

Public–Private Partnerships for Higher Education Institutions in the United States

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Abstract: Public–private Partnerships have become a common delivery method for diverse types of projects ranging from transportation and energy infrastructure to social infrastructure. Previous research has mainly focused on PPPs for infrastructure and other non-social projects. Although PPP projects for higher education institutions share some common attributes with their traditional counterparts, they also have unique aspects such as institutional culture as well as structure of ownership and management. Hence, the objectives of this research were to (1) conduct a systematic collection and analysis of PPP projects in higher education institutions in the United States; and (2) conduct a gap analysis to provide recommendations for future projects and lessons learned from past ones. A gap analysis of the published data on higher education PPPs was undertaken, identifying 45 educational PPP projects in the United States. The main areas of study were type of project (e.g., housing, commercial, mixed use, etc.), size, and investment made. Additionally, a questionnaire survey was disseminated to experts in the field to collect data on these projects and report on them. The results showed an increasing trend in project size between 1994 and 2018 with the majority being for housing developments while a smaller percentage was for commercial and utility projects. A geographical representation shows a large number of projects clustered in the Southern and North-eastern regions of the United States. Additionally, a questionnaire survey was used to identify samples of these projects and present them as a case study. The number of PPPs is expected to rise due to funding cuts and state appropriation cuts. Finally, the proposed recommendations can also be extrapolated for other social or infrastructure projects.

Keywords: public–private partnership; higher education; social infrastructure; United States

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1. Introduction

In recent years, public institutions have suffered from a decline in available funds. In 2020, Rutgers University lost \$60 million from canceled surgical proceedings at their center and \$50 million in refunds to students for unused university facilities [1]. The University System of Georgia’s 26 colleges and universities faced a \$350 million loss from canceled events and summer revenue. Several organizations have reported that higher education needs approximately \$46 billion [2]. Although several state appropriations and Congressional Acts have been passed to support the universities, they may not amount to the total fund needed. For example, Congress has passed the Higher Education Emergency Relief Fund awarding \$14 billion to postsecondary education [3]. This has motivated higher education institutions in the United States to seek private investment for the

delivery of their projects. Therefore, these institutions have increasingly turned to PPPs for the delivery and operation of facilities such as housing and parking lot projects. University PPP projects have increased in value from a total of \$100 million in 2003 to \$3.1 billion for housing projects alone [4].

Public–private partnerships (PPPs) have become an attractive form of project delivery for many public entities due to their potential benefits including faster project completion, reduced delays in projects, and reduced change order costs. Generally, the private sector is contracted to undertake some of the financial burden and to deliver the services due to their experience in these projects [5]. PPPs have been used for the delivery of projects in diverse sectors such as infrastructure (roads, bridges, railways), environmental (waste, water, wastewater), and social projects (housing, libraries, healthcare, recreation) [4]. In a PPP, the private sector plays a larger role in the procurement and delivery of a project as compared to the traditional approach, which is of benefit to the university [6]. Public universities are then able to transfer risk and delegate their project to a private entity, thereby freeing the university and its resources to focus on education [7].

Previous literature shows that PPPs have mainly penetrated non-social infrastructure projects in the United States in transportation and environmental projects [8]. For social infrastructure projects, there has been a proclivity for the studies to focus on some aspects such as lifecycle performance [9]; PPP contracting for primary and secondary education [10]; affordable housing projects [11]; social infrastructure for universities [3]; asset recycling [12]; and low-income housing [13].

Although there has been extensive research on PPP use in the United States, their focus has mainly been on infrastructure projects. However, research on PPPs for higher education institutions in the United States remains limited. In that regard, this paper makes a novel contribution to literature by focusing on PPPs for higher education institutions in the United States and reports on these projects. A gap analysis was conducted to identify current trends as well as recommendations for future projects. Therefore, the objectives of this paper were as follows:

- a. conduct a systematic collection and analysis of PPP projects in higher education institutions in the United States;
- b. conduct a gap analysis to provide recommendations for future projects and lessons learned from past ones.

Firstly, a systematic identification and collection of U.S.-based higher education PPP projects was conducted. Secondly, a questionnaire survey was administered to high-level experts working in these institutions (and involved in these projects) to provide an in-depth analysis on a sample of the projects. These two methods were used to combine tacit and explicit knowledge and show a comprehensive presentation of the use of PPP in U.S.-based higher education institutions.

The following section presents the background on PPPs for higher education institutions, governance mechanisms, legislation in different states, contractual frameworks between the public and private parties, and, finally, the advantages and challenges observed.

2. Background

2.1. Public–Private Partnerships in Higher Education Institutions

PPPs have typically been used for the delivery of traditional infrastructure projects such as transportation and water sanitation projects. The successful delivery and operation of these projects has spurred the spread into many other project types. This has caused a shift towards delivering social infrastructure projects such as housing, healthcare, and court houses using PPPs. According to Casady et al. [8], social infrastructure projects have amounted to 25% of total PPP projects in the United States as of 2018. The main drivers for this wave have been the public sector's high debt levels as well as their inability to finance some projects due to the unavailability of funds. State

government appropriations for higher education institutions have declined by 21% between 2009 and 2013, which have amounted to \$14 billion [14]. The decreased state contribution coupled with increased operating costs and increased enrolment numbers have fostered the need for an alternative delivery mechanism. Many public entities have sought this alternative procurement method because of their struggle with obtaining financing for their projects [15]. Examples of higher education institutions that have entered into PPPs are the University of Maryland, University of Arizona, University of West Florida, and the University of California.

PPPs as a model usually service one of three areas of an institution (or a combination of these areas):

- a. front-office, which includes student affairs and enrolment;
- b. back-office, which includes supporting operations such as finance;
- c. facilities, which are the physical assets such as halls, cafeterias, and dorms.

Previous research has mainly focused on the first two types, where the private entity delivers a service for the public institution. For example, Warasthe [16] presented a framework of partnership between Namibia University of Science and Technology (NUST) and The Chartered Institute of Logistics and Transport, which is a private organization that offers training and certification. This enabled NUST to offer new training opportunities, penetrate a new market, and utilize an established and experienced organization [16].

This paper focuses on the third type, which is PPP use for the delivery of higher education facilities in U.S. institutions. These facilities can be classified into mission-serving or revenue-generating [17]. Mission-serving facilities are built for a specific purpose such as the neurosciences project for the University of California in San Francisco, while revenue-generating facilities include housing complexes (Texas A&M College Station) or parking garages (Ohio State University). Multiple reasons exist behind an institution's choice for this delivery method, including:

- a. lack of required financing (due to budget cuts);
- b. inexperience of an institution in this development type or with the targeted population that the development is being built for;
- c. experience of the private sector;
- d. risk mitigation (transfer to the private sector);
- e. fast delivery for a development [18,19].

For example, the University of California (UC) in Davis entered into a partnership for a \$280 million development (the West Village) with a direct investment of only \$17 million [20]. Another example is the University System of Georgia's PPP agreement, which was off the balance sheet, which meant that it would not affect the university's credit rating. Similarly, the University of California-Davis campus residence hall project was incentivized by off-balance sheet financing and the University of California-Irvine's Vista Del Norte housing project aimed to not impact its debt capacity [21]. Although private capital may come at an increased cost compared to public financing (and debt), it can also include lower costs in terms of maintenance as well as risks (when the private party is responsible for them). These are among the important drivers behind PPP use for these projects.

2.2. PPP Governance in Higher Education Institution Projects

The two main factors that dictate how public universities handle PPP projects are the structure of the university and governance. The United States does not have a centralized PPP unit responsible for overseeing all projects. Hence, governance mechanisms vary widely across different states as well as within each state [5]. Some states have a centralized division that controls all public-private partnerships in the state's educational institutions, whereas in other states each university is considered autonomous in its decision-making. For example, the state of Georgia controls 26 higher education institutions and has established financing programs to build housing projects in these institutions [22].

These programs offer financing options to the institution and are governed by the 'Board of Regents' (BOR). This 'Board of Regents' oversees the administration of public education in a state and can even authorize or decline the use of a PPP in a university. Examples of states that have a BOR are Georgia, Iowa, Arizona, Kansas, South Dakota, California, and Texas. On the opposite end of the spectrum are states that have a decentralized structure, such as Virginia, where each institution is responsible for its own public-private partnership endeavors.

