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To cite this article: D Rosnarti *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **780** 012035

IOP Conf. Series: Earth and Environmental Science **780** (2021) 012035 doi:10.1088/1755-1315/780/1/012035

Open public space and student use in Campus-A of Trisakti University, Jakarta, Indonesia

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Abstract. The Campus-A of Trisakti University in Jakarta has a significant Green Open Space (GOS). The purpose of this study is to learn how we can increase the use of GOS by students. For that purpose, we mapped the density of a group of students, facility, tree, and buildings within the GOS in the campus. We did regression analysis with the density of groups of students as the dependent variable and the other variables as the independent variable. The results of this study, the density of trees and facility explain the density of groups of students better than the density of the built-up area. From the regression equation, we know the value of the density of trees and facilities that can give optimum values to students use of space.

1. Introduction

Campus-A of Trisakti University is in Jakarta Indonesia. The location of the campus is in the most urbanized part of Jakarta, so its surrounding has a minimal natural feature such as vegetation. However, the Campus-A itself has a substantial portion of green open public space (OPS) located on the middle of the campus. About half of the land where Campus-A is green OPS. Before Covid-19 pandemic, the OPS at Campus-A of Trisakti University is very active with students all day long.

The OPS at Campus-A is under the management of the Landscape Management Division of Trisakti University. The division manages the OPS from planning, design to maintenance. However, not all of the OPS at Trisakti University used by students. There is some part of the OPS that is less used compared to other areas that filled with student activity. In other words, why are there parts of the OPS in Campus-A much more preferred by the student, while there are other parts less preferred? The motivation of our study is to understand how an OPS plan and design can increase its utilization by students. If we can answer the question stated, we hope to develop all part of the OPS in Campus-A so all of the space could attract people, and mainly student to use it. To answer the question on how we could plan and design OPS so it can attract students to use it, we look at several works of literature below.

According to several researchers, OPS attract people because it is suitable for their particular needs. But, what are their needs from OPS? Some research mentioned visibility to and from an OPS will increase the attraction of open space to people. Lu et al. [1] also said how accessibility to and from an OPS could attract people. Other research stated that the existence of greenery such as tree and shrub could increase its attraction to people [2-5]. OPS is also attractive to people if people can relax in it. Paul et al. considered the relation of an OPS to human identity as an attraction [6].

There are not many studies that looked at how the interrelation of variables to OPS will influence the preference of OPS to a human being. There are also researches which show that the attraction of human to OPS depended more on the existence of greenery compare to a built-up area such as

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buildings. Our study will try to look at how the interrelation of attributes of OPS, such as greenery, facility, and built-up area influence the attraction of OPS to students in Campus-A of Trisakti University.

2. Methods

The spatial unit of analysis of this research is convex-space. The term of convex-space is from Hillier and Hanson book title The Social Logic of Space published in 1984 [7]. Thirty-eight of the spatial unit of analysis in this study is the set of convex-space used in the study by Agus on the Campus-A in 2003 [8]. We use convex-space as a unit of analysis with two reasons. Firstly, convex-space is an isovist which visually unites the space as a single comprehensible space [1,7,8]. Secondly, according to several papers, a convex space is a social space [9]. The OPS, which is the subject of our study, is an open space that is visually united where students use to socialize. With the above reasons, we deemed convex-space as an appropriate unit of analysis for our study. Figure 1 is the map of convex-space at Trisakti University.

