



Multipurpose cadastre for campus room appraisal

Satrio Muhammad Alif ^{*a}, Agung Pandi Nugroho ^a, Bambang Edhi Leksono ^b

Received 29th August 2018

Accepted 21st August 2019

Published 31st August 2019

Open Access

DOI: 10.35472/jsat.v3i1.112

^a Geomatics Engineering, Institut Teknologi Sumatera, Lampung Selatan 35365, Indonesia

^b Geodesy and Geomatics Engineering, Institut Teknologi Bandung, Bandung 40132, Jawa Barat, Indonesia

* Corresponding E-mail: satrio.muhammad@gt.itera.ac.id

Abstract: The use of fundamental components of multipurpose cadastre which can be used as basic information and backbone for government policy with geographical information system as a tool are applied in this research method to appraise campus room. The process to appraise of the facilities in a room begins with collecting facilities data which related to attribute data and defining room boundary which related to spatial data. Room appraisal are analysed by firstly calculate room value based on facilities and activity hours. The method to calculate room value is comparison of quantity and functionality of facilities in every room. Thorough analysis is conducted to separate room value data containing human errors. The determination of which category (high, medium, low) every room fit in is based on distribution of value of every room value which is free of human errors. Room appraisal using this research method will lead to optimize every campus room especially low category room. This approach is also effective way to record number of rooms and facilities of campus comprehensively.

Keywords: Multipurpose cadastre, Appraisal, Geographic Information System

Introduction

Within campus, there are rooms to support the activity of campus inhabitants especially students such as classrooms, laboratory, canteen, library, hall, and offices. Facilities of campus which are distributed to those campus rooms should be recorded to determine which rooms within buildings lacking facilities to support inhabitants' activity. Managing facilities within campus building, showing the location of campus facilities spatially, and appraising room is necessary but rare to be conducted especially in fast-developing campus with a newly bought large quantity of facilities every year since it needs more manpower. Room appraisal and facilities management are necessary to ensure campus facilities are distributed evenly [1]. Room appraisal could also be used as a basis of room rent pricing and asset loss calculation in case of disaster [2].

Multipurpose cadastre is a system used to appraise rooms based on facilities within land parcel effectively. Multipurpose cadastre is an integrated land information system containing legal (e.g. property ownership or cadastre), physical (e.g. topography, man-made features), and cultural (e.g. land use, demographics). Multipurpose cadastre is an ideal solution as inputs as well as instrument in establishing modern land

administration system [3]. Multipurpose cadastre can be used as basic information and backbone for government policy [4].

Room appraisal using multipurpose cadastre is had never been done before since it needs computerized databases and GIS technology. The advent of computerized databases and GIS technology provides an opportunity to develop a greater understanding of land and how land may be more efficiently and effectively managed [5]. Room appraisal is usually done by using the traditional method which is not seamless, hard to update and not comprehensive. Therefore, the traditional method is not effective method especially in fast developing campus. Multipurpose cadastre itself has already used in the last 10 years since the mentioned technology has rapidly developed in last 10 years [6]. It is already used for other purposes such as developing land information system in Malaysia [7]. The fundamental component of multipurpose cadastre is attribute data which is the value of land parcel facilities. Other fundamental components - geographic control data, base map data, cadastral data - are used as position information and provide weight in room (part of land parcel) appraisal [8]. High value-room means the room is comfortable and/or used productively by its



occupant. The case studies of this research are rooms that are located in the land parcel owned by Institut Teknologi Sumatera in Lampung Province, Indonesia. This research will show the effective method to appraise campus rooms within buildings based on productivity and facilities.

Methods

This research uses a survey method in which it calculates the facilities in Institut Teknologi Sumatera. Room which is appraised in this research is rooms that located in seven buildings: two-floored 'A building', two-floored B building, three-floored C building, three-floored D building, five-floored male dorm, five-floored female dorm, and two-floored lecturer dorm.

The process in giving the value of facilities in room begins with collecting facilities data which related to attribute data and defining room boundary which related to spatial data. The process starts with data management and room appraisal. The tool used in applying multipurpose cadastre to appraise room parcel is geographical information system (GIS).

Data Management Method

Data collected in applying multipurpose cadastre are the fundamental component of multipurpose cadastre. Those are spatial reference frame, base maps, cadastre map, attributes data. The spatial reference frame is collected from 13 bench marks located in Institut Teknologi Sumatera referred to SRGI2013 geospatial reference frame, WGS84 reference ellipsoid and ITRF2008 epoch 2012.0 reference frame. The current base map is obtained from photogrammetry measurement with scale 1:1000 acquired on February 2017. Cadastre map that delineate boundary of Institut Teknologi Sumatra parcel is obtained from Institut Teknologi Sumatera land document. The principal boundary of this research is a delineation of boundaries of campus buildings which is obtained from Institut Teknologi Sumatera building floor plan. The boundaries of are rectified in Institut Teknologi Sumatera base maps with control points used are 4 corners of the respective building. Area of the room is calculated to provide weight in room appraisal. Attributes data which is facility and occupants are obtained by doing 'facility counting' activity.

