Early college high school. UTEP. Retrieved April 18, 2022, from https://www.utep.edu/student-affairs/echs/


Heinberg, R. (2010). What is Sustainability?. Post Carbon Institute


Mike Loya center for innovation and Commerce. (n.d.). UTEP. Retrieved April 11, 2022, from https://www.utep.edu/loyacent


Social Sustainability. (n.d.). Retrieved February 16, 2022, from https://www.mapleridge.ca/1779/Social-Sustainability


Sustainability Components: Balancing Environmental, Economic, and Social Equity Components.


Sustainable Development. (n.d.). Retrieved from https://science.gu.se/english/about/sustainable-development


UTEP CARES (n.d.). UTEP. Retrieved April 26, 2022, from https://www.utep.edu/utepcares/


### Glossary

**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTEP</td>
<td>The University of Texas at El Paso</td>
</tr>
<tr>
<td>HEI</td>
<td>Higher Educational Institutions</td>
</tr>
<tr>
<td>CTP</td>
<td>Campus Transformation Project</td>
</tr>
<tr>
<td>ECHS</td>
<td>Early College High School</td>
</tr>
<tr>
<td>UB</td>
<td>Upward Bound</td>
</tr>
<tr>
<td>Collaborative</td>
<td>El Paso Collaborative of Academic Excellence</td>
</tr>
<tr>
<td>EPCC</td>
<td>El Paso Community College</td>
</tr>
<tr>
<td>AASHE</td>
<td>The Association for the Advancement of Sustainability in Higher Education</td>
</tr>
<tr>
<td>STARS</td>
<td>The Sustainability Tracking, Assessment &amp; Rating System</td>
</tr>
<tr>
<td>EPWU</td>
<td>El Paso Water Utilities</td>
</tr>
<tr>
<td>USFWS</td>
<td>US Fish and Wildlife Services</td>
</tr>
<tr>
<td>USBR</td>
<td>US Bureau of Reclamation</td>
</tr>
<tr>
<td>USIBWC</td>
<td>US Section of the International Boundary and Water Commission</td>
</tr>
<tr>
<td>El Paso #1</td>
<td>El Paso County Water Improvement District No. 1</td>
</tr>
</tbody>
</table>
Appendix 1

AASHE

AASHE acronyms for “The Association for the Advancement of Sustainability in Higher Education.” It is the leading organization that works to advance sustainability in the world of higher education. It looks at the different sustainability initiatives undertaken by universities and colleges through their faculty, students, and staff, who are the real drivers of sustainability programs at various higher educational institutions. Established in 2005, AASHE has over 900 member institutions from 20 countries but mainly from within the United States.

To evaluate sustainability in higher educational institutions, AASHE has developed the STARS (The Sustainability Tracking, Assessment & Rating System) evaluation program. It is a voluntary, transparent, and self-reporting framework for higher educational institutions to evaluate their’s sustainable performance, leading to a sustainable transformation. The evaluation process includes 139 environmental, ecological, and social indicators divided into four categories: education and research, operations, planning, administration & engagement, and innovation. STARS intends to cover a wide range of institutions from 2-year college to 4-year university, from a teaching-intensive institution to a research-focused university, from an institution just entering into the world of sustainability to a university pioneer in that field. There are five reasons to design STARS:

1. To provide a framework to understand sustainability in every sector of higher education.

2. To enable valid and meaningful comparisons over time and across institutions using a standard set of measurements.

3. To create an incentive for continued improvement leading towards sustainability.
4. To facilitate sharing information about higher education’s sustainability practices and performances.

5. To build a community strong and more diverse in campus sustainability.

STARS has been one of the most thoroughly tested campus sustainability frameworks in North America. Launched in September 2009 using version 1.0, then gradually moved to v1.1, v1.2, v2.0, v2.1, and v2.1.3. In July 2019, v2.2 was published, and it is currently in use. Depending upon the evaluation by AASHE and the score gained, any institution is given one among the five ratings: platinum, gold, silver, bronze, and reporter. A reporter is a free option, whereas all others are paid options. Any institution’s STARS score is based on the percentage of applicable points it earns across four categories. Each evaluation is valid for three years.
Appendix 2

American Canal Extension

The first and the oldest partners of the American Canal Extension project were the USIBWC and the El Paso #1, and later, in the mid of 1996, EPWU also joined the project (Sproul, 2011) as there was a potential to make more water available for the community (Sproul, 2019). In the 1990s, work started on the American canal extension, which involved reconstructing 3.2 miles of the existing canal and constructing 12.1 miles of the new concrete-lined canal (Sproul, 2011). This canal parallels the Rio Grande between downtown El Paso and the heading of the Riverside Canal, on the north of the Jonathan Rogers Water Treatment Plant. Water that was carried in the American Canal Extension was discharged to the Riverside Canal so that it could be delivered either to the downstream irrigators or the Jonathan Rogers Plant for treatment for community use (Sproul, 2011).

