

# An empirical investigation of common sense of public facilities in Japan

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## Introduction and Motivation

- As the technologies related to land data acquisitions and GIS have been developed, many people of different backgrounds have become users of various GIS services. However in most cases, designs of geospatial data (e.g., classification system) have to be adjusted for general use by people who do not have any expert knowledge.
- The goal of this study is to clarify the characteristics of common sense of land use categories, that is how people perceive and conceptualize land use categories, particularly *public facility*, in Japan.

### Why public facilities are important ?

- Some services (e.g., car navigation system) are generally equipped with a function called **facilities searching**, whose database includes public facilities.
- Although the *public facilities* category can often be seen in large-scale land use data, there are no **consistent definitions** of the category.

### What is common sense ?

- Common sense is knowledge or experiences shared by people, and can be divided into cultural-specific and cultural-invariant types.

## Methodology

- Two analyses, namely a simple psychological test and the thematic accuracy assessment of land use data, were performed and their results were compared with each other.

### Psychological test

- The psychological test, which involved the gathering of different concepts of land use categories is conducted in the form of a questionnaire.
- This test was administered to 122 graduate and undergraduate students majoring in earth sciences, and it contained some facility classes, which were grouped into four categories: *public facility*, *commercial facility*, *residence*, *others*.

### Thematic accuracy assessment of land use data

- This assessment was performed to complement the psychological test, because of the limitations of the attributes of the respondents of the psychological test.
- The land use data used in this analysis was a products of human interpretation aerial photos for rural area and a detailed residential map (Fig.1) for urban area.
- Some classification errors can be seen in this data(e.g., a public school was classified as a green area).
- The thematic accuracy assessment was carried out under the assumption that some of the classification errors were due to the differences between the classification definitions in the data specification and the interpreters' concepts of land use categories (i.e., common sense shared by various interpreters).

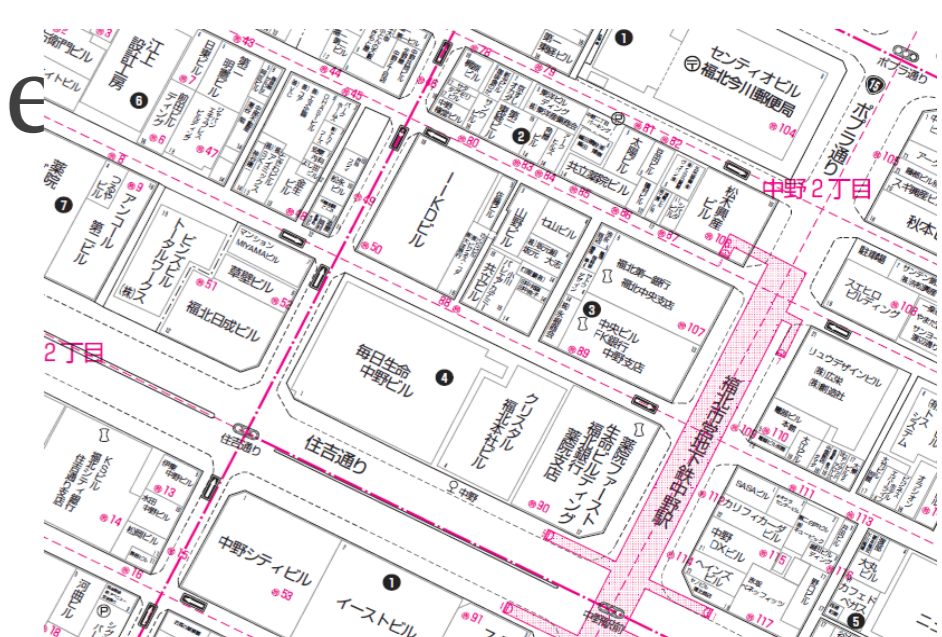


Fig.1 Residential map published by ZENRIN Corp. and covering most of Japan at the 1:2500 scale.

### Why two analyses were compared ?

- Both of the analysis would suggest common sense of public facilities shared by interpreters and students, respectively.
- The results of the analyses suggest the common sense of public facilities in Japan, if the comparison of the analyses show the same trends between the results.