Other countries such as Egypt, Japan, and the United Kingdom have a central PPP unit, which enables a consistent governance mechanism. This unit aids in pre-project screening, provides technical and project-delivery support, and provides advisory services [23,24]. Casady and Geddes [23] proposed creating PPP units to lower the transaction cost in these contracts by centralizing all needed expertise into one agency. O'Shea et al. [24] proposed the consolidation of PPP procurement in one agency to benefit from the experience. Although it would be difficult to create a centralized PPP unit for the United States, several units could be created based on geographical location. These units would be responsible for policy formulation, project analysis, quality control, and providing assistance to public entities. Casady et al. [25] suggested the creation of a central/national PPP unit as well as sectoral agencies and other enabling agencies for the success of PPPs.

2.3. PPP Legislation

Similarly, PPP-enabling legislation is also inconsistent across the different states. This PPP-enabling legislation is important as it addresses whether agreements can include revenue sharing, non-compete clauses, and other details [26]. They can either limit or encourage private sector participation depending on the specific provisions in the legislation. According to Martin [27], 37 states have some type of legislation for PPPs. However, the provisions in these legislations are not consistent throughout the states. For example, Geddes and Reeves [2] reported that Indiana and South Carolina were the only states that did not allow unsolicited bids whereas California and Arkansas were the only states that protected the confidentiality of the private entity's proposal. Several states (Arkansas, Indiana, New Jersey, Oklahoma, and Texas) have generic PPP social infrastructure enabling legislation while other states (California, Florida, Georgia, and Virginia) have specific legislation, both of which apply to public universities [3].

However, not all states have PPP-enabling legislation; therefore, some states are ahead of the curve in their PPP adoption. For example, Georgia passed PPP-enabling legislation in 2015, which allows any department, agency, authority, or Board of Regents of the University System of Georgia to enter into contract with a private entity to lease, develop, finance, construct, operate, and maintain projects. Although many states have PPP-enabling legislations, these legislations are not consistent in all states and are sometimes limited to certain project types such as transportation infrastructure. According to Martin [28], 37 states had passed PPP-enabling legislation and only eight of them included social infrastructure projects as of 2018. Hence, there is no standard for all PPPs in the United States.

2.4. PPP Contractual Frameworks

Under any PPP contractual framework, there are generally two main methods for the concessionaire to recuperate its investment. The first method is through user fees, where the concessionaire receives payment for services from developments such as residence halls or dining courts. The second method is through public sector subsidies, where the public institution pays the concessionaire a pre-established amount. An example of this is an availability payment or payment for performance where the public institution pays the concessionaire regardless of demand. Two definitions exist for 'availability': pure and constructive. Pure availability refers to the presence of a functioning and available facility for use while constructive adds metrics that must be met such as quality, safety, and performance [29]. For example, pure availability of a residence hall would refer to usable

halls while constructive availability refers to clean, safe, and well-lit, in addition to other criteria. Generally, some contracts retain that the contract is terminated upon payoff of bonds or when a minimum rate of return is achieved by the concessionaire.

In some instances, the university chooses an arrangement whereby it opts to provide some monetary contribution in addition to private financing if the private financing comes at a higher cost. Another form of agreement is when the public institution leases its land to a for-profit company that funds the project. For example, the developer can lease the land for a period of 50 years during which it will construct the property, operate it, and recuperate the money invested [30]. Some private entities opt for partial or full financing of the development using equity. For example, in Ohio State University's Parking Project, one of the private entities involved was an Australian state-owned pension manager that provided an equity investment. Although this method expedites the development, it forces the public institution to surrender some control over the financial and managerial aspects [31].

2.5. Advantages of Public–Private Partnerships for Higher Education Institutions

Public–private partnerships have many advantages over the traditional delivery method, including [14,32]:

- a. perceived lower cost to the public institution;
- b. possibility for unaffected credit rating and investments off the balance sheet;
- c. single contract (with one private party), which makes it easier to track, manage, and divide responsibilities and risks;
- d. better method for entry into a new market (such as housing or energy) without any previous experience;
- e. quicker execution and utilization of the private entity's experience;
- f. an efficient method to meet the growing university needs.

These needs can be observed as on-campus student housing and parking lots to accommodate the increased student enrolment every year as well as accommodate the vehicles. Martin [28] reports that around 300 housing projects valued over \$9 billion were completed for public and private universities.

2.6. Challenges That Face PPPs for Higher Education Institutions

Several challenges arise with the increased adoption of PPPs in the higher education sector, including [33,34]:

- a. potential for void contracts;
- b. university ceding high levels of control of the development;
- c. complexity of deals;
- d. multi-parties involved and possibility of disagreement;
- e. limitation on future developments so as not to affect the current project (for example, a new housing project that would compete with the current one and possibly reduce its revenue);
- f. lack of a consistent legal framework.

The differences in PPP enabling legislation among states have also been observed and reported by previous studies. PPP projects are procured at the local and state levels and are subject to different legal frameworks from one state to another. The lack of a centralized legal framework or PPP unit in the United States leads to differences in PPP adoption among the states as well as in procurement among the signed projects.

3. Research Methods

3.1. Systematic Literature Review

In this study, a systematic literature review (SLR) was used to collect comprehensive data on the use of public–private partnerships for higher education institution projects in the United States. The SLR was used to identify projects and reduce bias in the selection and inclusion of studies due to its systematic nature [35]. There are three steps involved in SLR: plan the literature review, conduct the review, and finally, report on the findings [36]. In the planning step, the objectives and protocols for systematic literature review are developed. The objective in this paper is to identify cases where a PPP was used in U.S. higher education institutions. The research questions identified were as follows:

R.Q.1 What are the trends of PPP use for higher education institutions in the United States?

R.Q.2 What are the benefits and challenges observed in these types of projects?

R.Q.3 What are the recommendations for future projects and lessons learned from past ones?

The planning step of SLR starts by identifying the search process to be followed. The order of search conducted was as follows:

- a. Journal articles were identified using pre-identified sources from Scopus such as ASCE library and Science Direct. Google Scholar was also used for cross-referencing and multiple refinements of the search were also conducted to search for the projects. The keywords used in this paper were “Higher Education Institutions” and “public–private partnership”, “social infrastructure”, “Public–Private Partnerships for Higher Education Institutions”, and “Higher Education Projects in the United States”. Over 600 articles on PPPs were identified, which were narrowed down to 90 relevant articles for review and further analysis as only studies in English that were published from 2010 onwards were selected to proceed to the next review stage. The articles were then evaluated by reading the abstract of each article for inclusion/exclusion. Exclusion was mainly for articles that discussed projects outside the United States or those that did not discuss projects for higher education institutions.
- b. Online PPP databases were searched, such as the World Bank database, Infra PPP database, and P3 Bulletin.
- c. Websites of well-known private parties in the PPP area were searched including Plenary Group, American Campus Communities, JLL, and Corvias. Some of these companies had separate sections for education projects. This was used as a secondary search to identify projects.
- d. Magazines and newspaper articles were also targeted to identify projects. An example is Forbes.com, where PPPs such as those for Wayne State University and the University System of Georgia were identified [37].
- e. Finally, university websites were searched to cross-reference projects found in magazines and newspaper articles and to gather more information on the identified projects. For example, after identifying Wayne State University’s PPP project in the previous step, a search was conducted on the university website to gather more details.
- f. This resulted in the identification of 60 PPP projects conducted for U.S. higher education institutions from 1994 to 2018 (date of project signing). There were several projects before 1994, but this study limited the years studied to only after 1994 due to data unavailability. These projects were found among 54 universities. This study investigated contract structures, stakeholders, types and sizes of facilities, and budgets and durations of the projects that have been objectively sorted through SLR.

3.2. Literature Review of Previous PPP Surveys

While the previous subsection focuses on reviewing the literature on PPPs for higher education institutions, this subsection focuses on reviewing previous studies that focused on understanding PPP projects through questionnaire surveys. In general, research on

PPPs for higher education institutions has been scarce and mainly reported on a specific project in a newspaper article or website. Thus, this subsection will focus on discussing previous surveys that analyze PPP projects in general, including the surveys conducted for higher education institutions. Table 1 summarizes previous studies that utilized questionnaire surveys for understanding and analyzing PPP projects. The table shows that the response rates in similar surveys can be as low as 17% and 12.5% as highlighted in the studies by Xu et al. [38] and Ika et al. [39]. Additionally, Luthra et al. [40] reviewed previous studies that utilized surveys for understanding PPP projects and showed that a response rate of 20% is acceptable in similar surveys. Finally, Table 1 shows that the total number of responses in similar surveys can be as low as 8 [41], 10 [42], or 13 [43] respondents in their studies because of the scarcity in the number of experts in these areas.