Those attributes data are stored in database to facilitate updating, modifying, deleting the data. Those attributes

data are classified into three entities: Facility, Room, and Facility-Room. Facility entity contains code, name, brand, figure, and score of facility. Room entity contains code, name, usage, location, floor, and activity hour per day. Activity hour per day is mark to identify occupant activity in the room. The Facility-Room entity contains facility code, the room code which is constraint to code in facility entity and room entity, respectively, and the number of the good-conditioned facility, bad-conditioned facility, and unused facility in the corresponding room. The code of facility and room are unique. Entity relationship diagram of this research is shown on Figure 1.

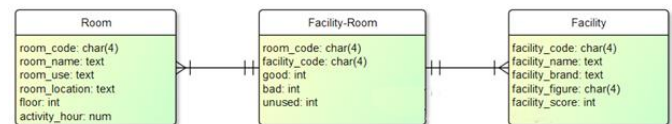


Figure 1. Entity relationship diagram of this research

Room Appraisal Method

The method to calculate room value is the comparison of quantity and functionality of facilities in every room. Room appraisal is analyzed by firstly calculate room value based on facilities. Facilities calculation processes are done carefully and by its occupant permission. Valuation and weighing for every facility are conducted depends on objective of valuation [9]. The objective of valuation in this research is to obtain room value. It also correlates with productivity of respective room [10]. Less productive the room, less room value will be. The facilities valuation method conducted by rate the room based on its functionality. Later, each facility are compared to other facility. Facilities included in room valuation are relatively static items (such as chair, desk, and cabinet).

Results And Discussion

The results of processing fundamental components of multipurpose cadaster are thematic map of campus rooms within buildings including room productivity and facility attributes. The thematic map contains information about facilities in every room used to appraise the room along with room value. The processed buildings are seven buildings: two-floored 'A building', two-floored B building, three-floored C building, three-floored D building, five-floored male dorm, five-floored female dorm, and two-floored lecturer dorm. Facilities in campus building are surveyed by 5 surveyors in 10

days (each day takes 5-6 hours). The data is inputted in the pre-defined database in less than 1 hour. Facility values used to appraise room is defined based on its functionality compared to other facilities. The facility value is higher when the facility is more useful. The example of the facility and its values are shown on Table 1.

Table 1. Facility values defined based on its functionality

Facility Code	Facility Name	Facility Value	Category
F019	Air Conditioner A	11	Electronic
F028	Air Conditioner B	13	Electronic
F033	Air Conditioner C	12	Electronic
F034	Air Conditioner D	10	Electronic
F081	Air Conditioner E	15	Electronic
F024	Fire Alarm A	14	Electronic
F031	Fire Alarm B	14	Electronic
F154	Safe	10	Furniture
F052	CCTV	20	Electronic
F016	CPU	15	Electronic
F048	Dispenser	10	Electronic
F096	Finger Scan	10	Electronic
F047	Focusing Screen	5	Appliance
F074	Curtain A	10	Furniture
F141	Curtain B	10	Furniture
F062	Hydrant	14	Appliance
F004	Lamp A	4	Electronic
F006	Lamp B	3	Electronic
F075	Clock	7	Appliance
F043	Towel Bars	7	Furniture
F085	Carpet A	8	Furniture
F189	Carpet B	10	Furniture
F190	Carpet C	10	Furniture
F037	Double Bed	20	Furniture
F174	Single Bed A	10	Furniture
F173	Single Bed B	10	Furniture
F046	Fan A	6	Electronic
F064	Fan B	7	Electronic
F086	Fan C	5	Electronic
F187	Stove	10	Appliance

A thorough analysis is conducted to separate room value data containing human mistakes. The mistake is indicated by

either value which is too high or too low or unmatched familiar room. The cause of mistakes are mistyped code of room entity and facility-room entity or miscalculate facility in 'facility counting' activity. Other cause is trouble to access to room like the locked room with the private key while doing an activity. Facilities surveyed in this research are 196 types of facilities while rooms surveyed in this research are 610 rooms or ~10 rooms per hour.