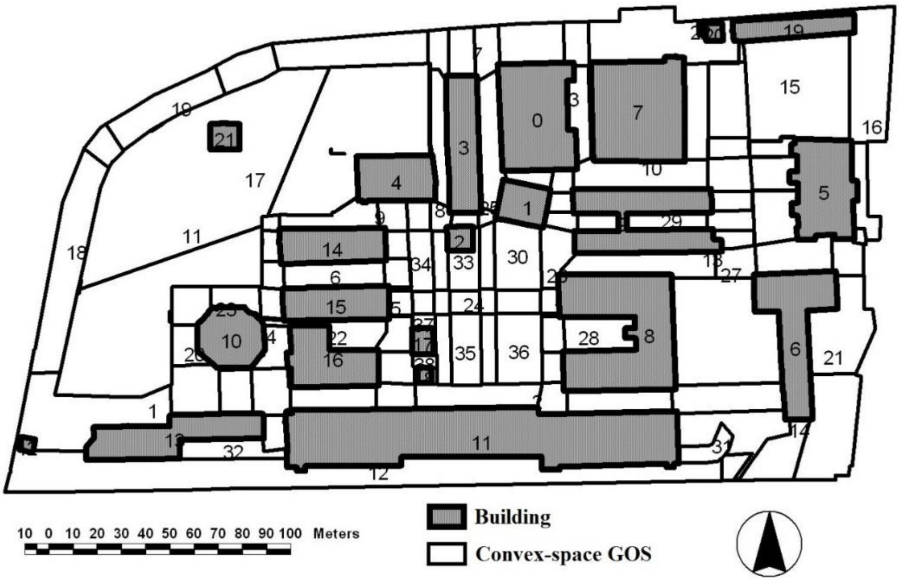

Figure 1. Convex-spaces of OPS as a unit of analysis.

In this study, we analyze the convex-spaces in terms of four attributes or variables. The first variable is the density of groups of student that use a convex-space. The density of a group of students is the dependent variables and proxy for the preference to an OPS. In the second semester in 2019, a week-long, our students that took our Site Design class surveyed and mapped the distribution of groups of students that utilized the OPS in Campus-A of Trisakti University. Figure 2 is the thematic map of the density of groups of students per hectare that use the OPS for each respective convex-space in Campus-A of Trisakti University.

The second variable in this study is the density of trees per hectare. The students as surveyor only counted a tree if it has above shoulder girth diameter equal or larger than 10 cm. We considered this variable as a proxy for greenery. Agus in 2001 did not use tree count as a proxy of vegetation. Instead, Agus used the shadow of a tree as a proxy for foliage [8]. However, the calculation of shadow that falls on a convex-space due to its temporal aspect made measurement much more complicated. To measure the greenery easier for the students to survey, we used tree count. Figure 3 is the thematic map of the density of tree in Campus A of Trisakti University.

The third variable is the density of building that has common borders with a convex-space as unit analysis of this study. This variable is the proxy of the built-up area and access to facilities that delineate a convex-space [2]. We count every building that has a common boundary with the unit of analysis. Figure 4 shows the thematic map of the density of the count per/hectare.

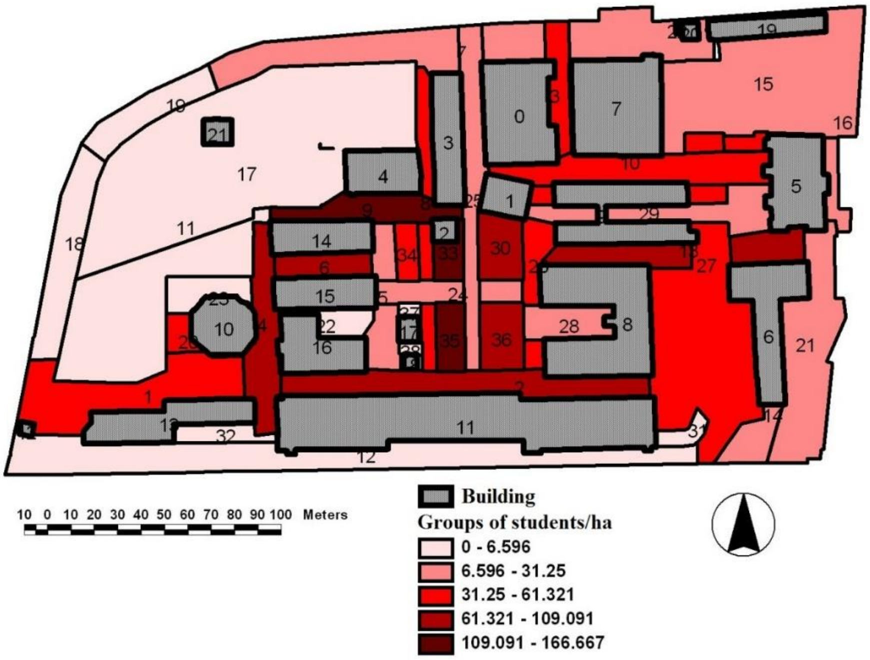

Figure 2. Map of the density of groups of students in convex-space of OPS in the Campus-A of Trisakti University.

