

Article

Public-Private Partnership and Circular Economy—What Croatian Students Learn at University

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Abstract: The global economy has been hit by crises in recent decades and the COVID-19 pandemic has contributed to great uncertainty in the possibility of a lasting recovery and an energy transition that will enable sustainable green growth. Budgetary constraints impede the regular delivery of public services, especially in developing countries. Energy efficiency and sustainable economic growth in Croatia can be improved with public-partnership models providing public services. However, this concept is often considered as not appropriate due to many misconceptions in public opinion. We analysed a survey of almost 1500 Croatian students with the aim of verifying the importance of formal education in the recognition of realistic aspects of PPP among the population, which represents important social capital. In comparison to other students, students who have been taught about public-private partnership models at university are more likely to recognise certain misconceptions about public-private partnerships and are more likely to think that it is possible to successfully implement such projects in Croatia. Compared with others, students in the field of energy have shown a greater tendency to apply models of public-private partnership in the energy sector, even though these concern the exploitation of natural resources where there is a traditional tendency to protect the autonomy of public governance. Compared to their male colleagues, female students are more prone to misconceptions about PPPs and are less supportive of private management of public infrastructure.

Keywords: public-private partnership; energy transition; energy sector; alternative financing of public services; budgetary constraints; survey; students



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1. Introduction

The onset of market shocks in recent decades has posed a challenge to public sector decision-makers to provide sustainable public energy services within increasingly limited budgetary possibilities. While the recent COVID-19 pandemic has significantly affected the fiscal capacity of the public sector, reducing the economic activity of all sectors of the economy, the demand for innovative public services in the energy sector is constantly increasing.

According to the European Commission [1], in the next programming period of 2021–2027, a circular economy plan is to boost energy transition in Europe. In this context, the EU Commission has created an action plan [1] that focuses on conducting projects that, by 2050, will create a sustainable green growth model that will contribute more resources to the planet than it takes from the planet. Such an approach requires a significant change of mindset at all levels. A key issue arises regarding the financing of projects. While most prosperous EU countries will tend to use traditional public sector financing models, the onset of market shocks and growing fiscal constraints will require the increasing use of alternative models which include greater private sector involvement.

Given the new approach and the challenges that EU countries will face in the future in terms of energy procurement and financing models, more and more scientists are focusing their research on the significant impact of higher education on the implementation of these

processes. For example, Rokicki et al. [2] explain the importance of higher education in EU countries in achieving a circular economy in the energy sector, whilst Hongo [3] examines the circular economy potential with the implementation of public-private partnership (PPP) models in Japan.

Based on defined needs, some of the most important alternative models of financing the new initiative in the energy transition in Europe 2021–2027 [1] are the models of PPP as a form of cooperation between the public and private sectors to jointly implement public infrastructure projects (such as the construction of electricity networks, public lighting networks, or smart transport solutions). Given that, in such projects, cooperation is based on clearly defined obligations in the long-term contract period [4], the importance of formal education in adopting such models represents added value to a public sector that aims to generate future innovative solutions and encourage efficiency.

Taking all this into consideration, this paper has two main goals. The primary focus is placed on the application of PPP financing options in the financing of energy projects in the circular economy. For this purpose, a review of the literature and an outline of previous research are given.

A secondary focus is placed on a methodological framework that aims to examine how formal education affects general attitudes on the applicability of these innovative funding techniques. A survey was conducted with the aim, among other goals, to verify the importance of formal education in the recognition of realistic aspects of PPP among the population which represents important social capital.

2. Literature Review in Conventional and PPP Financing Options

The conventional or traditional financing model is, according to Yescombe [4], widely used in financing, building, operating, and maintaining all kinds of public infrastructure. In many EU Member States, this is the only model applied. In conventional financing, the public sector is responsible for the provision of public infrastructure, and all project risks are borne by the public sector. By applying conventional options, the private partner is responsible for the project during the construction phase only. On the other hand, applying PPP financing options has different characteristics and relationships between the public and private sectors. These relationships are based on long-term contracts with the main aim of providing public services. In such contracts, the public partner is responsible for defining the standard of a public service that it can pay for, while the private partner is responsible for making this service available. According to Grimsey and Lewis [5], the private partner bears significant risks relating to the financing, construction, operating, and maintenance of infrastructure, while the public partner bears the risks regarding regulatory issues and paying only for services received.

In addition to risk sharing, the EC [6] has presented many advantages for the public sector in developing countries, hence for the community in general, in the implementation of PPP projects: the possibility of raising additional finance in an environment of budgetary restrictions, the use of entrepreneurial operational efficiencies which aims to reduce costs and increase the quality and efficiency of public services with the rapid development of infrastructure. These factors create market stability, attract foreign private investment, and boost economic growth.