Table 1. Summary of previous surveys that utilized questionnaire surveys for understanding and analyzing different PPP projects.

Study	Scope	Number of Responses
[44]	Understanding the nature of PPP projects in China to propose the appropriate risk allocation across the different sectors.	The survey was sent to 203 experts and 47 experts completed the survey and sent it back (23% response rate)
[38]	Developing a risk assessment model for transportation PPP projects in China.	A total of 98 responses were collected out of the 580 invitations that were sent to experts in the area (17% response rate).
[45]	Understand the main barriers for renewable energy PPP projects in China.	A total of 73 responses were collected out of the 105 invitations that were sent to experts in the area (70% response rate).
[39]	Understand and identify the success factor for the World Bank PPP projects across the globe	A total of 178 responses were collected out of the 1421 invitations that were sent to the World Bank experts (12.5% response rate).
[46]	Analyze and study the nature of renewable energy PPP projects in the North African region	The analysis was conducted based on the responses of 18 experts.
[47]	Analyze and identify the main barriers for PPP projects in Egypt.	The analysis was conducted based on the responses of 23 experts.
[48,49]	Analyze and identify the main barriers for PPP projects in Egypt.	The analysis was conducted based on the responses of 25 experts.
[41]	Understand the impact of the construction period on the success of transportation PPP projects in India.	A total of 8 responses were collected out of the 30 invitations that were sent to the experts (27% response rate).
[50]	Understand the nature of PPP projects in the MENA region.	The analysis was conducted based on the responses of 50 experts from Egypt, 19 from Jordan, and 20 from Tunisia.
[51]	Analyze the factors affecting renewable energy projects in Pakistan	The analysis was conducted based on the responses of 273 employees who were involved in renewable energy projects.
[52]	Analyze the key success factors for renewable energy projects in Pakistan	A total of 272 responses were collected out of the 450 invitations that were sent to experts in the area (60% response rate).
[53]	Understand the main barriers for renewable energy PPP projects in China.	A total of 216 responses were collected out of the 369 invitations that were sent to experts in the area (59% response rate).

[54]	Understand the main barriers for PPP projects in Iran.	A total of 48 responses were collected out of the 51 invitations that were sent to experts in the area (94% response rate).
[55]	Understand the nature of transportation PPP projects in Ethiopia.	A total of 52 responses were collected out of the 85 invitations that were sent to experts in the area (61% response rate).
[42]	Analyze the nature of housing PPP projects in Tanzania.	The analysis was conducted based on the responses of 10 experts.
[56]	Understand the barriers and key success factors for PPP projects in Egypt.	A total of 55 responses were collected out of the 80 invitations that were sent to experts in the area (69% response rate).
[57]	Understand the nature of water-specific PPP projects in Egypt to propose the appropriate risk allocation	The analysis was conducted based on the responses of 53 experts.
[58]	Understand the nature of renewable energy PPP projects in the Dominican Republic.	The analysis was conducted based on the responses of 25 experts.
[43]	Understand the nature of PPP projects in the educational sector in Egypt.	The analysis was conducted based on the responses of 13 experts.
[59]	Understand the nature of PPP projects in the renewable energy sector in Kenya.	A total of 263 responses were collected out of the 769 invitations that were sent to experts in the area (34% response rate).
[60]	Understand the main factors affecting PPP projects in developing countries (Egypt, India, China, and Pakistan).	The analysis was conducted based on the responses of 42 experts.
[61]	Understand the main factors affecting renewable energy PPP projects in China, India, and Russia.	The analysis was conducted based on the responses of 57 experts in total.
[62]	Understand the main factors affecting renewable energy PPP projects in Pakistan.	A total of 516 responses were collected out of the 750 invitations that were sent to experts in the area (69% response rate).
[63]	Understand the main factors affecting renewable energy PPP projects in Pakistan.	A total of 376 responses were collected out of the 408 invitations that were sent to experts in the area (92% response rate).

3.3. Questionnaire Surveys

A questionnaire survey was then conducted to collect insights from a sample of the higher education PPP projects in the United States. Purposeful sampling was used to identify experts who are involved in PPPs at each university. It is a widely used technique to identify individuals experienced in a certain area to report on information-rich cases [64]. Experts involved in the projects were identified from various sources, including journal and newspaper articles and university websites. All experts were all involved in the decision-making phases of their respective project. Forty-five questionnaires were distributed with three reminders sent out and the survey was kept open for a period of three months. A total of 10 responses were received from experts working at the identified universities with a response rate of 22.2%. The number of responses and response rate obtained is similar to previous studies in the literature as shown in Table 1. This observed response rate and number of responses is mainly due to the scarcity in the number of experts in the area. Hence, the acceptable response rate can reach 15% and the acceptable number of responses can be as low as 8 responses as observed in the study by Gupta et al. [41]. According to previous literature on qualitative research, the number of samples is small in case-oriented analysis where no statistical inference is made based on the sample size [65,66]. This is enriched through purposive sampling to choose the correct experts to

report on data-rich cases [67,68]. Hence, the sample size depends on the researchers, the survey respondent's expertise, and the data obtained from the survey. The respondents had an average of 20 years of experience in facilities management and operations, specifically at higher education institutions. Their specific positions are listed below:

- President and CEO of a university property foundation with over 25 years of experience serving higher education institutions.
- Vice president for finance and administration with over 25 years serving in this position
- Vice President for student life with over 20 years of experience in university housing and operations
- Associate Vice President Facilities Management and Campus Services with over 30 years of experience in facilities management and operations
- Associate Vice President for Capital Budgeting & Facilities Operations with over 30 years of experience
- Associate Vice President of Facilities Management with over 20 years of experience
- Associate Vice President for Business and Auxiliary Operations and Chief Housing Officer with over 25 years of experience
- Chancellor with over 20 years of experience in university operations and capital planning.
- Associate Vice Chancellor with over 15 years of experience in facilities management

The survey was divided into two sections: multiple-choice questions focusing on the status of their projects and open-ended questions targeting the reasons behind choosing PPP as a delivery method, problems the institutions faced, and suggestions for future projects. The survey consisted of four sections. Section one focused on collecting information about the project such as the name of the project, type of delivery method (Build–Operate–Transfer, Build–Own–Operate, etc.), purpose of the project (student housing, parking facility, or mixed-use facility), duration of concession, contractual cost of the project, any changes in the project cost, project type (new construction, demolition + new construction, rehabilitation of existing structure, remodeling of existing structure, operation of existing facility), project start year, project completion year, current stage of the project (in design phase, in operation phase, etc.), state of the project with respect to schedule, and finally the state of the project with respect to cost.

Section two focuses on collecting information about the background of the projects such as the reason for adopting PPP, percentage of financial support provided by the university, and the financing structure. Section three focuses on evaluating the projects with respect to the challenges the project faced and whether PPP was a better approach as compared to the traditional procurement approach. Finally, section four focuses on collecting the experts' feedback about PPPs and future recommendations. The experts were asked whether they would adopt PPP in future projects and what recommendations they have for future higher education PPP projects. The next section of the paper describes the analysis conducted on the literature review followed by a discussion of the results. Similarly, the section afterwards describes the analysis and discussion of the questionnaire survey conducted to showcase a sample of these projects.

4. Systematic Literature Review

4.1. Analysis of the Systematic Literature Review

Forty-five higher education PPP projects were shortlisted in this study using a systematic literature review. The remaining 15 projects (out of 60) were eliminated due to insufficient data on them. These projects were first analyzed in terms of geographical locations and mapped out in order to visualize the number of projects and project types as well as location trends.

Figure 1 shows a graphical representation of the shortlisted projects. These projects were plotted on the map of the United States in order to visualize the trends of PPP use in terms of:

- a. geographical characteristics;
- b. type of project. The total number of projects collected was 60.