## Results

### Psychological test

- In this test, the respondents classified some facility classes into four categories.
- The number of respondents who perceived that the facilities related to culture and education (e.g., library and public school) are classified into public facilities category is higher than the number of respondents who perceived that kindergarten and special vocational school are classified into the same category. The ownership of facilities might be an important factor.
- Although all of wholesale markets in Japan are established by public ownership, most of them are not classified as public facilities. The function of facilities might be a more important factor.

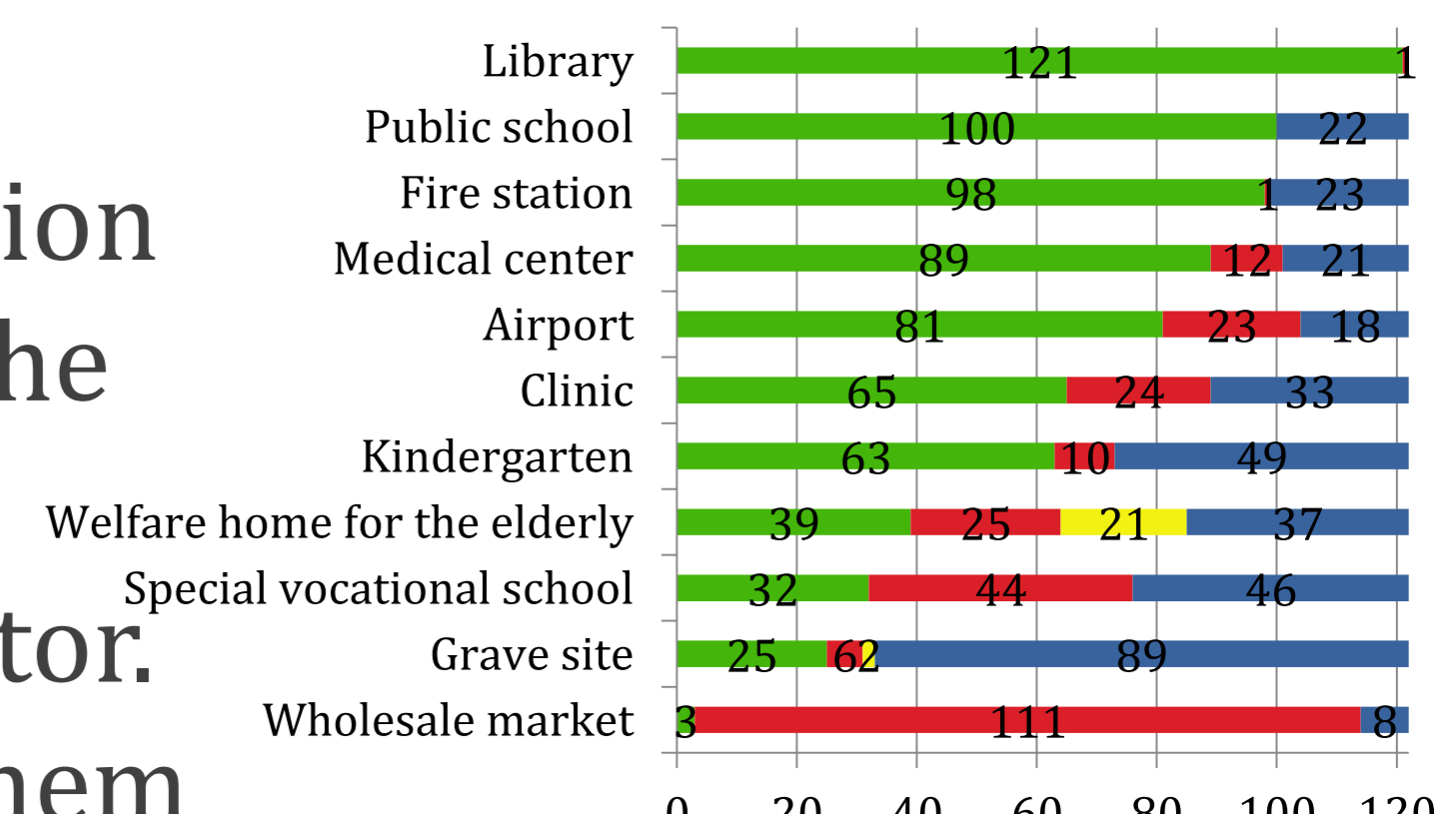


Fig. 2 Subset of the result of the psychological test

### Thematic accuracy assessment

- The land use data used in this analysis is the Detailed Digitalmap Information (10m Grid Land Use) (DDI) published by Geospatial Information Authority of Japan (GSI).
- In this assessment, the list of public facilities (NNI), produced separately from the DDI, was used as reference data.
- The reference data (NNI) is a point data and its positional accuracy is based on a topographical map of 1:25000 scale. The NNI includes 844 kinds of facility classes.