Since PPP is recognised as a desirable model for private sector involvement for the new programming period 2021–2027, public opinion in recent years has focused increasingly on whether the application of such models is associated with corruption and the privatisation of public services (see also Hall 2014 [7]). For example, Schomaker [8] stated that PPPs, due to principal-agent problems, may be affected by governance problems and prone to corruption at least in one of their implementation phases. On the other hand, Zhang et al. [9], while exploring long-term PPP projects, showed that microeconomic and principal-agent theories can be fully utilised in creating added value for the public sector. However, one of the paradoxes of the last few decades has been the continuity and even growth of infrastructure PPPs despite the loud voices of critics [10].

Regarding PPP and energy projects in the circular economy sector, several researchers have previously investigated these investments. In 2019, Rogić Lugarić, Dodig, and Bogovac [11] carried out research regarding the implementation of PPP models and EU funding mechanisms in the energy sector. The authors concluded that Croatia needed to significantly improve the legal framework for implementing such projects.

Another research was conducted in 2013 by Bukarica and Robić [12], who primarily focused on the energy efficiency gap in Croatia, based on researching the perception of four groups of key stakeholders: public institutions, businesses, civil society organisations, and the media. In their conclusion, they found a lack of political will for adopting such policies and projects but stressed that initial steps from politicians (a top-down approach) should be simultaneously followed by actions from all stakeholders, in light of the customary support mechanisms in Croatian society (as in education, health, and energy).

Milenković, Rašić, and Vojković [13] explored the application of PPP models in providing energy efficiency projects in project proposals related to smart cities. In their conclusion, they stated that PPPs are the most effective way to implement measures that will result in higher efficiency and long-term advantages for the public sector.

Bogovac, Rogić Lugarić, and Dodig [14] carried out research based on a survey conducted from 2016 to 2019, with over 1500 students, mostly from the University of Zagreb, Croatia, aiming to explore students' general views on PPP as an alternative model of financing public infrastructure projects. The results of the research indicate that students support such projects in general and recognise that private partners better manage infrastructure because they are innovative and competitive. Regarding the common misconceptions about PPP, students, whose unsatisfactory state of knowledge can be changed by human action guided by scientific and professional knowledge, believe that the risks of increased corruption and covert privatisation are the most significant threats for the public sector and the community. Students consider that such models can be successfully achieved abroad but not in Croatia, and do not support the private management of natural resources (water, energy, and the coastline). Students receive most of their information about PPP through the internet and television, while those who identify university as an important source of information have a more positive general opinion of PPP.

In line with the second set goal of this research, with the aim of examining how formal education affects the propensity to apply the PPP model, in this analysis, we assess more deeply the importance of formal education in the application of alternative forms of financing energy projects in a circular economy through the model of public-private partnership.

Human capital is important for economic growth whilst education is one of the most significant human capital accelerators. Students are a specific group of young people. They will belong to the most educated part of the population which will form part of the social elite [15].

According to Jensen and Jetten [16], since students represent important social capital, by virtue of formal higher education, they can respond more effectively to the upcoming challenges and any myths associated thereto. With this research, we sought to emphasise a clear link between the formal education of students and public opinion in respect of the application of PPP models in the implementation of energy sector projects.

Strengthening the role of formal education enables the perception of the advantages and disadvantages of different funding models (such as PPP) and allows students to identify all elements of competitiveness and innovation that affect projects regardless of current public opinion. More than ever, it seems that the importance of formal education has become imperative for the implementation of alternative funding models expected in the next EU programming period 2021–2027, defined by the EU circular economy action plan [1]. Moreover, it is fully in line with recent studies on citizens' inclusiveness in the development of PPP [17].

By emphasising the importance of formal education in applying PPP projects, it might be of practical use to dispel some of the myths about the application of PPP models in the Republic of Croatia, with the aim of improving the management of public infrastructure in

a circular economy. In this context, Andres and Guasch [18], explaining public perception in Latin America, stated that “the process of privatization could have been better publicized and its content better explained. Had this been done, privatization could have achieved greater benefits and enjoyed higher popular approval”.

The specifics of developing countries, regarding their lag in economic growth, might be explained by the use of information and communication technology, one of the important variables in the process of the acquisition of knowledge for young people. Bahrini and Quafas [19] found that the use of mobile phones, the internet, and the adoption of broadband were the main drivers of economic development in the Middle East, North Africa, and Sub-Saharan Africa (SSA). Habibi and Zabardast [20] proved that countries, both the most and the least developed countries, with better access to education have the information and communication technology more positive to economic growth.

Szymkowiak et al. [21] found that generation Z (the first born in the World of Internet-connected technology) prefers to use modern technology to support and direct their learning.