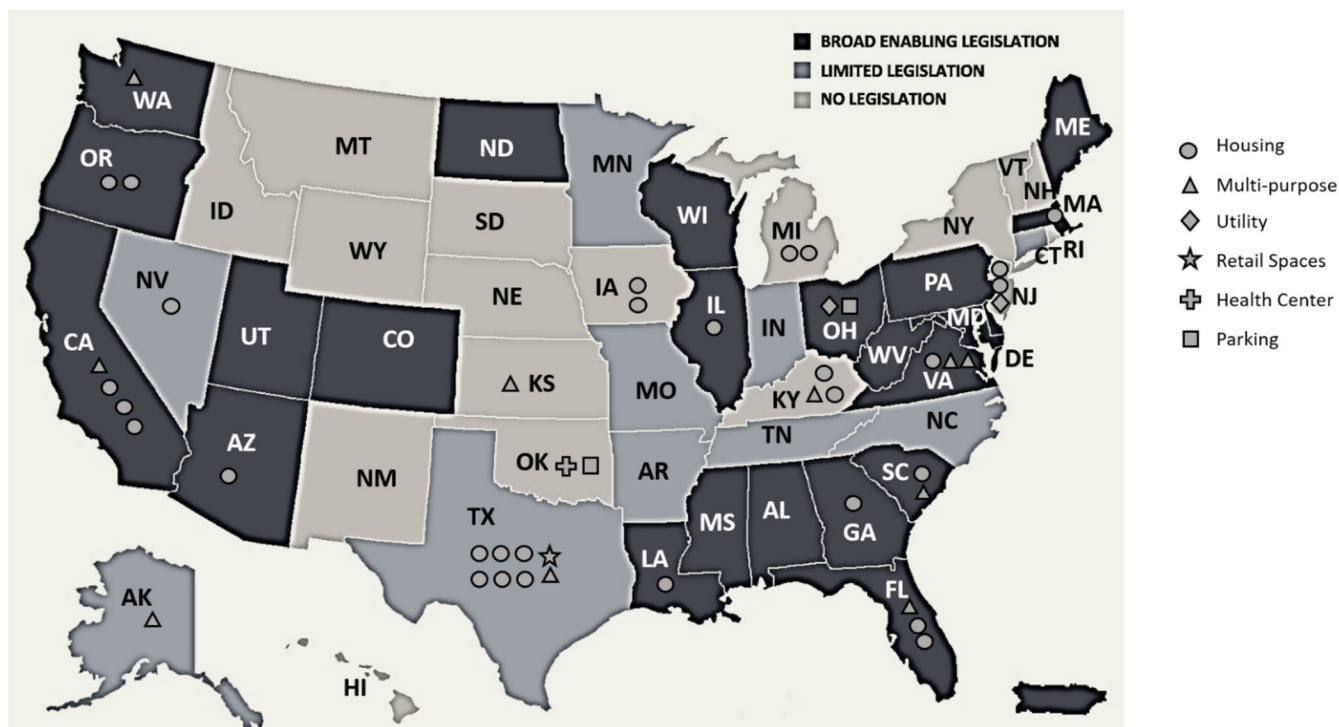


Figure 1. Map of the types of PPP Projects.

Out of these projects, 15 projects were eliminated due to insufficient data on either the cost or contract sign date. Figure 1 shows the resulting 45 projects plotted on the map of the United States. These 45 projects were all for public colleges and universities. It can be observed that the largest number of projects was found around the Southern and Northeastern regions of the United States. The projects were also plotted based on their type, which include:

- a. housing;
- b. mixed-use (a combination of housing/commercial/retail use);
- c. utility;
- d. commercial/retail space;
- e. health center;
- f. parking.

Figure 1 shows the distribution of project types and shows the following numbers: 28 housing projects, eleven multipurpose projects, two parking projects, two utility projects, one retail, and one health center. It can be observed that the most common type of project is the construction and operation of facilities, especially of housing complexes. Other facilities include parking lots and commercial and office spaces. The main reason behind this is that these facilities are revenue-generating, which in turn helps the concessionaire recover the money spent during the construction phase quicker. This way, in many instances, the public institution does not have to provide any money to the concessionaire (or sometimes only small amounts are provided). Generally, available financing options include tax-exempt bonds and subsidies from the institutions themselves, whereas the concessionaire can bring in their own private investments or that by other lenders.

There is no available source on PPP legislation specifically for higher education projects; however, the Federal Highway Administration (FHWA) has provided a classification, mainly for transportation projects. In some instances, it is explicitly stated that the legislation also includes other project types such as housing or education. FHWA's legislation is classified into three levels: broad, limited, or no legislation [69]. Broad legislation indicates that there is no limitation on the use of PPP with respect to project type or sponsoring agency, while limited legislation restricts PPP use to certain project types or sponsoring agencies.

Some states that have PPP-enabling legislation include Texas, California, Pennsylvania, and Florida. It can be observed that these states were found to have more higher education-related PPP projects than their counterparts. Although some of this (limited) legislation was for transportation-based projects, nevertheless, it helped pave the way for different types of PPPs. This classification helps in comparing between states with legislation (broad or limited) and those without. A cluster of projects can be noticed in California, Pennsylvania, Texas, and New Jersey, all of which have broad/limited legislation. The states that do not have any PPP projects are generally those that do not have PPP-enabling legislation. Although some states like Oklahoma and Kansas have PPPs even though there was no legislation found. Some legislation specifies that educational/housing facilities are authorized to be implemented as PPPs including that of Arkansas, Connecticut, Florida, and Maryland. Previous studies have highlighted that states with available legislation tend to attract private sector's attention more, thereby increasing the number of PPPs in these states [3,27,70,71]. This is in line with the findings of this research, as shown in Figure 1.

Table 2 shows the list of 45 PPP projects that were shortlisted along with the universities associated with them, cost, and year of signing. Some of the observations on these projects include that the majority of the projects were housing developments with the exception of seven projects, which were energy systems, parking lots, and research centers. Table 3 shows a breakdown of the 45 projects by state, type of project, as well as total investment. The largest project (in terms of cost) is Wayne State University's \$1.4 billion housing project. The next is Ohio State University's \$1.165 billion energy systems project, followed by the University of California's \$1.138-billion-dollar multipurpose project for its Merced Campus. The remaining projects are all between \$5.8 and \$718 million. The largest total PPP investment is by the University of California at \$1.8 billion. Some universities have multiple PPP projects, which are usually multiple phases of the same development. For example, the University of Texas at Dallas has two projects: Northside, a mixed-use housing project signed in 2015 followed by Northside 2, which was signed in 2017. Another example is Prairie View A&M's four phases for its housing project that started in 1996, which ended with the last one in 2011.

Table 2. List of Identified Higher Education PPPs.

Institution	Project Name	Description	Cost	Year
City University of New York	The Towers at CCNY	Development of a student housing project.	\$43 M	2006
Eastern Kentucky University	Housing Project	Construction of two residence halls.	\$75 M	2016
Florida International University	Bayview Housing	Develop, finance, build, own, and operate a student housing complex.	\$57.60 M	2014
George Mason University	Long & Kimmy Nguyen Engineering Building	Construction of 180,000 square feet building containing classrooms, research areas, and private lease space.	\$61 M	2007
Kansas University	Central District Development Project	Construction of multiple facilities including: new science building, parking garage, utility plant, a 500 and a 700-bed housing and dining hall.	\$350 M	2016

Louisiana State University (LSU)	Nicholson Gateway	Development of a housing project	\$575 M	2016
Montclair State University	The Heights	Construction of a housing complex composed of 2000 beds.	\$211 M	2010
Montclair State University	-	Design, construction, upgrade, and maintenance and operation of the university's energy plant for a duration of 30 years.	\$90 M	2011
Northeast Texas Community College	Residential Housing East	Construction of a new residence hall with 112 beds and a wellness center that includes a weight room and multipurpose room.	\$5.8 M	2016
Northern Illinois University	-	Development of student housing including 120-bed residential units and commercial spaces.	\$20 M	2006
Ohio State University	CampusParc	50-year concession to operate, manage and rehabilitate a car park.	\$483 M	2012
Ohio State University	-	Finance, improve, operate, and maintain energy systems (electric, gas, steam, heating and cooling).	\$1.165 B	2017
Portland State University	University Pointe at College Station	Construction of a 16-storey housing hall under an 85-year lease.	\$90 M	2012
Prairie View A&M	University Village	Construction of a housing complex composed of 2000 beds in three phases. Three additional phases were also added (2000, 2003, 2011) to construct new housing complexes as well as remodel existing ones.	\$62 M	1996
Southern Oregon University Ashland	-	Construction of a 700-bed housing complex.	\$40 M	2011
Tarleton State University	Heritage Hall	Construction of a housing complex with 514 beds for a 32-year ground lease.	\$25 M	2014
Texas A&M College Station	Park West student housing	Construction of a student housing complex consisting of about 3400 beds.	\$360 M	2015
Texas Woman's University	Residential Village Project	Development of a student housing project that includes residential amenities such as lounge spaces, study areas, and community places.	\$75.5 M	2018
University of Alaska Fairbank	Wood Center Dining Facility	Expansion to the existing Wood Center Building.	\$28 M	2012
University of Arizona	-	Construction of two housing complexes that include commercial space. It includes new construction and renovations for a dormitory (\$157 million), parking garage, recreation center and office building.	\$300 M	2017
University of California	MT Zion Medical Offices Building	Demolition and building of new operating rooms and upgrade of existing facility.	\$16 M	2009
University of California at Merced	2020 Project	Development of 1680 beds in student housing, 1570 parking spaces, a 600 seat dining hall, a lab and buildings with offices and classrooms, a conference arena, a transit bus hub, a pool as well as athletic and recreational facilities	\$1.138 B	2016
University of California	UCSF Neurosciences building	Development a new facility.	\$357.6 M	2016
University of California	UC Davis West Village	Housing complex built to house about 4500 people, which is the largest planned "zero net energy" development in the U.S. This will be done through the use of solar power systems.	\$280 M	2010
University of Houston-Victoria	-	Construction of a housing complex composed of 380 beds.	\$20 M	2015