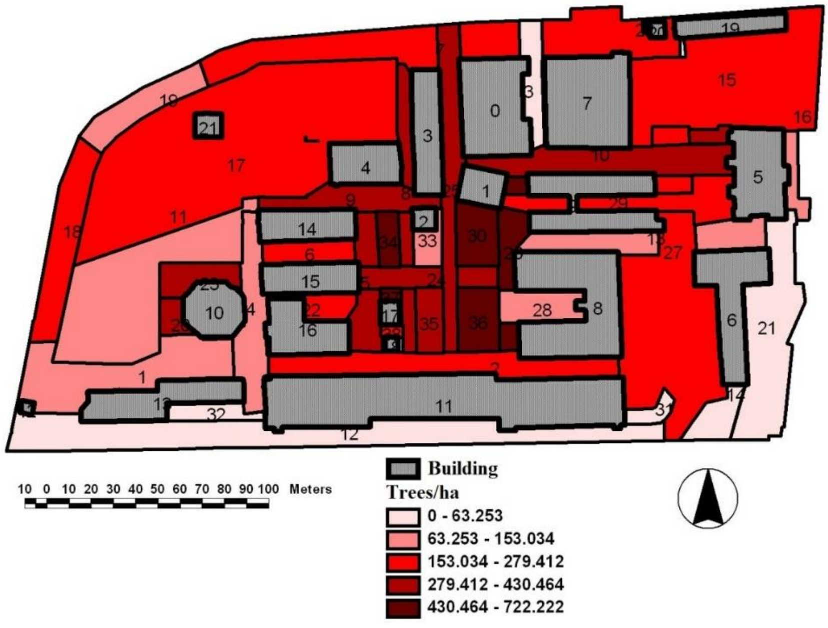

Figure 3. Map of the density of trees in Campus-a of Trisakti University.

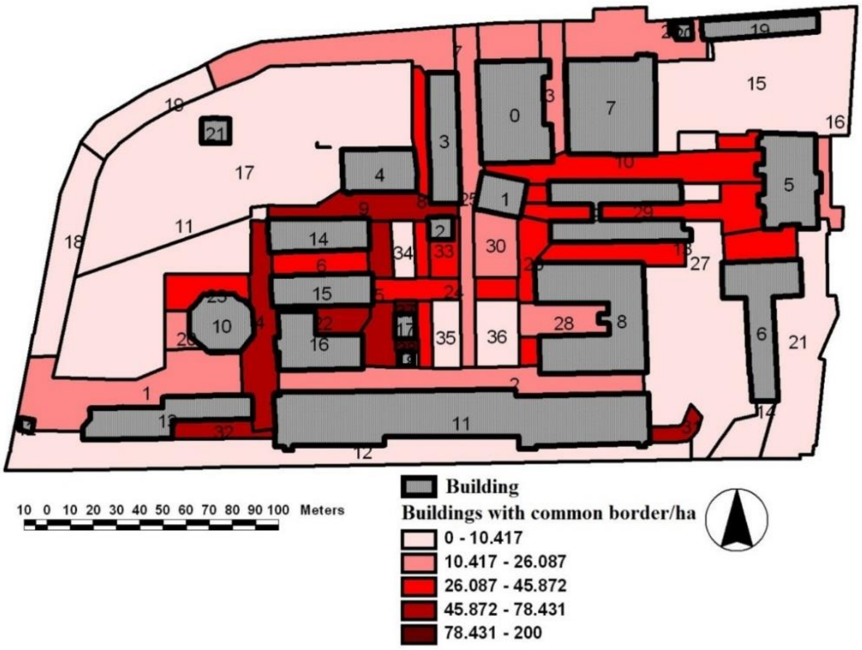

Figure 4. Map of the density of buildings with common border to a convex-space of OPS.

The fourth variable is the density of facilities per hectare in the OPS of Campus-A of Trisakti University. As in Mumcu et al., and Akhir et al., our surveyor counted and mapped all facility that supports the activities of the students in the campus such as thrash bin, seating, food and amenity kiosks [10,11]. We considered the density of total count of any facility as the density of facilities per hectare. Figure 5 is the thematic map of the density of facility per hectares in Campus-A of Trisakti University.