Economic growth and sustainable development can also be explained by the impact of the entrepreneurial behaviour of the population, especially among young people. Daim et al. [22] found that “although they feel more supported by their families, females are less self-confident, more tense, reluctant and concerned about entrepreneurship”.

Based on previous research and evidence, together with a theoretical basis of the importance and benefits of formal education, in this paper, we will explore in more detail how realistic students are in recognising common misconceptions about PPPs, their beliefs in the possibility of implementing PPPs in Croatia and will examine the effect of specific formal education in the formation of opinions regarding private sector involvement in various PPP projects, including gender differences.

3. Hypotheses

The main objective of this research is to determine the importance of formal education in framing opinions among students regarding some aspects of PPP. In order to establish if there are statistically significant differences in opinions between students who specifically stated that they acquired their knowledge about PPP at university and students who did not, we divided the students into two groups and analysed the results separately (H1 and H2). Due to the fact that the energy sector has many aspects which constitute subjects in the syllabus of the Faculty of Electrical Engineering and Computing, we sought to examine whether these students were more supportive of private management in the energy sector (H3). Gender differences regarding the topic are examined in H4.

As we have already explained, PPPs are often beset with common misconceptions and biases that blur the real notion of these models, especially in developing countries [23,24]. In our survey, we selected seven of these, according to public opinion in Croatia, as follows: “it increases the risk of corruption in the public sector”, “it is covert privatisation”, “it is covert outsourcing”, “the state is losing ownership of public infrastructure”, “the state is losing the crucial right to make decisions”, “it is just a way for the government to allow the depletion of natural resources”, and “it certainly increases the price of public services”. The aim of this research is to examine the impact of formal education on the opinion of students regarding these threats. Thus, we formulate the first hypothesis as follows:

Hypothesis 1 (H1). *In comparison with students who did not acquire knowledge about PPPs at university, students who did are less inclined to agree with common misconceptions about PPPs.*

Since 93% of students believe that PPP projects can be successfully implemented abroad, while only 35% think that they are possible in Croatia [14], we established the second hypothesis in order to study in more detail how formal education influences the opinions of students regarding the feasibility of such models in Croatia:

Hypothesis 2 (H2). *In comparison with students who did not acquire knowledge about PPPs at university, students who did are more inclined to agree that the successful implementation of PPPs is possible in Croatia.*

Twelve departments of the Faculty of Electrical Engineering and Computing at the University of Zagreb, with its educational, research, and scientific activities, are recognised centres of excellence in specific fields, not only in Croatia but also in the region [25]. We assumed that studying at this Faculty is an important variable in distinguishing between those students who do and those who do not support private management in the energy sector:

Hypothesis 3 (H3). *In comparison with other students, students of the Faculty of Electrical Engineering and Computing (FER) are more supportive of the idea of private management in the energy sector.*

Additionally, we were interested in finding if there is any difference in attitudes towards PPPs between male and female students since some studies have found that there are significant gender differences in terms of business subjects. The participation of private partners in projects related to public goods might be one of the variables that cause hesitation regarding PPP in general:

Hypothesis 4 (H4). *There is a statistically significant correlation between gender and positive/negative attitudes towards PPPs.*

4. Data and Methodology

Since we sought to explore the general attitudes of students about PPP, we prepared a survey questionnaire with simple and general questions about these models. Explicit attitudes were examined in the section on supporting the association of public and private sectors in the management of public goods, opinions on the better management of the private sector with public goods, and the most important sources of information on PPP. Having in mind the possibility of socially desirable responses [26], we examined the implicit attitudes on more specific topics through questions on the most common misconceptions regarding risks to the public sector and the community, the type of private sector contribution to the PPP, and opinions on the possibility of implementing these projects in Croatia and abroad.

This is the first such research aimed at examining the general attitudes of students on as many topics and common prejudices towards PPP as possible, and to lay the foundation for future research. Therefore, the simplest variables were used—mostly dichotomous nominal (YES/NO) responses in order to reduce the number of those who would abandon the survey if they were confronted with a more complex way of evaluating individual claims.

The survey was conducted from 2015 to 2019. Each academic year, a survey was conducted in separate studies. The student survey began in the summer semester of the 2014/2015 academic year in the undergraduate and graduate professional studies of public administration and tax studies at the Faculty of Law in Zagreb. In the academic year 2015/2016, the students of integrated university law studies at the Faculty of Law were interviewed, in 2016/2017, students in the study of social work were surveyed, in 2017/2018, students of the Faculty of Economics and Civil Engineering in Zagreb were interviewed, and in 2018/2019, students of the University of Dubrovnik took part.