University of Iowa	Aspire at West Campus apartments—Phase 1	Phase 1 includes designing, building, financing, owning, and operating a student housing complex for a 40-year ground lease.	\$31 M	2012
University of Iowa	Aspire at West Campus apartments—Phase 2	Phase 2 of the construction and involves the construction of 252 housing units for a 41-year lease	\$34.5 M	2015
University of Kentucky	-	Upgrade and expansion of 9000 housing beds which is divided into five phases	\$600 M	2011
University of Kentucky	-	Dining services.	\$245 M	2014
University of Mary Washington	Eagle Village Mixed-use development	Development of housing, hotel, offices and commercial spaces.	\$115 M	2008
University of Massachusetts Amherst campus	-	Student housing facility	\$120 M	2017
University of Michigan at Flint	-	Renovate and transform a hotel into student housing.	\$175 M	2008
University of Nevada at Reno	-	Construction of a housing complex composed of 132 units for a 42-year concession period.	\$22 M	2013
University of Oklahoma	-	Improve, design, build, operate, and maintain utility systems for a 50-year concession period.	\$718 M	2010
University of Oklahoma	Health Sciences Center	-	\$128	2006
University of South Carolina	650 Lincoln	Design, build, finance, operate, and maintain an academic building and two housing residences for a 40-year lease.	\$120 M	2014
University of South Carolina	Campus Village	Demolition and construction of a student housing facility.	\$460 M	2017
University of South Florida	The Village	Development of a student housing project	\$134	2015
University of Texas at Dallas	Northside	Design, build, finance and operation of multiple facilities including a mixed-use housing and a retail space.	\$52 M	2015
University of Texas at Dallas	Northside 2	61-year ground lease with the university as part of the public-private partnership agreement to develop Northside 2.	\$67	2017
University of Washington	South Lake Union Medical Research Complex	Biomedical research facility. Renovate an existing structure and construct a new structure for laboratory and conference space as well as administrative building.	\$363 M	2001
University of West Florida	University Park Development	Consists of: a field house, leisure building, healthcare center, housing, student union, parking garage and bell tower.	>\$500 M	2013
University System of Georgia	-	Develop ~3500 beds and manage ~6000 beds of on-campus housing for nine USG institutions for a duration of 65 years.	\$517 M	2014
Virginia Commonwealth University	Gladding Residence Center Project	Develop a 360,000 square feet residence hall.	\$96 M	2016
Wayne State University	-	Develop, finance and operate the school's student housing. Originally set for \$308 M but increased to \$1.4 B.	\$1.4 B	2016

Table 3. Breakdown of the 45 projects.

	Housing	Multi-Purpose	Utility	Retail	Health Centers	Parking	Total No.	Total Investment (Millions)
Alaska		1					1	\$28
Arizona		1					1	\$300
California	3	1					4	\$1791
Florida	2	1					3	\$742
Georgia	1						1	\$517
Illinois	1						1	\$20
Iowa	2						2	\$65.5
Kansas		1					1	\$350
Kentucky	2	1					3	\$920
Louisiana	1						1	\$576
Massachusetts	1						1	\$120
Michigan	2						2	\$1575
Nevada	1						1	\$22
New Jersey	2		1				3	\$301
New York	1							\$43
Ohio			1			1	2	\$1648
Oklahoma					1	1	2	\$846
Oregon	2						2	\$130
South Carolina	1	1					2	\$580
Texas	6	1		1			8	\$667
Virginia	1	2					3	\$272
Washington		1					1	\$363
Total							45	

According to a study by Geddes and Wagner [26], the state with the most enabling provisions was Texas, with Virginia coming in second. This is consistent with the findings in Table 2, which show Texas as the state with the highest number of higher education PPP projects. Additionally, the first modern PPP was passed in Virginia [26]. Several other researchers reported similar findings on PPP projects in the United States. Istrate and Puentes [72] found California, Texas, and Virginia to be among the states with the highest number of PPPs and the Midwestern states with the lowest PPP adoption. Gilroy [71] reported that Texas, Virginia, Florida, and Georgia had the best PPP legislation models. Albalade et al. [70] investigated PPP-enabling legislation in the United States and reported the same states to have a favorable climate for private investment. According to Geddes and Wagner [26, 73], the presence of PPP-enabling legislation in a state serves the following purposes:

- a. provides a framework for public and private contracting;
- b. provides a basis for contractual terms, thus reducing transaction acts and negotiation time;
- c. indicates the state's commitment to private sector participation in projects in general;
- d. attracts the private sector due to legislation availability.

According to previous research, investment in higher education is not proportional to investment in infrastructure. Geddes and Reeves [2] reported that although California and Florida have similar state-level laws, PPP investment in infrastructure has been higher in Florida. On the contrary, investment in higher education PPPs has been significantly higher in California (over \$1.5 billion) than Florida (under \$700 million). This can be attributed to California's legislation that limits social infrastructure PPP use for auxiliary (revenue-generating) projects only whereas Florida does not have this limitation [3].

Figure 2 shows a scatter diagram of the size and type of the identified PPP projects from 1994 to 2018. Regarding trends on project sizes, this study observed that the project costs ranged from \$15 million to approximately \$1.4 billion. Most of the smaller projects were housing developments while the higher costs were for other types such as utility (a design, build, operation, and maintenance project for the University of Oklahoma for \$718 million in 2010), multi-purpose university park (\$550 million project for the University of West Florida in 2013), and parking facilities (\$483 million project for Ohio State University in 2012 as shown in Figure 2).