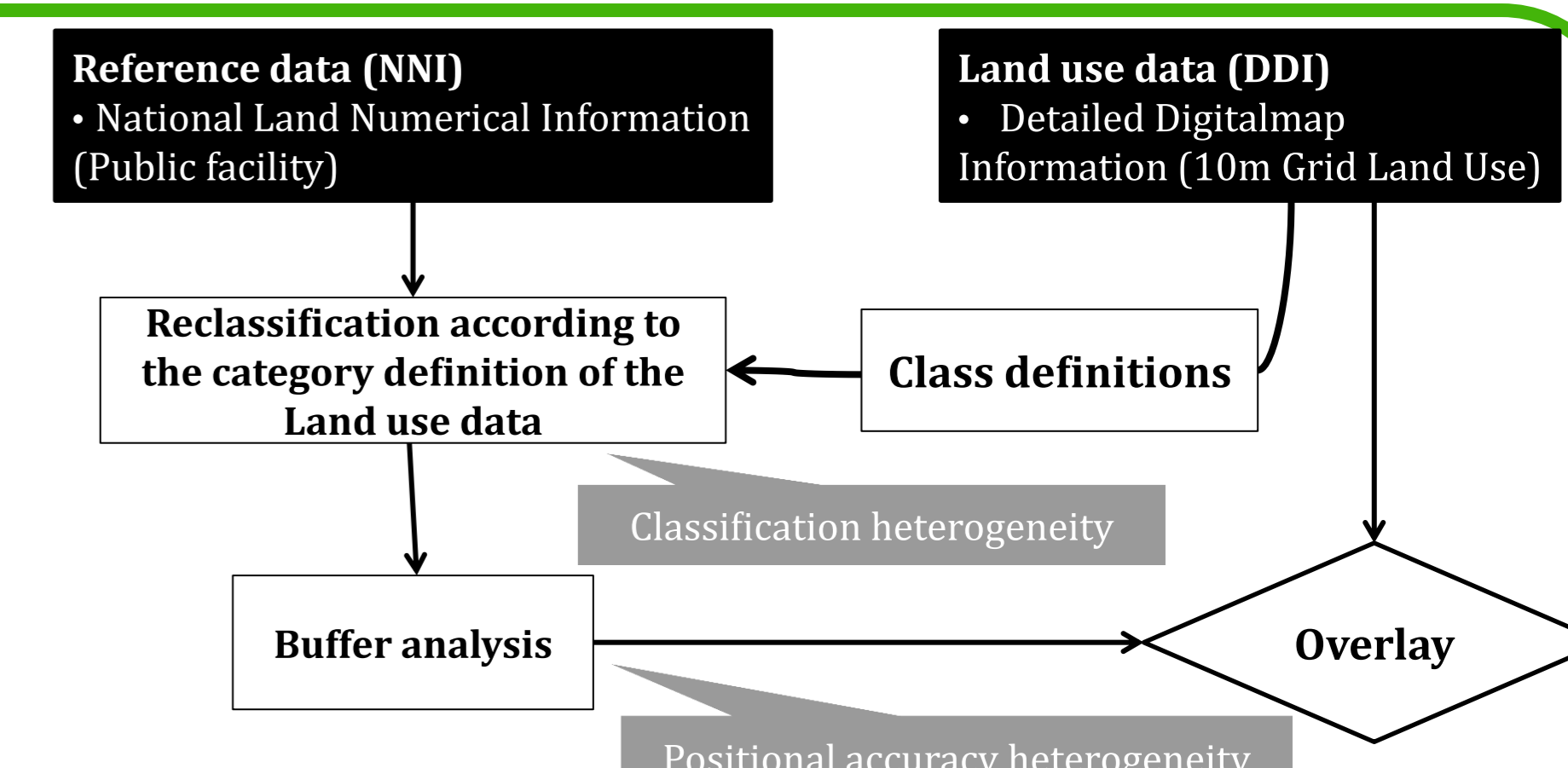


Fig. 3 Flowchart of the thematic accuracy assessment.