According to the Central Bureau of Statistics, the number of students in Croatia studying in parallel is approximately 0.75% to 1.03% in respective academic years. Before each survey, students were informed that the survey was anonymous, that no prior knowledge was required to complete the questionnaire, that personal attitudes were being examined, that the level of stress and discomfort would not deviate from normal everyday situations, and that they were not being exposed to any specific risk. In addition, students were asked not to complete the questionnaire if they had already completed it. Given all the above

facts, we believe that there was minimal possibility of double or multiple completion of the survey, i.e., this eventuality was statistically insignificant.

In order to include students who are actively studying by attending lectures, questionnaires were offered to students during classes, before the beginning of the lecture. The completion of the questionnaire took about ten minutes. Students were willing to fill in the questionnaire and only a few of them (up to ten) opted out. Completion of the questionnaire was voluntary and without any kind of reward.

In a focus group of 11 students, along with the research leaders, the understanding and effectiveness of the questionnaire and its duration were checked. After minor changes, printing and the collection of data began.

We received 1568 returns from students who participated in the research. Participants who missed three or more responses were not included in the processing, so all data for 1497 participants were processed. Of that number, most students (897) were surveyed at the Faculty of Law in Zagreb, 319 at the Faculty of Civil Engineering in Zagreb, 184 at the Faculties of Economics in Zagreb and Dubrovnik, and 94 at the Faculty of Electrical Engineering and Computing in Zagreb.

Women made up the majority of the sample, approximately two-thirds (987; 67.6% of the sample). More than four-fifths of participants were aged from 18 to 25 (1231; 82.6%), while older age groups were under-represented. Approximately two-thirds of students study full-time (962; 64.3%). The most represented respondents were students in the first three years of study (84.2%), while students in the fourth and fifth years of study were less represented (15.5%).

The survey questionnaire consisted of two parts: basic socio-demographic data on respondents (age, gender, type, and year of study) and seven questions. Students also had the possibility of writing comments on PPP or about the questionnaire at the end. The first of the questions regarding PPP was "Do you support the cooperation of the public and private sectors in the management of public goods?". The second question explored the common misconceptions regarding PPP: "Which of the following statements best describes the risks to the public sector and the community?", and referred to seven sub-questions that could be answered with "yes" or "no" ("The state is losing ownership of public infrastructure"; "It is just a way for the state to allow the depletion of natural resources"; "It increases the risk of corruption in the public sector"; "It is covert privatisation"; "It is covert outsourcing"; "The state is losing the crucial right to make decisions"; and "It certainly increases the price of public services"). The next question was: "Do you think that the private sector better manages the infrastructure than the public sector?" ("yes", "no" or "I do not know") followed by a more precise query: "The private sector contributes to partnership with the public sector with:" followed by a choice of four responses ("increased competitiveness", "innovativeness", "reduced prices of services" and "no contribution") together with a blank space where students could write their own category.

The following question, "Do you support private governance in the Republic of Croatia?", consisted of seven sub-questions ("public roads", "water supply", "city transport", "prisons", "schools", "energy" and "the coast") which could be answered with "yes", "no" or "I don't know".

The sixth question was also of a semi-structured type: to the question "How did you get information about PPP?", the two most important answers could be chosen from the five offered, including the option "other": "University", "Television", "Internet", "Press" and "Professional literature". Finally, the question "Do you think that the PPP model can be successfully implemented" had sub-questions "Abroad" and "In the Republic of Croatia", and could be answered with "yes" or "no".

Since our survey consisted of simple binary variables, a Chi-Square analysis was the only appropriate analysis to test our hypotheses. There are many measures of association between categorical variables, but we reported the Phi coefficient specifically created to measure the association between two binary variables.

In order to determine if there is a correlation between gender and attitudes towards PPPs, we created two new variables, i.e., we transformed a few categorical variables into two numerical ones and conducted a Pearson correlation analysis.

Data were coded and analysed with IBM SPSS 25 software, using Frequencies, Descriptive Statistics, Crosstabs with Chi-Square tests and the Phi coefficient, the Kolmogorov-Smirnov test of normality of distribution, and the Pearson correlation analysis.

5. Results

Seven statements that describe common misconceptions about the consequences of PPPs were offered to students. For each of the statements, students could choose the answer “Yes” if they agreed with it, and “No” if they did not. Below is a frequency table (Table 1) with all seven statements, sorted from the most frequent misconceptions to the least frequent.

Table 1. Answers to the question: “Which of these statements describe best the risks of public-private partnerships for the public sector and the community?”.