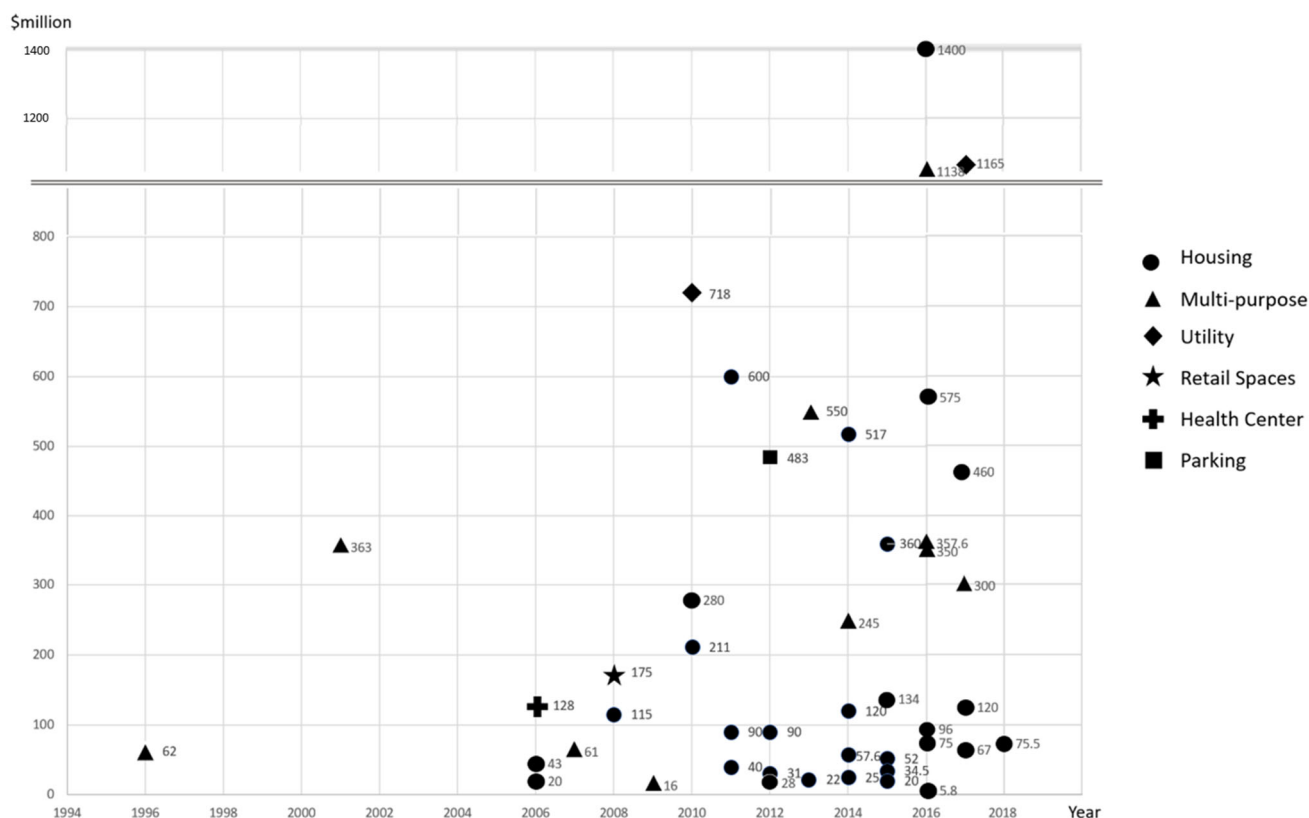


Figure 2. PPP Projects in higher education institutions by year and size.

An increase in the size and number of PPP projects over the years can be observed from Figure 2. Prior to 2010, the financial crisis caused an unstable economic climate in the U.S., which affected lending institutions and deterred PPP use. The increase in PPP use post 2010 can be attributed to many factors such as universities

- relying on the private sector for their experience,
- shifting to a delivery method that reduces their risk and investment,
- lack of financial resources,
- value-for-money attained,
- decline in state financial support [18,19].

Private universities are also expanding their developments using private financing methods such as Drexel University, which contracted a private entity for a \$3.5 billion mixed-use facilities project.

Some of these PPP projects were for unique developments such as the UC Davis West Village Development, which is considered the largest net-zero development in the U.S. of its kind [74]. Another unique project was the first PPP parking project in the U.S. by Ohio State University. Additionally, the University System of Georgia also showed a unique development by entering into a PPP for a group of nine campuses at once. It is important

to note that Georgia's legislation restricts university PPPs to housing and related service [3].

4.2. Discussion of the SLR

This section presents a discussion of the research findings based on the literature review conducted and reports on the findings of the 45 identified projects. To do so, this section is divided into three topics: reasons for PPP adoption; benefits realized; and challenges faced by the higher education institutions.

4.2.1. Reasons behind PPP Adoption

This study investigated financial structures, planned budgets, schedules of the identified 45 projects, and reasons behind PPP adoption. Many public universities have recently adopted PPPs because they have suffered from a decline in the available financing or because of a need for expansion or housing. For example, the California State University (CSU) system was in need of an expansion because of its projected threefold growth in student enrolment by 2025. CSU decided to enter into partnership with a private entity to develop, operate, and maintain a 32-acre plot of land based on a ground lease mechanism [75]. The University of California at Merced is another university that sought to double its enrolment and needed to expand the classrooms, residences, retail, parking, and other facilities. It is projected to be one of the largest PPPs with a cost of \$1.4 billion for a combination of housing, dining facilities, and parking projects with almost 2 million square feet of new facilities. This project was named the "North American Social Infrastructure Deal of the Year" [76]. One of the reasons that UC Merced sought a PPP was to minimize maintenance risk from the new facilities [75]. It was also the first university expansion project in the U.S. to use the availability payment mode, which meant that the concessionaire receives a payment regardless of demand.

PPPs were chosen by some institutions for projects they do not have any experience in or those where the private party has sufficient previous experience in. Sometimes, the institutions preferred to focus on academics and delegate new construction or operations to a private party. The rise of PPPs in other sectors in the U.S. has also spurred their adoption in the social infrastructure sector, specifically higher education institutions.

4.2.2. Benefits Realized by the Universities

Based on the literature review conducted, several benefits were identified from the use of PPPs in projects for higher education institutions. These include:

- a. faster delivery and slightly higher quality. In some cases private financing was not the university's main goal, hence the project was able to be delivered quicker than was possible using university debt;
- b. effective and efficient delivery;
- c. unaffected capacity debt;
- d. better streamlined processes and more decisions made by third-parties and not university staff;
- e. less expensive than debt financing by the university;
- f. consolidated selection and contracting period;
- g. delivered a project (housing) that the university did not want to deliver/construct itself;
- h. public institution not concerning themselves with the operation and maintenance of a development, since it is the developer's responsibility;
- i. entering into a new market sector with reduced risks to the university.

For example, the University of Oklahoma entered into a 50-year concession to design, build, operate, and maintain utility systems. One reported benefit of this project is the "monetization of non-core assets" [4]. Another example was the Virginia Commonwealth University's PPP project (the Long and Kimmy Nguyen Engineering Building), which was

the first ever to be procured under Virginia's "Public Private Educational Facility and Infrastructure Act of 2002". This act authorized public entities to enter into a PPP for the development of a project [76]. Figure 1 shows that there are three PPPs in Virginia, one housing project and two multi-purpose projects. Additionally, the types of services enlisted depend on the legislation available in a state. For example, Georgia only allows the design-build-finance-operate-maintain combination whereas Virginia allows a combination of any of the aforementioned components [3].

4.2.3. Challenges Faced by the Universities

Public opinion on non-higher education PPP projects also had an effect on these projects. For example, the increased rates for Chicago's parking project and cancellation of the parking meter systems in Pittsburg and Los Angeles were a challenge to Ohio State University's parking project. Therefore, justifying the use of PPP could be a challenge in some instances [2]. One reported risk was of the private entity deferring maintenance of the facilities. In order to prevent this, the University of California Merced used "preventive maintenance life cycle costing" in its Merced 2020 project [28].

It can be observed from this research that the trend of distribution of PPPs is not consistent among the states as well as within a state. This could be attributed to the wide spectrum of PPP legislation available and the inconsistent adoption of PPPs among the different sectors (e.g., education, transportation, energy, etc.). Out of the 45 projects, 22 projects were delivered in states with broad enabling legislation, followed by 12 projects in states with limited legislation, and 10 projects in states with no legislation. Establishing a uniform PPP procurement process and enabling legislation would lead to a smooth procurement and delivery of these assets.

5. Questionnaire Survey

5.1. Analysis of the Questionnaire Survey

The results of the questionnaire survey were analyzed to collect insights provided by the experts on their projects to provide a sample of the higher education PPP projects. Table 4 is divided into seven sections, which are facility type, duration, project status, reason for choosing PPP, mode of recouping investment by private entity, project financing, and future use. Additionally, the results of the questionnaire survey are summarized in Figure 3.

Table 4. Results of the questionnaire survey.

Name of the University	PPP Type	Project Purpose	Contractual Cost of Project	Project Start Year	Project Completion Year	Status with Respect to Schedule	Status with Respect to Cost	Method of Recouping Investment by Private Entity	% of Financing by the University	Financing by Private Entity
Tarleton State University	Build-Lease-Transfer	Student Housing	\$101 M–\$200 M	2014	2015	Behind Schedule (third phase was behind schedule; first two were fine)	Below budget	Rent fees	81–100%	Bonds
Northern Illinois University	Build-Lease-Transfer	Student Housing	\$401 M–\$ 600 M	2010	2012	Unaware of exact status	Unaware of exact status	Fees paid over the concession period.	0–20%	Commercial financing
Southern Connecticut State University	Others (City to build and assume all operating cost and the University will use the school as a lab for education and communication disorders)	Others	\$50 M–\$100 M	2018	2019	On schedule	Below budget	State funded public school construction funds	0–20%	State of Connecticut Public School Construction Bond Funds
UC Davis	Build-Own-Operate	Student Housing	\$401 M–\$ 600 M	2019	2022	Behind Schedule (due to feasibility and budget constraints)	Over budget	Rents	0–20%	Bond financing
Texas Woman’s University	Design-Build-Finance-Operate	Mixed-use facility (e.g., a mixture of housing and retail spaces)	\$50 M–\$100 M	2018	2019	Ahead of schedule (The housing is ahead of schedule but the separate dining hall may fall being schedule)	Over budget	Through rent for 40 years and also through an annual payment from dining.	0–20%	Tax exempt bonding
Wayne State University	Design-Construct-Manage-Finance	Student Housing	\$201 M–\$400 M	2017	2020	On schedule	On budget	Bond holders repaid through revenue stream from rents.	0–20%	Private placement bonds
University of South Florida	Build-Own-Operate	Mixed-use facility (e.g., a mixture of	\$101 M–\$200 M	2017	2018	On schedule	On budget	Rent fees for a duration of 45 years after completion	Other	70 percent, 30 percent equity