DISCUSSION

The use of multipurpose cadastre to appraise room started from direct survey to managing facility in database and appraising room is effective. The number of surveyed room by 5 surveyors in ~10 rooms per hour is quite normal for unpublished work of facilities management in common company. But, the idea of appraising room based on facility by using multipurpose cadastre system is rarely but effective approach as two activities combined into one activity: calculating facility. The further activity related to facility management such as: purchasing new facility, moving facility from one room to another room, disposal of facility can be easily conducted by this approach. Those activities are conducted by managing facility entity and facility-room entity. In case of room change, room entity need to be managed. The process of entity management directly alters room value. Therefore, activity that takes longest time to appraise room is initial survey while further facility management takes time only for updating entity. Thus, multipurpose cadastre gives benefits to room appraisal [12].

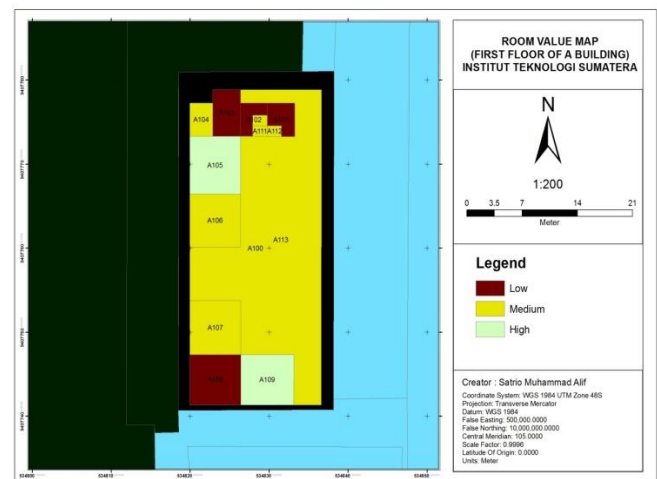


Figure 2. Room value map of first floor of A building
Based on the result of room values, three categories can be derived: high, medium, low. Those different categories are shown by different colors as shown in

Figure 2. The determination of which category every room fit in is based on distribution of the value of every room which is free of human mistakes. Low category room is room with room value less than 100. High category room is room with room value more than 700 while medium category room is room with value between 100 and 700. Result from this research of 709 campus rooms within buildings are 52 high category rooms, 478 medium category room, and 179 low category rooms. Rooms which have trouble to access are automatically categorized as low category room since the data is failed to obtain. The example of room appraisal of first floor of Building A shown on Figure 2 is shown on Table 2. A108 or server room is one of the example room categorized as low category room since it has trouble to access.

Table 2. Room appraisal of first floor of Building A

Room Code	Area (m ²)	Room Name	Activity Hour/Week	Value	Category
A109	40.1	ICT	80	1011	High
A105	44.1	Staffing	48	711	High
A107	41.7	New Students Admission	48	444	Medium
A106	40.6	Infrastructure	48	441	Medium
A111	2.4	Female Toilet Chamber	10	185	Medium
A113	357.3	Hall	74	152	Medium
A110	2.3	Female Toilet Chamber	10	146	Medium
A104	11.6	Warehouse	40	145	Medium
A112	2.3	Male Toilet Chamber	9	135	Medium
A108	38.7	Server	8	56	Low
A101	13.9	Men's Toilet	9	44	Low
A102	13.5	Female Toilet	8.5	9	Low
A103	19.6	Panel Room	4	9	Low

In general, the room with certain category have similar characteristics such as high category room like small meeting room have high value since it has many high-valued facilities, high daily occupant, and small area; medium category room like small meeting room have medium value since it has high daily occupant but large area; low category room like student association room has low value since it has low daily occupant.

Room appraisal using this research method will lead to optimize every campus room especially low category room. In general, in order to increase room value, treatments needed to be done are adding more facilities and occupants: while treatment to decrease room value to make all campus room into balanced room are the opposites.

Conclusions

Campus room appraisal within buildings based on productivity and facilities can be done effectively with this research method. The uses of fundamental components of multipurpose cadastre with geographical information system as a tool are applied in this research method to appraise campus room. This approach is also effective way to record the number of rooms and facilities of campus comprehensively. The primary key of three entities used in database model plays a big role since human mistakes arise from it. This approach gives information to policy maker about campus facilities which are not distributed evenly. This approach also gives information of asset loss in case of disaster by considering facilities price. This approach can be further applied to determine whether a campus room is optimum. It is recommended for further research to use this approach to appraise other campus rooms or rooms in more broad scope such as settlement, commercial area, and city to calculate asset loss in case of disaster.

Conflicts of interest

There are no conflicts to declare

Acknowledgements

This research was funded by Institut Teknologi Sumatera Smart Mandiri 2017 Research Grant Fund No. 235/IT9.KPA/SK/PP/2017. Authors acknowledge assistance from students of Institut Teknologi Sumatera to help collecting data for this research. Authors also acknowledge cooperation from every Institut Teknologi Sumatera staffs.

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