Risk	Yes (%)	No (%)	Total (%)
Increased risk of corruption in the public sector.	70%	30%	100%
Covert privatisation.	62%	38%	100%
Covert outsourcing.	59%	41%	100%
The state losing ownership of public infrastructure.	56%	44%	100%
The state losing the crucial right to make decisions.	54%	46%	100%
The depletion of natural resources.	51%	49%	100%
A certain increase in the price of public services.	50%	50%	100%

As seen in the frequency table, the most frequent misconception about the consequences of PPPs is an increased risk of corruption in the public sector, with a frequency of 70%. The two next most frequent misconceptions are that PPPs are covert privatisations or covert outsourcing, with 62% and 59% agreeing respectively. A little more than half of the respondents think that through PPPs the state is losing ownership of public infrastructure or the crucial right to make decisions for the common good. When it comes to the depletion of natural resources or the increased price of public services, about the same number of students agree and disagree. Students were also equally divided in the matter of the possible increase in the price of public services.

To find out if there is a statistically significant difference in the perception of these risks between students who acquired knowledge about PPPs at university and other students, we quantitatively analysed the relationship between variables in contingency tables and then conducted Chi-square tests.

Seven Chi-Square analyses were conducted regarding each common misconception. In two of them, Hypothesis 1 was accepted and in five it was rejected at the 5% significance level (Table 2).

Both groups of students equally perceive the following risks to the public sector and the community in PPP projects: increased corruption, covert privatisation, covert outsourcing, the state losing the crucial right to make decisions, and a certain increase in the price of public services. The hypothesis is confirmed regarding only two risks.

The null hypothesis of the Chi-square test for the statement that the state loses ownership of public infrastructure through PPP projects is rejected ($\chi^2(1) = 8,655, p = 0.003$). Students who acquired knowledge about PPPs at university are less inclined to agree with this statement in comparison with students who acquired their knowledge about PPPs from other sources. This means that within the category of students who learnt about PPPs at university, there are fewer students who agree with this misconception than theoretically expected. However, the association coefficient of Phi = 0.076 ($p = 0.003$) means that the association between the two variables is positive but weak.

Table 2. Chi-square test results for all misconceptions.

Misconception	χ^2 Value	df	Sig. (<i>p</i>)	<i>n</i>	Hypothesis 1
The state losing ownership of public infrastructure.	8.655	1	0.003	1.490	Accepted.
The depletion of natural resources.	17.938	1	0.000	1.483	Accepted.
Increased risk of corruption in the public sector.	0.781	1	0.377	1.494	Rejected.
Covert privatisation.	2.168	1	0.141	1.493	Rejected.
Covert outsourcing.	1.753	1	0.186	1.479	Rejected.
The state losing the crucial right to make decisions.	1.173	1	0.279	1.489	Rejected.
A certain increase in the price of public services.	1.471	1	0.225	1.491	Rejected.

The null hypothesis of the Chi-square test for the second statement is also rejected ($\chi^2 (1) = 17,938, p = 0.000$). Students who acquired knowledge about PPPs at university are less inclined to agree with the statement about the depletion of natural resources, in comparison with students who acquired their knowledge about PPPs from the TV, the internet, media, professional literature, etc.

The association coefficient of Phi = 0.110 ($p = 0.000$) means that the association between the two variables is positive but also very weak.

Interestingly enough, both groups of students perceive equally the potential risk of the price of public services increasing through PPPs. Although there is no statistically significant difference between the groups, it is interesting to see that students who acquired knowledge about PPPs at university are more inclined to agree with this statement than is theoretically expected, in comparison with the other group. This is the only such statement where some potential statistical significance would point in the opposite direction to the other six statements.

The question was aimed at students' attitudes to the successful implementation of PPPs in Croatia as compared to other countries ("abroad"). As many as 65% of students think that it is not possible to successfully implement PPPs in Croatia in comparison with 7% of students who think that it is not possible abroad.

A Chi-square test was applied and a statistically significant difference in answers was found regarding the successful implementation of PPPs in Croatia between students who learnt about PPPs at university and those who did not (Table 3).

Table 3. Chi-Square Test results for the implementation of PPP models in Croatia.

Question	χ^2 Value	df	Sig. (<i>p</i>)	<i>n</i>	Hypothesis 2
Do you think that successful implementation is possible in Croatia? Yes/No by formal education	20.217	1	0.000	1.476	Accepted.

The null hypothesis of the Chi-square test was rejected ($\chi^2 (1) = 20,217, p = 0.000$), so we concluded that students who acquired knowledge about PPPs at university have a more positive attitude to the successful implementation of PPPs in Croatia in comparison with students who acquired their knowledge about PPPs from other sources. The association coefficient of Phi = $-0.117 (p = 0.000)$ means that the association between the two variables (learning about PPPs at university and answering "Yes" to the question about the successful implementation of PPPs in Croatia) is positive, although weak.