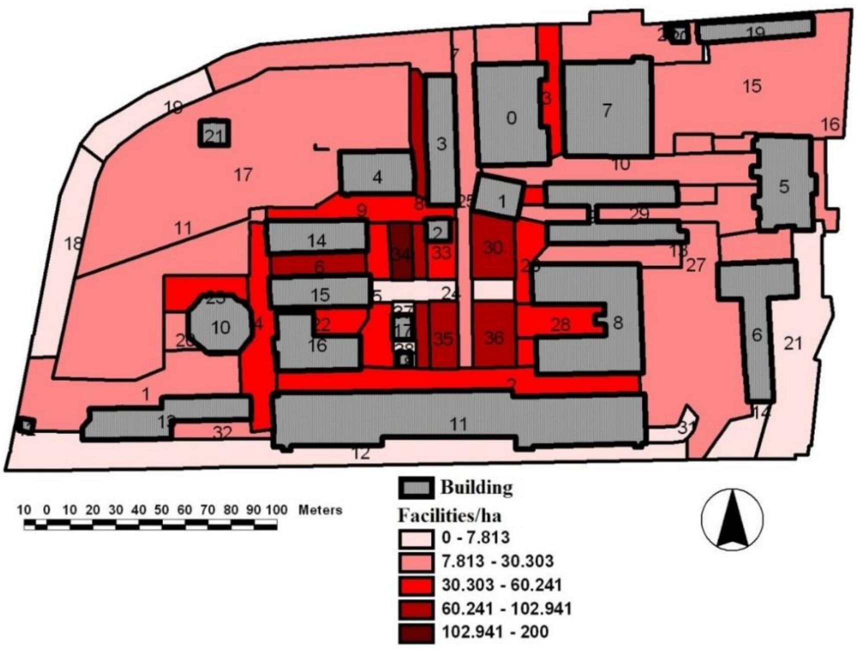

Figure 5. Map of the density of facility in Campus-A of Trisakti University.

We did a regression analysis with the variable density of groups of students as dependent variables, while the other three variables as the independent variables. However, before doing the regression analysis, we need to look at how the correlation among the independent variables is grouped. For that purpose, we did a Factor Analysis to the dependent variables. Then we did a regression analysis with the density of groups of students as dependent variable and factor scores as independent variables.

To abbreviate the names of the variables, table 1 is the list of the abbreviation of variable names, and its operational definition. From this point on in the analysis, we will use the abbreviation of those variables in this paper.

Table 1. List of variables in this study.

Variable	Operational definition	Unit
StudDen	The density of groups of students per unit OPS area	Groups of students/ha
FaciDen	The density of facility per unit OPS area	Facility/ha
TreeDen	The density of tree per unit OPS area	Tree/ha
BuildDen	The density of buildings count that have the same boundary with the unit analysis of OPS	Count/ha

3. Results and discussion

We get two factors from Factor-Analysis. Factor-1 with the largest component consists of FaciDen and TreeDen, while Factor-2 has BuildDen. We used Regression analysis to see the relationship between the two factors to StudDen, and the results are in table 3.

Table 2. Rotated factor matrix.

Variables	Factor-1	Factor-2
TreeDen	0.863	0.253
FaciDen	0.818	-0.341
BuildDen		0.960

Table 3. Result of regression analysis on factor scores.

Variable included in the equation	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	43.218	6.959		6.210	0.000
Factor Score 1	16.685	7.053	0.367	2.366	0.023

Variable excluded from the equation	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
Factor score 2	$-.191^{b}$	-1.242	0.223	-0.205	1.000

The regression analysis shows Factor 1 is better in explaining the dependent variable StudDen than Factor 2. Therefore, we think it is better to do a regression analysis of each respective variables of Factor 1. From the regression analysis, we found the density of facility (FaciDen) significantly explain the density of groups of students (StudDen). Both table 4 and figure 6 show the result of the regression analysis of FaciDen as the independent variable and StudDen as the dependent variable. Equation (1) is the regression equation between StudDen and FaciDen. Equation (1) is quadratic.