Louisiana State University	Design-Build-Finance-Operate	housing and retail spaces) Mixed-use facility (e.g., a mixture of housing and retail spaces)	\$401 M–\$ 600 M	2016	2021	Ahead of schedule	Below budget	Development fee and operational fee	0–20%	Bonds
University of Kansas	Design-Build-Operate-Transfer	Others (Science education; research, parking, central plant and housing)	\$201 M–\$400 M	2015	2018	Ahead of schedule	Over budget (Additional costs related to research equipment installation were not included.)	Project development fees; on-going fees for operations	81–100%	LLC established and bonds rated based on university assets; bond sale managed to outside investor group with experience in University backed research facilities
University of Iowa	Others	Student Housing	\$50 M–\$100 M	2012	2014	Ahead of schedule	Below budget	Through apartment leasing to graduate student for duration of the ground lease from the University to developer (30 years)	land via a ground lease to developer at zero cost, but no additional University funds	55% developers own equity and 45% financed

were used. Developer takes 100% of risk)

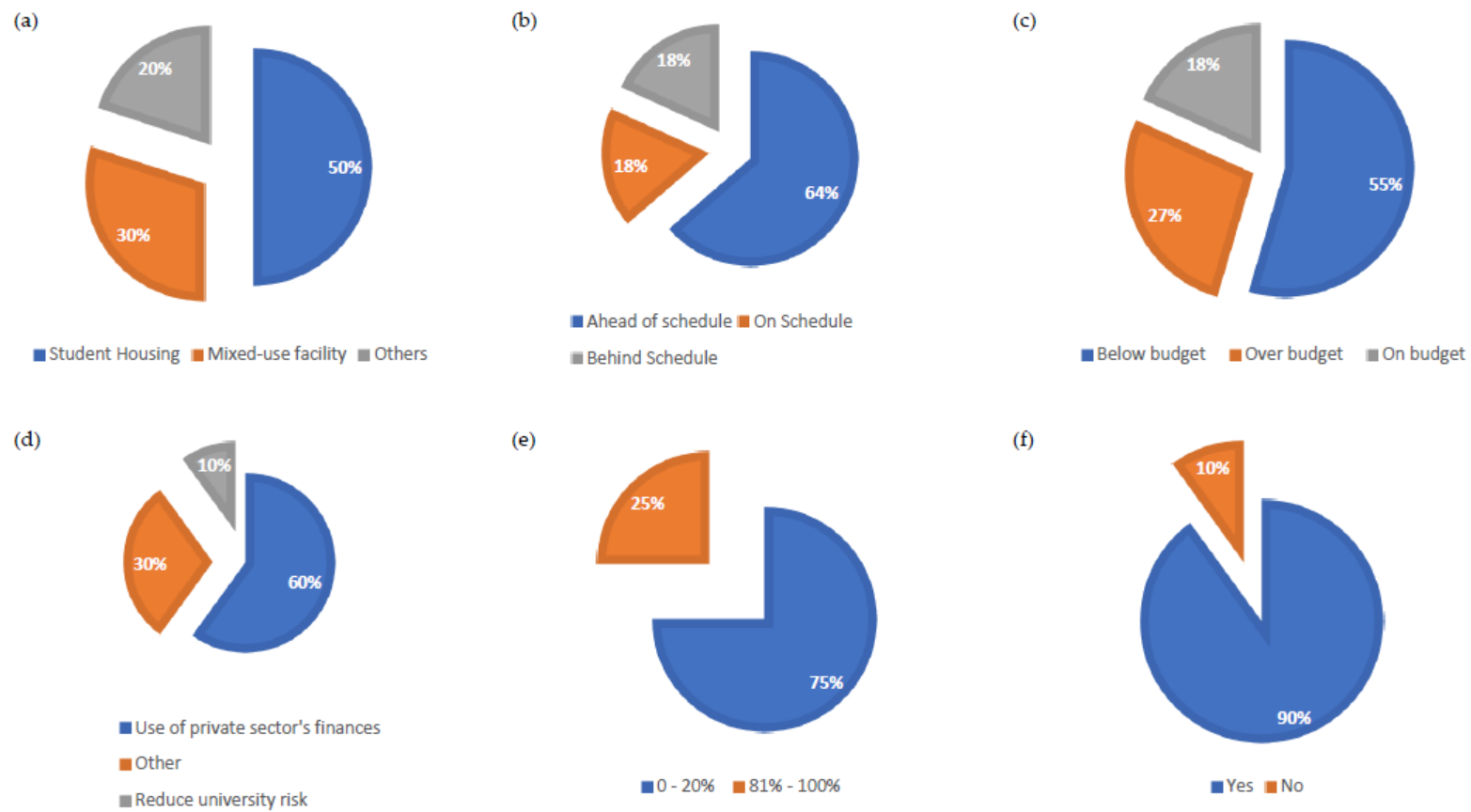


Figure 3. Statistical summary of some of the results of the questionnaire survey: (a) project purpose, (b) project status according to schedule, (c) project status according to cost, (d) reasons for adopting PPPs, (e) % of financing provided by university, (f) whether the expert will adopt PPP in the future.

5.1.1. Facility Type

The majority of the responses (50%) indicated housing as the purpose of the facility followed by mixed-use for housing and retail (30%). These two types are common revenue-generating mechanisms, showing their popularity as PPPs since it is easier for the private party to recoup their investment. Some of them were greenfield projects whereas others involved demolition followed by reconstruction. Other universities opted for PPPs for their unique projects. For example, Kansas University contracted with one developer for their 55-acre site to develop a science facility, student union, parking structure, and utility and transportation infrastructure. Hence, they benefited from having a single contract for their entire project instead of multiple contracts, which also led to an expected reduction in overall cost between \$25 and \$100 million as well as a shorter timeline [77].

5.1.2. Duration

All concessions had a duration between 25 and 50 years. Generally, some state legislation has a limit on the maximum concession duration. For example, Florida legislation for social infrastructure allows for a maximum concession period of 40 years while Georgia allows up to 65 years [3]. Four of the projects included the design while the rest included construction and operation only. Some universities opted for a full PPP (design, build, finance, and operate) to transfer everything to the private party and free its resources to focus on academics. This is dependent on the state legislations available, if any.

5.1.3. Project Status

Only two projects were reported to be behind schedule while those remaining were either on or ahead of schedule. Some experts reported that having the private party responsible for many phases granted it a level of autonomy which quickened the schedule. The private party is also incentivized to stay on-schedule in order to start operating the facility and generate revenues (in instances where revenue is recouped by the private or even shared among the private and public partners). Similarly, a study by the UK National Audit Office found that a higher percentage of PPP projects were completed on budget compared to traditional projects [72].

With respect to cost, three projects were reported to be over budget, which were at the University of California at Davis, the University of Kansas, and Texas Woman's University. The last project reported the reason to be Hurricane Harvey in Texas that affected the construction market. Previous research reported some PPPs being over budget, especially for their first PPP experience due to increased costs of preparing the contractual documents.

5.1.4. Reasons for Choosing PPP

The main reason chosen by the majority of the respondents was the ability to use the private sector's financing. Other reasons provided include seeking a collaboration that would benefit the university and students, leveraging the private's financing and construction process without the typical state bureaucracy of a traditional construction project, as well as leveraging the private entity's experience. Additionally, reducing university risk by transferring some of it to the private entity was an important incentive for the universities. For example, California legislation emphasizes the reason behind PPP use is risk transfer and quicker project delivery [3].

5.1.5. Mode of Recouping Investment by Private Entity

The majority of the responses indicated housing rent fees to be the only source of income for recouping the investment. Other sources include annual payments (e.g., from dining facilities), public financing, and development and operation fees.