When it comes specifically to public-private partnerships in the management of energy, there was no statistically significant difference in the answers "Yes" and "No" found between students depending on whether they learnt about PPPs at university or from other sources ($\chi^2 (1) = 0.480, p = 0.488$). However, another Chi-square test was applied to find out if there was any difference among students in their approach to energy management specifically, depending on the subject they study. Four different faculties were included in the sample—the Faculty of Law, the Faculty of Electrical Engineering

and Computing (FER), the Faculty of Civil Engineering, and the Faculty of Economics and Business.

As explained, the highest percentage of students are from the Faculty of Law (61%). The next largest group are students from the Faculty of Civil Engineering (20%). There are 13% students from the Faculties of Economics and Business, and only 6% of students from the Faculty of Electrical Engineering and Computing (FER).

Between 65% and 70% of students from the Faculty of Law, the Faculty of Civil Engineering, and the Faculty of Economics and Business do not support private management in the energy sector. Students from the Faculty of Electrical Engineering and Computing are equally divided between supporting and not supporting private management in the energy sector (50% positive and 50% negative answers).

The Chi-square test resulted in a rejection of the null hypothesis that the distribution of the positive and negative answers is random and not dependent on the faculty—the result being that students of the Faculty of Electrical Engineering and Computing are more supportive of the idea of private management in the energy sector: $\chi^2(3) = 10,362, p = 0.016$; contingency coefficient = 0.085 (Table 4).

Table 4. Chi-Square Test results for FER students regarding support of PPP in the energy sector.

Question	χ^2 Value	df	Sig. (<i>p</i>)	<i>n</i>	Hypothesis 3
Do you support private management in the energy sector? Yes/No by Faculty	10.362	1	0.016	1.410	Accepted.

The low value of the contingency coefficient points to the fact that, although statistically significant, the association between a specific faculty and the attitude towards private management in the energy sector is fairly low. However, the statistical significance of χ^2 can be attributed to the more positive attitude of FER students towards private management in the energy sector than theoretically expected in comparison with other faculties.

In order to test this hypothesis, we created two new variables by transforming the answers to existing variables (yes/no) into numerical values. The first of such created variables was “The presence of misconceptions”. For each misconception that the respondents agreed with, they received 1 point and for each misconception, they disagreed with they received 0 points. Since there were 7 misconceptions to agree/disagree with, by adding the points we gained a new numerical scale for each individual student with a value range from 0 (disagreeing with all misconceptions) to 7 (agreeing with all misconceptions). The second of such created variables was “Support for the private management of public infrastructure”. Respondents were asked if they would support private management of 7 specific public goods/infrastructures: public roads, public transport, roads, prisons, schools, water, energy, and the coast. If their answer was “yes”, they received 1 point and if they answered “no” they gained 0 points. In the same way as before, by adding the points, we obtained a new numerical scale with a value range from 0 (not supporting private management of any public good) to 7 (supporting private management of all public goods).

After we had created these two new variables, we tested the normality of the distribution of both. The Kolmogorov-Smirnov test resulted in the rejection of the null hypothesis (distribution is not normal!), but since this test is very sensitive to the sample size and is very strict, we additionally checked certain distribution parameters (such as asymmetry and kurtosis) to determine if we were able to proceed with correlation analyses despite certain deviations from a normal distribution.

Below are the results of the normality tests and skewness and kurtosis measurement:

- “Presence of misconceptions”: (Kolmogorov-Smirnov (1442) = 0.119; $p < 0.001$); Skewness = -0.183 , Kurtosis = -0.757 .
- “Support to private management of public infrastructure”: (Kolmogorov-Smirnov (1442) = 0.150; $p < 0.001$); Skewness = 0.772, Kurtosis = 0.126.

Since skewness and kurtosis measures were fairly low, we concluded that there was only a slight deviation from the normal distribution and proceeded with the Pearson correlation analysis between each variable with gender ($M = 0$; $F = 1$).

In both cases, we obtained a statistically significant correlation. The results are shown in Table 5.

Table 5. Correlation between gender and the presence of misconceptions, and between gender and support for the private management of public goods/infrastructure.

Misconception	r Value	r ²	Sig. (p)	n	Hypothesis 4
Gender and presence of misconceptions	0.116	0.013	0.000	1.461	Accepted.
Gender and support for the private management of public goods/infrastructure	−0.120	0.014	0.000	1.461	Accepted.

The correlation between both variables with gender is weak, explaining only 1.3% and 1.4% of the variance respectively. However, the correlation is statistically significant and indicates that females are more prone to having misconceptions about PPPs and are less supportive of the private management of public goods/infrastructure.