The riverbed below downtown El Paso is dry. Out of several purposes of the American Canal Extension, the main one was to capture the water of the Rio Grande that was previously lost from the bed of the river as it flowed through El Paso. After the canal's construction, during most of the time of the year, the river's entire flow was diverted into the American Canal Extension. According to an estimate done by El Paso #1, during the irrigation season of the year 2000, around 30,000 acre-feet of water were salvaged by diversion into the concrete-lined canal (Sproul, 2011) (Sproul, 2019).
American Canal Extension was a project funded by the federal government, and it had to fulfill the requirements of the Fish and Wildlife Coordination Act. According to the act, the US Fish and Wildlife Services (USFWS) evaluated the project and found out that the American Canal Extension project would affect 164 acres of upland habitat and 12 acres of herbaceous wetland, and creating 30 acres of wetland habitat would offset the negative impacts of the project and for that Rio Bosque was chosen as the preferred site (Sproul, 2019).
Appendix 3

*Rio Bosque Wetland Refuge*

The commitment of USIBWC to create a wetland habitat at Rio Bosque sparked the thought of a larger wetland project. In early 1995, the Texas Rio Grande Compact Commission set forth the "Riverside Wildlife Refuge Area" concept in collaboration with Ducks Unlimited. This area would include the whole of Rio Bosque Park along with the 250 acres of reconfigured sewage oxidation ponds at the decommissioned Socorro Wastewater Treatment Plant. EPWU and El Paso #1 were carefully thinking and analyzing the idea of using these ponds as regulating reservoirs to capture available water from the Rio Grande during periods of higher-than-normal flows. To make this plan a success, several agencies and organizations, mainly Rio Grande Compact Commission-Texas, Ducks Unlimited, the USIBWC, the USFWS, EPWU, El Paso #1, the city of El Paso's Parks and Recreation Department and Planning Department, and the US Bureau of Reclamation (USBR) (Sproul, 2011) came together to discuss the feasibility of this project. In the beginning, the discussion was to name the site Riverside Wetlands Refuge Area, but later it was named Rio Bosque Wetland Refuge (Sproul, 2019).
Appendix 4

Execution of Plan

The initial plan focused only on Rio Bosque, which was to rebuild an old bend of the Rio Grande that wound through the park for approximately two miles, create three large, shallow basins, totaling 234 acres, that could be flooded by diverting water from the old river channel and install water-control structures to carry out such diversions (Sproul, 2011).

The water for the Rio Bosque Wetland Park was to be sourced from Roberto Bustamante Wastewater Treatment Plant. The treated effluent from the wastewater treatment plant would be drained to the Riverside Intercepting Drain, an El Paso #1 facility that flows parallel to the Rio Grande on the west side of the plant. A structure to control the water flow would be installed in the drain in the northwest corner of the park. Here, the water would be turned towards the old river channel within the park, and after the water had flowed through the park, it would be returned to the drain (Sproul, 2019).

The planning for the Rio Bosque Wetland project had no formal agreement specifying the time and volume when water would be released to the park. Throughout the planning process, El Paso #1 committed to delivering treated effluent to the park with the exception that, during the dry months of the year, it would not be able to do so during the irrigation season (Sproul, 2011).