5.1.6. Project Financing

Bonds were indicated as the most common source for the majority of the projects. Six experts indicated that the universities provided 0%–20%, two indicated 81%–100%, and one indicated that the land was provided by the university via a ground lease but no other monetary contribution was provided. This is also dependent on specific state legislation. For example, PPP-enabling legislation in Florida limits social infrastructure projects to land owned/controlled by the public university or state government while California prefers the opposite [3].

5.1.7. Future Use

Nine participants out of ten indicated that they would use PPP for future projects. Some reported that this would mainly depend on the current debt capacity and on the type of project itself. PPP would be favored for independent projects such as housing and athletics projects. One expert indicated that although they used PPP for their housing project, it was a unique setting and they will not repeat it specifically because it would be cheaper for them to execute the project themselves using bonds at a cost lower than that of the private entity.

5.2. Discussion of the Questionnaire Surveys

This section delineates the challenges faced by the universities as well as future opportunities for PPP projects at higher education institutions based on the data obtained from the ten cases.

Based on the results of the questionnaire survey, the experts reported several challenges related to PPP use at their universities. In some projects, there were construction quality concerns, which affected the construction process. Another issue reported in some instances was the lack of partner sharing of the risk. Although one of the main attractive points of a PPP is the risk sharing between the public and private entities, there were some cases where the university eventually put in more money. Under some arrangements, short of the university closing, the private partner had very little risk from changes in student enrollment or rising costs of maintenance/repairs/operations. These changes stem from the long-term commitment of a PPP project [78]. A way to overcome this would be including a role for partner involvement in operations and sharing of financial risk. Additionally, a change procedure can be included in the contract, which delineates how to deal with changes during the construction period [78].

Since the university is no longer the sole owner of the project (e.g., the private entity owned 30% equity in one project), this led to cultural changes with the presence of a private entity. Therefore, some compromises that were allowed when the housing project was fully university-owned did not fit the PPP business model. State legislations (for social infrastructure) vary in this matter where Florida requires ownership transfer to the state/university at the end of the contractual duration while California requires the ownership by the private partner [3]. Some universities reported challenges in securing bond financing. In some instances, negotiating the deal took a longer time than expected. According to Geddes and Reeves [2], some of the challenges facing a PPP include contract negotiations, complex contracts, and difficulty in managing partners throughout the project phases.

Some projects saw a quick movement of the phases, which made it difficult for the university to follow up with the private partner due to the university's limited resources. Some experts reported that any design elements were determined by contractors; therefore, the role of the design architect was diminished and the ability to adapt design to evolving research project needs was also limited.

Risk of private entity deferring maintenance of the facilities was also suggested by some experts. In some cases where the concessionaire was responsible for the maintenance over long periods of time, they received a fixed (or pre-set) fee for it. Since it is in the

concessionaire's best interest to defer maintenance until after the lease is over (to reduce their expenditure), the institution should place requirements on the state of the facility during operation and at time of agreement termination. This would cause the private party to conduct maintenance early-on when it is cheaper to perform. Although this clause is generally included in many PPP contracts, it is important to highlight it due to its severity.

In the case of a design–build–finance–operate–maintain, the private party is held accountable for the asset throughout the entire lifecycle, which is an incentive to produce a high-quality product from the start to avoid high maintenance costs later on [79]. For example, in the University of South Florida's "Residential Village Project", the private entity is required to provide "life cycle repair and replacement schedules", which are verified every five years by an independent assessment [28]. The challenges reported by universities are applicable to other projects as well. For example, the UN Habitat reports that the challenges facing PPPs for urban development projects are differing goals of the public and private sectors and resistance to private sector involvement [80]. These observed challenges will aid in the formulation of PPP frameworks for future projects.

6. Lessons Learned and Recommendations for Future Projects

Although PPPs have presented many benefits to higher education institutions, there have also been some challenges that need to be tackled. This section discusses lessons learned as well as recommendations for higher education institutions based on the literature review and cases reviewed. Recommendations for future projects include using a development advisor and conducting a 'study of need' prior to seeking a vendor. According to O'Shea et al. [24], Irish guidelines require four ex-ante Value for Money assessments to be conducted during the procurement process of social infrastructure PPPs. This multi-step process can also be implemented in U.S. higher education projects to ensure the suitability of use of a PPP over the traditional method. Ex-post reviews of PPP procurement are also encouraged to extract key lessons [24]. For housing projects, a post occupancy evaluation can be conducted and a comparison be made to traditionally procured projects. This study should not only include the cost of construction, but also operation and maintenance. Several studies have highlighted the importance of the operations phase and the uncertainty that occurs within it [78,81]. For example, when UC Merced conducted a study, they found that construction costs were higher (for the PPP method than the traditional method) but lifecycle, maintenance, and financing costs were lower, which led to their choice of PPP [82].

In order to retain control of housing projects during the operation phase, some universities opt for selecting the directors of the housing complexes [74]. Additionally, government supervision during the concession and especially in the operation phase is necessary to curb the private party's opportunism [83,84]. For the concessionaire, as a strategy to secure themselves, some have agreements with the institutions to guarantee a minimum rate of occupancy for housing projects or a minimum usage for parking projects. For example, UC Irvine committed to a three-year occupancy guarantee with the concessionaire for its housing project Vista Del Norte [17].

It is also important to delineate a method in the contract for future refinancing gains and cost-savings. For example, UC Merced sought a 50/50 split with the private party on future refinancing gains as well as any potential cost-savings that the private party may later introduce in the future. On the other hand, the private party must also secure its position by including a non-compete clause in the contract if necessary. This would protect it should the university think of building another competing facility during the concession period. Moreover, a stakeholder management plan must be created in the beginning to manage the multiple parties involved. This can be adapted from a currently available framework such as that proposed by Jayasuriya et al. [85] for stakeholder analysis, management, engagement, and monitoring.

Although PPP can be used to deliver any project type, it would be more beneficial to independent projects that would not hinder a university's operations. The most common independent projects are housing, parking, and commercial. These would provide mutual benefit to both parties; the university would benefit from the completion of the project without having to be involved in the daily activities and the private entity would benefit from the profits earned throughout the project operations. Additionally, since these projects are revenue-generating, they are attractive to the private sector [17].

It is also important for an institution to involve all stakeholders early-on in order to get their support. For example, UC Davis involved the community by holding 30 public meetings throughout the planning stage. Another strategy taken by Ohio State University (OSU) for its parking project was a contract provision to protect itself in case the concessionaire defaults by instilling that it keeps the upfront payment made to it by the concessionaire. OSU also limited the rate increases of housing rent to those similar to previous years' increases so that the concessionaire would not enforce tremendous increases. Another example is UC Irvine, which limited the private entity's rent to a range bounded by 100% of similar UC housing and 90% of similar private housing at most [17].

Finally, the success of some PPP projects has spurred private universities to use private financing initiatives. For example, Drexel University has entered into partnership with a private party for a \$3.5 billion community construction consisting of educational, medical, and business institutions to support the university's innovative mission [75]. This highlights the increasing trend of the use of private capital and expertise in delivering projects for higher education institutions. PPPs for higher education institutions have been generally regarded as lucrative projects by the private sector due to the growing enrolment of students at universities, which has had a positive effect on projects such as housing and mixed-use facilities.

7. Conclusions

Public-private partnerships have become a popular delivery method for traditional infrastructure as well as social infrastructure projects in the United States. These social infrastructure projects have mainly been developments for higher education institutions. As such, a steady increase has been observed of private entities developing projects that inevitably support the mission of universities and colleges. The findings of this research suggest that PPPs have become an attractive project delivery method for higher education institutions in the United States. Based on the data collection and the questionnaire survey that was disseminated, PPP was used by many institutions to reduce their risk, use private financing, deliver various project types, and transfer the maintenance and operating risks as well as full/partial expenses to the private party. It is especially beneficial to deliver revenue-generating projects and those the university is inexperienced in. Studying these PPPs raised several issues in relation to PPP units and legislation. Although a relationship was observed between the number of university PPPs and the availability of social infrastructure PPP legislation, this needs to be further studied in a state-by-state manner. The presence of consistent frameworks, PPP legislation, and PPP units would enable the delivery and success of more university projects. Hence, PPP units can be established in each state to support the spread of PPP projects in various sectors. Future research should focus on PPP legislations and public policy that can support non-infrastructure projects. This study contributes to the body of knowledge by identifying the current state on PPPs for higher education institutions in the United States and providing a gap analysis that reports on the lessons learned as well as recommendations for future projects based on the identified case studies. Potential challenges and benefits behind PPP use were also discussed based on the identified case studies.

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