6. Discussion

Although almost all the hypotheses are confirmed by statistical significance, the association between the variables is somewhat weak.

Students are more creative and innovative than their non-student peers and are potential bearers of new trends. They articulate generational interests, aspirations, and problems on behalf of young people and, given their liberal views, can offer alternatives to further social development [15]. They can be considered as the social avant-garde [27]. This poses the question: why do students not recognise more significantly the possible benefits of the implementation of PPP in Croatia, even though they have acquired knowledge about it through formal education?

The answers might be found in many variables that were not specifically measured and processed by the questionnaire, for example, the high perception of corruption in Croatia, the low efficiency of public administration, hostile public opinion against PPP and entrepreneurship in general, bad experiences with privatisation, and young people's mistrust of political institutions [28–30]. Moreover, the answers are at its core: PPP is a sophisticated and remarkably complex model that requires the long-term perspective of the observer. The calculation of the net present value (NPV) of a project over its entire lifespan is crucial in understanding the costs and benefits in terms of public service, as well as for comparison among the offered options. As Graham and Harvey [31] found in their research, even chief financial officers of companies in the USA, more often than expected, do not use such financial models as a basis for their decisions, especially older ones, those who work in small firms, and those without MBAs. In spite of the fact that NPV includes the time value of money and the value of cash flows over the whole life of an infrastructural project, people, even professionals, tend to rely on simplified versions that explain project benefits in the short term (and ignore possible future losses). This short-termism, and the inclination of people to think of simple solutions, is explained by Kahneman [32], where an opinion system that works automatically and quickly, with little or no effort, considers only easily accessible, automatically activated information, and ignores other information which is relevant for a proper conclusion to be drawn. Such thinking is not interested in the quality or number of arguments from which it draws conclusions and therefore leads to excessive self-confidence in decision making. Ariely [33] explains that people do not see the danger of actions that have cumulative and delayed effects, especially if short-term benefits are visible.

Regarding the recognition of misconceptions about PPP, it is something of a disappointment that students who have acquired knowledge about PPP at university are less prone to such attitudes in respect of only two risks: the state losing ownership of public in-

frastructure, and the depletion of natural resources. However, given the above-mentioned negative attitudes in society and among young people, such results should come as no surprise. It is encouraging, on the other hand, that students have learned that ownership of infrastructure is not lost in PPP projects, and it is particularly promising that there is a difference in attitudes towards natural resources. In Croatia, national pride in natural beauty, which is a valued resource, is strongly expressed. These findings confirm the importance of formal education since even with such an important and sensitive topic, confidence in the possibility of implementing PPP projects increases.

There were interesting results, being the opposite of what was expected, regarding the issue of the risk of an increase in the price of public services. The reason may lie in the fact that these students did learn about PPP. This is a partially correct answer, given that the long-term view of public service delivery is taken into account in a PPP model, which presupposes a higher quality of services due to the increase in value for final consumers, which reflects the same standard of public services for the total duration. The price is also stable, which is not the case for traditional models, since the latter does not recognise a pricing framework at all. In other words, PPP pays for the standard of service and not the infrastructure facility itself: unlike traditional models known to the general population, these models clearly show the capital costs and total living costs of a project. This is supported by the price of the project, which United Nations Economic and Social Commission for Asia and the Pacific [23] stated as misleading but in the opposite sense (“PPP projects are less expensive”) and explains this in the context of the impossibility to offset higher borrowing costs with efficiency gains.

For other risks, the results of both groups of students are the same, which is not surprising if we take into account how these risks relate to various aspects that may be affected by corruption and under-capacity in public administration.

In the context of the interpretation of the second hypothesis, it is interesting that the vast majority (93% of all students) believe that such models are possible abroad, though it was not specified in which countries. Such results may imply that the attitude of students is that PPP models can be successfully implemented anywhere except in Croatia, which indicates huge dissatisfaction with the situation. However, anecdotal evidence suggests that in Croatia the term “abroad” implies developed western countries, in the EU, and in general. It is encouraging that despite this, those students who acquired knowledge about PPP at university are more inclined to believe that it is possible to successfully implement such projects (even) in Croatia.

The confirmation of the third hypothesis provides broader insight into the importance of education. Those students studying at the Faculty of Electrical Engineering and Computing were more supportive of private management in the energy sector, which might be explained as a positive response to the various concepts of financing and partnership, based on their knowledge of the merits of a specific industry. Increased confidence about alternative and non-traditional options for concrete realisation can rely on education about a specific sector. Since previous hypotheses tested the opinions of students who acquired information about PPP at university, this finding confirms the importance of education for all PPP stakeholders.

Young people in Croatia share the fate of their peers from Europe in a number of areas of everyday life, especially those from transition countries [15].