It was anticipated that, during years when a full allocation of Rio Grande Project water was available to El Paso #1 for irrigation, the treated effluent would be made available to the park during the irrigation season. In association with USFWS, Ducks Unlimited made a detailed management plan for the wetland cells at Rio Bosque, which specified optimum times for flooding and drawdown that extended well into the irrigation season and for periodic irrigation during spring and summer (Sproul, 2019).
### Appendix 5

Table 2.5 Total Multipliers for Output, Earnings, Employment, and Value Added by Industry Aggregation

<table>
<thead>
<tr>
<th>Industry Description</th>
<th>Final Demand</th>
<th>Multiplier</th>
<th>Direct Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farms</td>
<td>1.5474</td>
<td>0.4182</td>
<td>15.1399</td>
</tr>
<tr>
<td>2. Forestry, fishing, and related activities</td>
<td>1.7081</td>
<td>0.7706</td>
<td>27.6854</td>
</tr>
<tr>
<td>3. Oil and gas extraction</td>
<td>1.4760</td>
<td>0.4065</td>
<td>4.6266</td>
</tr>
<tr>
<td>4. Mining (except oil and gas)</td>
<td>1.5917</td>
<td>0.3377</td>
<td>6.4035</td>
</tr>
<tr>
<td>5. Support activities for mining</td>
<td>1.6357</td>
<td>0.4567</td>
<td>6.6433</td>
</tr>
<tr>
<td>6. Utilities</td>
<td>1.5114</td>
<td>0.2973</td>
<td>4.2662</td>
</tr>
<tr>
<td>7. Construction</td>
<td>1.8100</td>
<td>0.6099</td>
<td>11.5359</td>
</tr>
<tr>
<td>8. Wood product manufacturing</td>
<td>1.6027</td>
<td>0.3411</td>
<td>7.1972</td>
</tr>
<tr>
<td>9. Nonmetallic mineral product manufacturing</td>
<td>1.7296</td>
<td>0.3475</td>
<td>6.2766</td>
</tr>
<tr>
<td>10. Primary metal manufacturing</td>
<td>1.7463</td>
<td>0.3221</td>
<td>6.9784</td>
</tr>
<tr>
<td>11. Fabricated metal product manufacturing</td>
<td>1.6873</td>
<td>0.3746</td>
<td>6.8887</td>
</tr>
<tr>
<td>12. Machinistry manufacturing</td>
<td>1.5429</td>
<td>0.3224</td>
<td>5.5480</td>
</tr>
<tr>
<td>13. Computer and electronic product manufacturing</td>
<td>1.5398</td>
<td>0.4589</td>
<td>5.9515</td>
</tr>
<tr>
<td>14. Electrical equipment, appliance, and component</td>
<td>1.6687</td>
<td>0.3655</td>
<td>6.3381</td>
</tr>
<tr>
<td>15. Motor vehicles, bodies and trailers, and parts</td>
<td>1.5796</td>
<td>0.2935</td>
<td>5.3066</td>
</tr>
<tr>
<td>16. Other transportation equipment manufacturing</td>
<td>1.4876</td>
<td>0.3465</td>
<td>5.0745</td>
</tr>
<tr>
<td>17. Furniture and related product manufacturing</td>
<td>1.7460</td>
<td>0.4109</td>
<td>9.1029</td>
</tr>
<tr>
<td>18. Miscellaneous manufacturing</td>
<td>1.6085</td>
<td>0.3787</td>
<td>7.3816</td>
</tr>
<tr>
<td>19. Food and beverage and tobacco product manufacturing</td>
<td>1.6369</td>
<td>0.3092</td>
<td>6.4456</td>
</tr>
<tr>
<td>20. Textile mills and textile product mills</td>
<td>1.7193</td>
<td>0.4146</td>
<td>11.4430</td>
</tr>
<tr>
<td>21. Apparel, leather, and allied product manufacturing</td>
<td>1.7226</td>
<td>0.5237</td>
<td>17.2288</td>
</tr>
<tr>
<td>22. Paper manufacturing</td>
<td>1.5723</td>
<td>0.3063</td>
<td>5.2951</td>
</tr>
<tr>
<td>23. Printing and related support activities</td>
<td>1.6601</td>
<td>0.4372</td>
<td>10.3004</td>
</tr>
<tr>
<td>24. Petroleum and coal products manufacturing</td>
<td>1.3036</td>
<td>0.2325</td>
<td>2.8093</td>
</tr>
<tr>
<td>25. Chemical manufacturing</td>
<td>1.4072</td>
<td>0.2745</td>
<td>3.9205</td>
</tr>
<tr>
<td>26. Plastics and rubber products manufacturing</td>
<td>1.5182</td>
<td>0.2872</td>
<td>5.4666</td>
</tr>
<tr>
<td>27. Wholesale trade</td>
<td>1.6387</td>
<td>0.4296</td>
<td>7.1886</td>
</tr>
<tr>
<td>28. Motor vehicle and parts dealers</td>
<td>1.6424</td>
<td>0.5689</td>
<td>11.3069</td>
</tr>
<tr>
<td>29. Food and beverage stores</td>
<td>1.7175</td>
<td>0.5548</td>
<td>16.6868</td>
</tr>
<tr>
<td>30. General merchandise stores</td>
<td>1.6146</td>
<td>0.4899</td>
<td>16.2344</td>
</tr>
<tr>
<td>31. Other retail</td>
<td>1.7142</td>
<td>0.5415</td>
<td>17.1480</td>
</tr>
<tr>
<td>32. Air transportation</td>
<td>1.7579</td>
<td>0.3710</td>
<td>6.0949</td>
</tr>
<tr>
<td>33. Rail transportation</td>
<td>1.6703</td>
<td>0.3865</td>
<td>5.7863</td>
</tr>
<tr>
<td>34. Water transportation</td>
<td>1.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>35. Truck transportation</td>
<td>2.0643</td>
<td>0.6022</td>
<td>12.2490</td>
</tr>
<tr>
<td>36. Transit and ground passenger transportation*</td>
<td>1.9933</td>
<td>0.5927</td>
<td>29.0755</td>
</tr>
<tr>
<td>37. Pipeline transportation</td>
<td>1.8447</td>
<td>0.7723</td>
<td>9.8354</td>
</tr>
</tbody>
</table>