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$$\text{StudDen} = 1.7587\text{FaciDen} - 0.0076\text{FaciDen}^2 \quad (1)$$

Table 4. Result of regression analysis with FaciDen as the independent variable and StudDen as the dependent variable.

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	b1	b2
Quadratic	0.683	38.853	2	36	0.0000	1.7587	-0.0079

Table 5 and figure 7 show the result of regression analysis with the density of tree (TreeDen) as independent variable and density of groups of students (StudDen) as the dependent variable. Equation (2) is the regression equation between TreeDen as independent variable and StudDen as a dependent.

$$\text{StudDen} = 0.2604\text{TreeDen} - 0.0003\text{TreeDen}^2 \quad (2)$$

Table 5. Result of regression analysis between StudDen (dependent variable) and TreeDen (independent variable).

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	b1	b2
Quadratic	.471	16.004	2	36	.0000	.2600	.0003

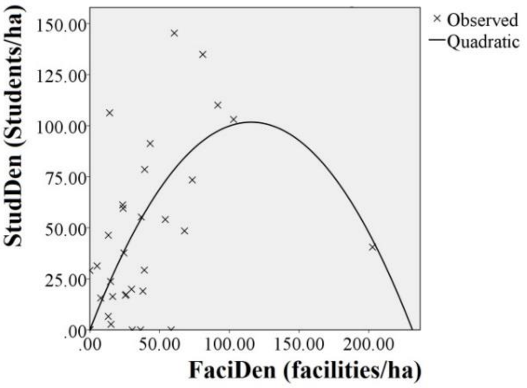

Figure 6. The quadratic curve of FaciDen and StudDen.

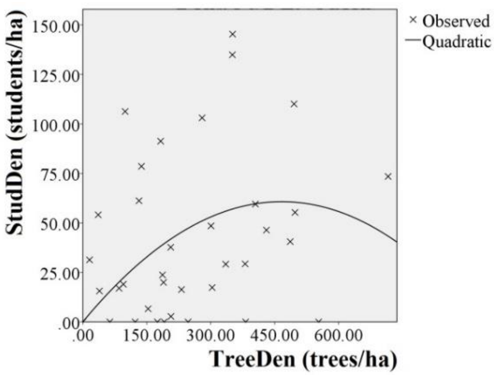

Figure 7. The quadratic curve of TreeDen and StudDen.

The density of facilities (FaciDen) and density of trees (TreeDen) explain the dependent variable StudDen better than the density of bordering building (BuildDen). This result is in accord with the study of Chen, and also of Bogerd [2,12]. The quadratic equation between StudDen and TreeDen is also coherent with the result of many similar studies [5]. The quadratic equation can give a mean on determining the number of trees and facilities that have an optimal effect on space usages. The optimum tree density and facilities density for optimal space usage can act as a guideline for evidence-based planning and design of OPS.

By equating the first derivative of Equation 1 into zero, we can see the value of the density of facilities for the optimal amount of student density is equal to 115.662 facilities per hectare. This optimal value is lower than the one mentioned by Whyte [13]. After we did a similar process to Equation 2, we know the importance of TreeDen that gives the optimal value of StudDen is equal to 466 trees per hectare. This result is in accord with the study of Schmitt [14].

With limited time and resources, our research had to settle with aggregated data. As a result, we could not differentiate the effect of varieties of facilities such as the existence of eating space compare to the count of garbage bin on the usage of OPS by students. Also, we could not differentiate whether the presence of trees more influences the use of OPS compared to the shadow of the tree in protecting people from the sun [8]. In the future, we hope to do a similar study but with more detailed data.

4. Conclusion

This study explains the characteristics of OPS in Campus-A of Trisakti University. The way students use the OPS in the campus significantly determined by the existence of facility and tree, but not by the proximity of built-up space with the OPS.

This study also determines the value of facility and tree counts that gives the optimum amount of student use of OPS. This value of variables that gives optimum usages is essential for professional so they can do planning and design of OPS base on evident.

The aggregated nature of our data should have been more detailed. Only with such study, we could help the professional by giving them the needed tools to do evident based planning and design of OPS.

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