### Assessment procedure (Fig.3)

- Extract NNI classes based on the data specification of DDI.
- Create 50m\* buffer to the extracted NNI data.
- Overlay the buffer zone on DDI (Fig. 4).

### Results of the assessment

- 87% of the NNI data overlapped with the public facility class of DDI.
- In most of the NNI classes, the public facility of DDI class overlapped with the largest number of NNI data, in accordance with the data specification.
- A considerable number of NNI data overlapped with the DDI classes except public facility.
- The DDI class overlapped with the second largest number of NNI data, suggesting that it is likely misclassified by interpreters.
- Based on the above-mentioned assumption, the interpreters conceptualize similar concepts between this DDI class and NNI class.

Inclusive categories	Medium categories	Narrow categories
Forest and agricultural land	Forest and wasteland	Flooded field Dry and other fields
Development area	Land under development	
Building area	Vacant land	
	Industrial land	
	Residential land	Low-density housing Dense, low-rise housing Medium and high-rise housing
	Commercial and other land	
Public space	Road	
	Park and green space	Other public facilities
Stream and lake		
Other		

Public service area: National or local governmental agency and each management facilities, Experimental station for agriculture, forestry and fisheries, Public facility of government corporation, Foreign embassy, Office of prime minister, Prison, Examination place for driver's license, and Community center established by national or local government.  
Cultural and educational facilities: Elementary school, Intermediate school, High school, Junior college, University, School under private management, School in the miscellaneous category, Library, Museum, Art museum, Public gymnasium, Public vocational training facility, Driving school, and Sports grounds of schools.  
Social welfare facilities: Medical facility, Clinic, Kindergarten, Day care center for children, Local moving center, Aylum for the elderly, Crematory, Nursing service facility, and Funeral hall.  
Supply and treatment facilities: Water and sewerage facility, Water purifying plant, Waterworks, Garbage disposal facility, etc.  
Transportation, distribution, and communication facility: Bus terminal, Airport and attached facilities, Central and local wholesale market, Gas making plant, Oil tank area, broadcast and communication facility, Electricity company, Electric power generation and transmission facility, Train facility, and Harbor facility.

DDI classes	Clinic	Local wholesale market	Museum	Crematory	Social insurance office	Wastes treatment facility
Forest and wasteland	1	2	4	7	0	4
Flooded field	6	8	1	6	0	2
Dry and other field	4	6	1	5	1	3
Land under development	1	0	0	2	0	0
Vacant land	21	9	2	1	1	5
Industrial land	42	7	4	3	1	38
Low-Density housing	138	31	14	3	4	3
Dense, low-rise housing	100	3	1	0	1	0
Medium and high-rise housing	15	5	1	0	3	0
Commercial and other land	217	62	18	3	12	5
Road	67	7	4	3	2	0
Park and green space	9	1	44	23	0	1
Other public facilities	711	212	175	120	75	31
Stream and lake	2	3	2	1	0	0
Other public facilities	1	0	1	1	0	0
Answer ratio(%)	53.26	59.55	64.34	67.42	75.00	33.70
Second highest ratio(%)	16.25	17.42	16.18	12.92	12.00	41.30