(Continued)

Notes:
1. Each entry in column 1 represents the total dollar change in output that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
2. Each entry in column 2 represents the total dollar change in earnings of households employed by all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
3. Each entry in column 3 represents the total change in number of jobs that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry. Because the employment multipliers are based on 2019 data, the output delivered to final demand should be in 2019 dollars.
4. Each entry in column 4 represents the total dollar change in value added that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
5. Each entry in column 5 represents the total dollar change in earnings of households employed by all industries for each additional dollar of earnings paid directly to households employed by the industry corresponding to the entry.
6. Each entry in column 6 represents the total change in number of jobs in all industries for each additional job in the industry corresponding to the entry.

Source: Regional Input-Output Modeling System (RIMS II), Regional Product Division, Bureau of Economic Analysis.
## Table 2.5 Total Multipliers for Output, Earnings, Employment, and Value Added by Industry Aggregation

### El Paso (Type II)

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>Multiplier</th>
<th>Final Demand</th>
<th>Direct Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Output/1 (dollars)</td>
<td>Earnings/2 (dollars)</td>
</tr>
<tr>
<td>38. Other transportation and support activities*</td>
<td>1.9391</td>
<td>0.6405</td>
<td>14.7648</td>
</tr>
<tr>
<td>39. Warehousing and storage</td>
<td>1.9061</td>
<td>0.4943</td>
<td>11.7145</td>
</tr>
<tr>
<td>40. Publishing industries (except Internet)</td>
<td>1.5293</td>
<td>0.4482</td>
<td>6.8075</td>
</tr>
<tr>
<td>41. Motion picture and sound recording industries</td>
<td>1.4297</td>
<td>0.3409</td>
<td>10.9181</td>
</tr>
<tr>
<td>42. Broadcasting (except Internet) and telecommunications</td>
<td>1.6805</td>
<td>0.3803</td>
<td>6.8641</td>
</tr>
<tr>
<td>43. Data processing, hosting, and other information services</td>
<td>1.6619</td>
<td>0.3671</td>
<td>6.5309</td>
</tr>
<tr>
<td>44. Monetary Authorities-central bank, credit intermediation, and related services</td>
<td>1.5418</td>
<td>0.4211</td>
<td>6.9709</td>
</tr>
<tr>
<td>45. Securities, commodity contracts, and other financial investments and related activities</td>
<td>1.7730</td>
<td>0.6484</td>
<td>17.2304</td>
</tr>
<tr>
<td>46. Insurance carriers and related activities</td>
<td>1.6588</td>
<td>0.4043</td>
<td>7.5414</td>
</tr>
<tr>
<td>47. Funds, trusts, and other financial vehicles</td>
<td>1.6315</td>
<td>0.3464</td>
<td>10.0433</td>
</tr>
<tr>
<td>48. Real estate</td>
<td>1.4434</td>
<td>0.2797</td>
<td>9.0113</td>
</tr>
<tr>
<td>49. Rental and leasing services and lessors of nonfinancial intangible assets</td>
<td>1.7515</td>
<td>0.4754</td>
<td>8.5165</td>
</tr>
<tr>
<td>50. Professional, scientific, and technical services</td>
<td>1.7455</td>
<td>0.6934</td>
<td>11.5047</td>
</tr>
<tr>
<td>51. Management of companies and enterprises</td>
<td>1.7242</td>
<td>0.6656</td>
<td>10.0534</td>
</tr>
<tr>
<td>52. Administrative and support services</td>
<td>1.7987</td>
<td>0.7132</td>
<td>18.6411</td>
</tr>
<tr>
<td>53. Waste management and remediation services</td>
<td>1.6859</td>
<td>0.4390</td>
<td>8.1379</td>
</tr>
<tr>
<td>54. Educational services</td>
<td>1.7155</td>
<td>0.6717</td>
<td>19.0709</td>
</tr>
<tr>
<td>55. Ambulatory health care services</td>
<td>1.7590</td>
<td>0.6793</td>
<td>13.0148</td>
</tr>
<tr>
<td>56. Hospitals</td>
<td>1.7977</td>
<td>0.6348</td>