The authors are not aware of any paper to date which has similar goals and type of study. This paper offers a research approach to measure students’ general opinions about PPP in Croatia. The methodology could be applied to other countries which seek to benchmark their results, research these aspects of the political risk of PPP, and derive policy measures to reduce it.

One study which surveyed students’ opinions regarding PPP was conducted in Nigeria [34] where the level of student satisfaction with the provision of university hostel accommodation using one specific model was examined. Such research, however, is not closely linked to our research.

Having in mind the research that proved that Croatian female and male students' attitudes to entrepreneurship differ significantly regarding all examined aspects [22], while female students are less inclined to entrepreneurship, our findings from H4 can be interpreted as new evidence of female students' caution about entrepreneurship.

Finally, we would like to stress the importance of information and communication technology in education. Young people in Croatia have mostly used the internet and television to gain information on PPP which shows how new opportunities of acquiring knowledge are necessary for their motivation to learn. If students, the proactive population, have to be shown the possibilities of increasing the quality and quantity of public services, this requires a top-down approach through new communication technologies [14,19–21].

7. Concluding Remarks

This paper has examined the possibility of applying PPP models of energy projects within the circular economy. In order to determine the impact of education on students' attitudes to PPP, this study draws several key conclusions, seeking to fill the scientific gap in the interpretation of the political risks of PPP projects.

We have shown that students who obtained information about PPP at university are less likely to believe in common misconceptions about PPP and that they more often believe that PPP models can be successfully implemented in Croatia. As far as energy education is concerned, FER students are more supportive of the idea of private management in this sector. Female students are more inclined to misconceptions about PPP and, in comparison with their male peers, are less inclined to support the private management of public infrastructure.

Croatian students believe that these projects can be successfully implemented abroad but not in Croatia, while those who acquired knowledge about PPP at university showed a greater general inclination to favour cooperation between public and private partners.

The findings of this research also have important practical implications. Global financial crises in recent decades, together with the COVID-19 pandemic, have increased budgetary constraints and have impeded the regular delivery of public services. The required energy transition that will create sustainable green growth depends on alternative models of financing, especially in developing countries.

PPP models can make substantial improvements in the energy sector's transition to a circular economy, but their long-term duration and complexity often blur the benefits and raise resistance to their implementation.

PPP is not popular in Croatia, nor is it used in the context of increasing energy efficiency as much as it might in terms of bringing benefits to the community. Stakeholders in these projects in the public and private sectors are not interested in their implementation. The general aversion to PPP models can be explained by the high perception of corruption in the country, the failure of the privatisation process, weak public administration, and low trust in institutions in Croatia.

Nevertheless, we have shown that education is important not only in terms of PPP but also in terms of energy PPP projects. Education can increase community and expert support as well as public administration capacity. Further and continuing education is necessary in this respect, together with less formal campaigns performed with the use of information and communication technology.

The interest of Croatian students in this topic can be fostered with the use of modern technologies where simplified explanations of the risks and benefits of the implementation of PPP models in the provision of public services can be easily transferred. A top-down approach with a reduction in the levels of corruption is a necessary prerequisite for the efficiency and maximum usefulness of PPP in Croatia. Without such a prerequisite, it is not recommended to enter into such long-term arrangements that might incur considerable costs and drain the capacity of public bodies, instead of improving public management and ensuring the supply of high-quality public goods in a circular economy.

The presented research contributes to covering students' general attitudes to PPP and provides insight into and evidence of the impact of formal education thereon. The presented data deriving from a significant number of surveyed students to the best of our knowledge, constitute the first survey on public-private partnerships conducted with university students. We hope that this pioneering work will encourage further research into this topic and contribute to education on public-private partnership, the application of such models in energy transition, and ultimately to the achievement of a circular economy.

When considering the results of the research, it is necessary to consider the limitations. First of all, students from only four university faculties were surveyed, mostly in Zagreb, with the Faculty of Law predominating. Therefore, our sample is not representative of the whole student population in Croatia. The results of our analyses serve as an indication for future, more comprehensive research, in terms of the sample as well as in terms of deeper analyses of underlying attitudes. Therefore, more research on this topic should be conducted on a sample that is more diverse. A future questionnaire should examine the reasons for attitudes towards PPP in more detail and the relationship with other variables relevant to this topic. It should consist of mainly numerical scales, to enable researchers to conduct more complex analysis, such as multiple regression or factor analysis.

Due to the limitations mentioned above, we look forward to further research on the topic in order to investigate, more specifically, the reasons for the aversion to alternative models of financing of public services, as well as the possibilities of improvements in implementation. Due to the similarities between developing countries, such research might be useful for all these countries that aim to improve public service performance, hence leading to sustainable development.

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