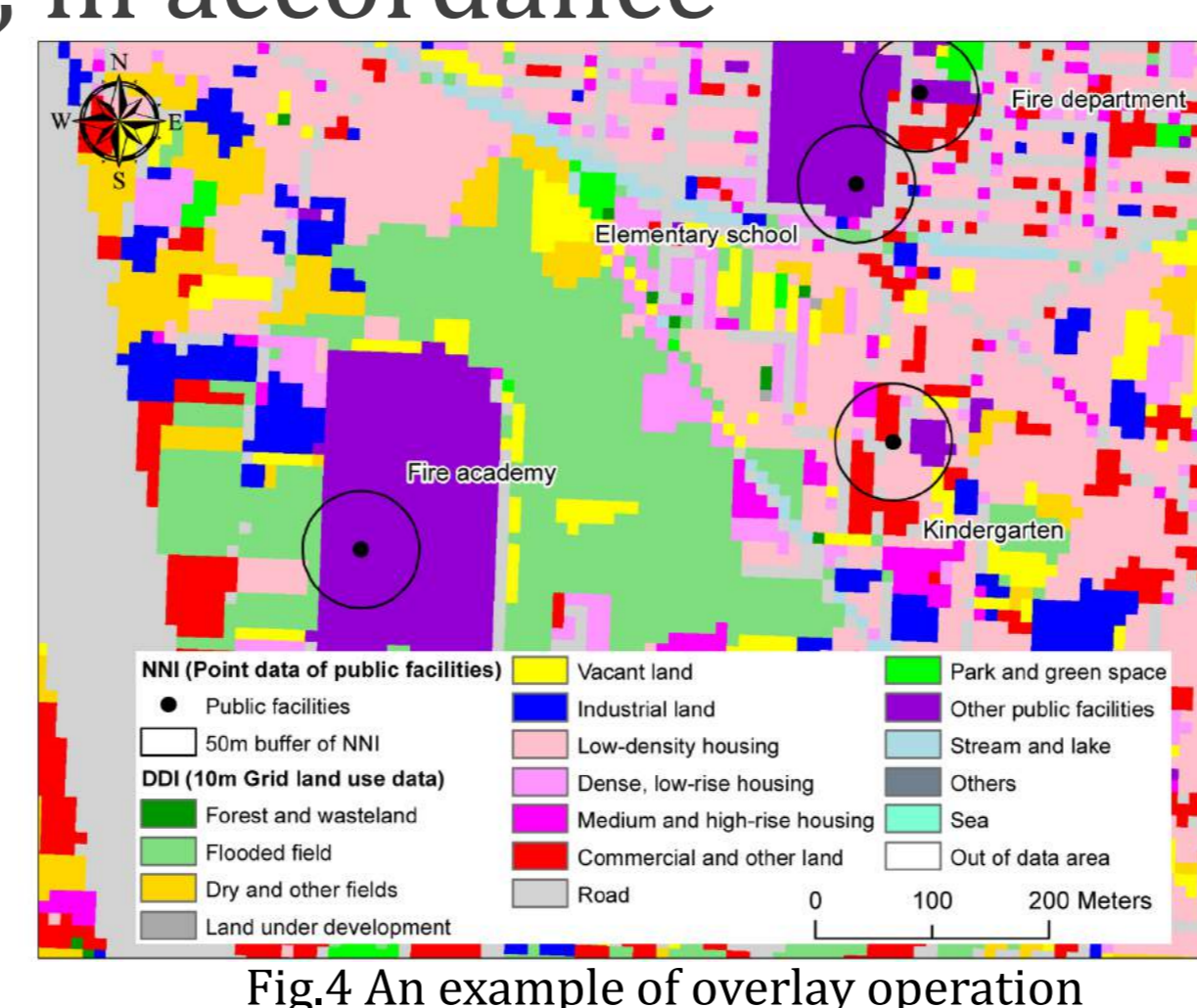


Fig.4 An example of overlay operation

\*The data source of both of DDI and NNI are 1:25000. The standard deviations of positional error should be less than 17.5m according to the work authorization document for public land surveys prepared by related ministry. Therefore, the positional difference between the two datasets was calculated to be 24.749m(=  $\sqrt{17.5^2 + 17.5^2}$ ). The 95% confidence interval of this positional error was estimated to be less than 48.51m (24.749 \*  $\pm 1.96$ ).

## Comparison

- The 11 kinds of common facilities in the two analyses are extracted (Fig. 5).
- The facility class of Clinic deviates from the main trend; it exhibits a lower value in the assessment than the psychological test. Some Clinics are often located in a section of a floor in commercial buildings.
- The results revealed a positive linear correlation; the correlation coefficient excluding Clinic indicates a positive linear correlation.
- The concepts of *public facility* between the interpreter and respondents have the same trends in terms of the 10 facilities.