<td>11.5884</td>
</tr>
<tr>
<td>57. Nursing and residential care facilities</td>
<td>1.8093</td>
<td>0.6874</td>
<td>19.8670</td>
</tr>
<tr>
<td>58. Social assistance</td>
<td>1.8108</td>
<td>0.6603</td>
<td>25.3283</td>
</tr>
<tr>
<td>59. Performing arts, spectator sports, museums, and related activities</td>
<td>1.6758</td>
<td>0.5508</td>
<td>15.9838</td>
</tr>
<tr>
<td>60. Amusement, gambling, and recreation industries</td>
<td>1.7513</td>
<td>0.5518</td>
<td>21.3518</td>
</tr>
<tr>
<td>61. Accommodation</td>
<td>1.6071</td>
<td>0.4462</td>
<td>13.5551</td>
</tr>
<tr>
<td>62. Food services and drinking places</td>
<td>1.7028</td>
<td>0.4908</td>
<td>17.8508</td>
</tr>
<tr>
<td>63. Other services*</td>
<td>1.8006</td>
<td>0.5376</td>
<td>13.4088</td>
</tr>
<tr>
<td>64. Households</td>
<td>0.9487</td>
<td>0.2796</td>
<td>7.0374</td>
</tr>
</tbody>
</table>

---

*Includes Government enterprises.

1. Each entry in column 1 represents the total dollar change in output that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
2. Each entry in column 2 represents the total dollar change in earnings of households employed by all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
3. Each entry in column 3 represents the total change in number of jobs that occurs in all industries for each additional 1 million dollars of output delivered to final demand by the industry corresponding to the entry. Because the employment multipliers are based on 2019 data, the output delivered to final demand should be in 2019 dollars.
4. Each entry in column 4 represents the total dollar change in value added that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
5. Each entry in column 5 represents the total dollar change in earnings of households employed by all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
6. Each entry in column 6 represents the total change in number of jobs in all industries for each additional job in the industry corresponding to the entry.

**NOTE:** Multipliers are based on the 2012 Benchmark Input-Output Table for the Nation and 2019 regional data. Industry List B identifies the industries corresponding to the entries.

**SOURCE:** Regional Input-Output Modeling System (RIMS II), Regional Product Division, Bureau of Economic Analysis.
Vita

Anand Raj was born in India, from where he received his Bachelor of Engineering. Later, he did a Master of Business Administration in Marketing and International Business, a dual degree program in collaboration between Christ University, India, and the University of Applied Sciences Würzburg-Schweinfurt, Germany. He worked for Wipro Infotech before moving to the US. He received his Master of Science in 2017 and working towards completing his Doctoral Studies in Environmental Science and Engineering at The University of Texas at El Paso.

Anand’s primary research focus is on sustainability in the context of Higher Education Institutions. He has analyzed the impact of a university on improving sustainability in a region. He studies the various contributors to sustainability and their impacts. He has participated in several conferences and published research articles. He is proficient in conducting interviews and has also helped acquire new grants.

He has a good reasoning ability and thinks out of the box, providing a new view angle to the approach. He has a problem-solving approach, which he applies to resolve research and management issues. He actively participates in extracurricular activities and takes a leadership role in executing them. He has worked taught introductory-level courses on sustainability and other related subjects and provided mentoring and professional assistance to students.

Contact: a.raj543@gmail.com