### Conclusions

- This results suggest that the results of two analysis about other facilities in the two analyses classes might indicate the characteristics of the concept of public facilities in Japan.
- The characteristics of the concepts about public facilities
  - What kinds of facilities are ease to be classified and what kinds of facilities are not ease to be classified.
- The thematic accuracy assessment should be improved for the irregular cases such as *Clinic*.

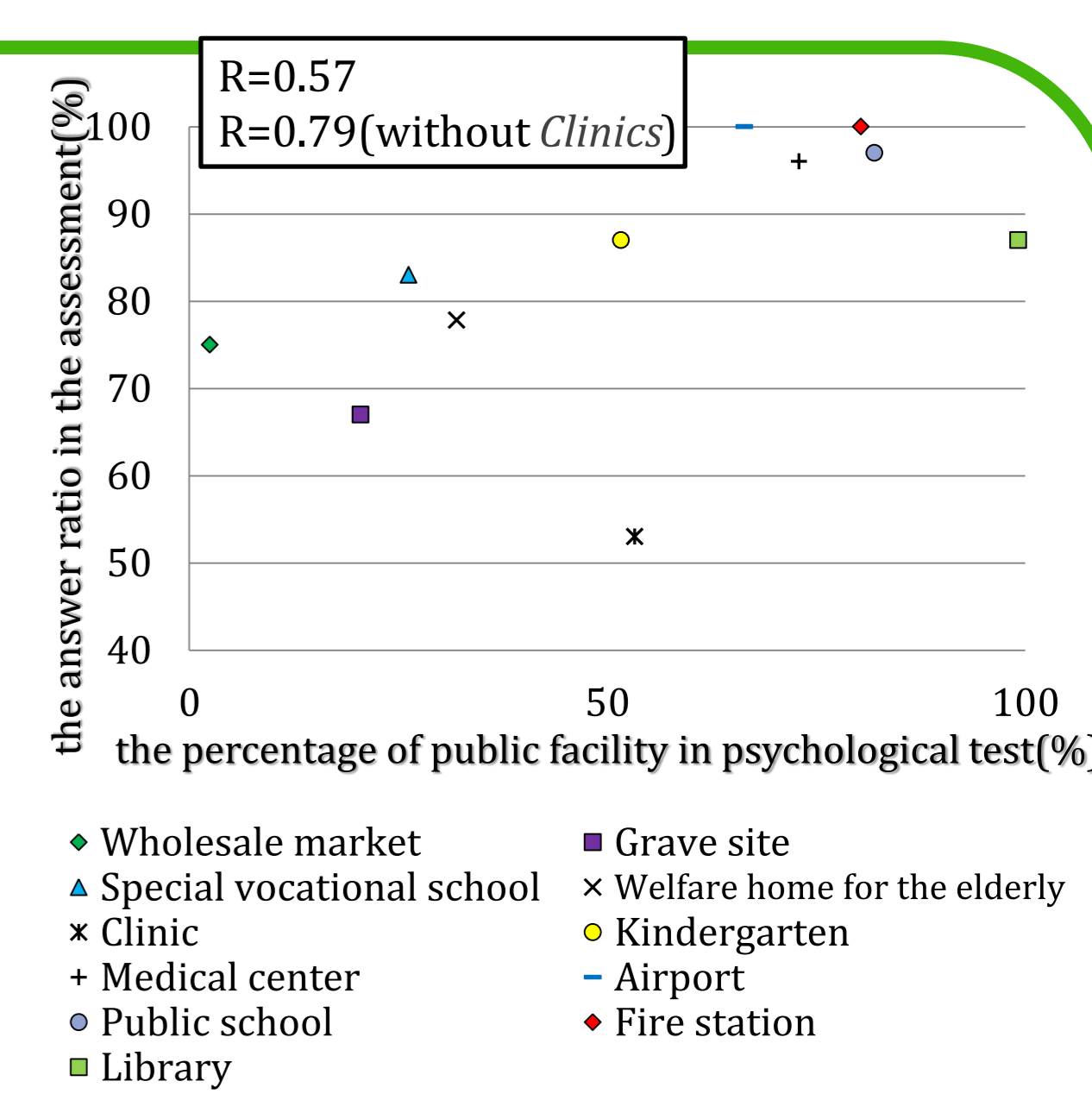


Fig. 5 the scatter plot of the results of the assessment and the psychological test