

Application of the SMARTER Method in Determining the Whitening of Study Permits and Teacher Study Tasks



Rahmat Daffa Affandi¹, Heny Pratiwi², Azahari³, Muhammad Ibnu Sa'ad⁴
Bachelor of Information System and Informatics Engineering STMIK Widya Cipta Dharma^{1,2,3,4}
Jl. M. Yamin, Gn. Kelua, Kec. Samarinda Ulu, Kota Samarinda, Kalimantan Timur 75123
Indonesia^{1,2,3,4}
e-mail: daffaaffandi52@gmail.com¹ henypratiwi@wicida.ac.id² azahari@wicida.ac.id³
saad@wicida.ac.id⁴



Author Notification
09 January 2023
Final Revised
25 January 2023
Published
2 February 2023

Affandi, R. D., Pratiwi, H., Azahari, & Ibnu Sa'ad, M. (2023). Application of the SMARTER Method in Determining the Whitening of Study Permits and Teacher Study Tasks. *Aptisi Transactions on Technopreneurship (ATT)*, 5(2), 205–215.

DOI: <https://doi.org/10.34306/att.v5i2.311>

Abstract

Study assignment programs and study permits aim to meet the need for staff with certain skills or competencies. in the context of carrying out tasks and functions as well as organizational development, reducing the gap between competency standards and or position requirements with the competencies of Teachers who will fill positions, as well as increasing the knowledge, abilities, skills, attitudes, and professional personality of Teachers, as an integral part of the development plan teacher career. This of course requires a decision support system to be able to assist the Education Office in selecting teachers to provide teacher study permits and study assignments. Decision Support Systems (DSS) or Decision Support Systems (DSS) are computer-based systems that are interactive in assisting decision-makers by utilizing data and models to solve unstructured problems. In this study, the SMARTER method was used as a multi-criteria decision making. The purpose of this research is to assist the Education Office in making decisions when providing a determination of the redemption of study permits, and teacher study assignments as well as providing uniformity and legal certainty in the implementation of study assignments and study permits, and supporting teachers within the local government so that they can improve competence and be more professional in carrying out its duties and functions. Based on research that has been done using the SMARTER method, the sum of each criterion is 0.7840. This implementation produces information that is relatively fast, precise, and feasible to use for updating study permits and teacher learning assignments, and can be carried out without being constrained by time by implementing a web-based application.

Keywords: *Decision Support System, SMARTER Method, Web, Study Permits*

1. Introduction

Study Permit is the granting of permission by the Governor to Civil Servants to continue formal education without leaving official duties. (East Kalimantan Governor Regulation Number 57 of 2019, concerning Study Tasks and Study Permits in Article 1) [1].

The study assignment and study permit program aims to meet the need for personnel who have certain skills or competencies in the context of carrying out their duties and functions as well as organizational development, reducing the gap between competency



standards and or job requirements with the competencies of teachers who will fill positions and increasing knowledge, abilities, skills, Teacher's professional attitude, and personality as an integral part of the plan Master's career development on. (Guidelines for Study Tasks and Study Permits for Civil Servants in Local Governments, in East Kalimantan Governor Regulation Number 57 of 2019) [1].

That there are teachers in East Kalimantan Province who have taken part in the improvement of educational qualifications and have not obtained approval for study assignments or study permits, to provide certainty for the adjustment of diplomas that have been obtained by teachers who have completed education and ensure the continuity of employee careers and in the framework of orderly personnel administration, it is deemed necessary granting whitening the status of study assignments and study permits to teachers in the province of East Kalimantan.

Decision Support System (DSS) or Decision Support System (DSS) is an interactive computer-based system in assisting decision-makers by utilizing data and models to solve unstructured problems [2].

With the problems faced, especially among teachers in East Kalimantan Province, a computerized system is needed that can help to obtain a good decision as needed.

Researchers chose the SMARTER method to help the Education Office make decisions when determining the whitening of study permits and teacher study assignments and to provide uniformity and legal certainty in the implementation of learning assignments and study permits and to support teachers in the local government environment in order to improve competence and be more professional in implementing duties and functions.

Simple Multi-Attribute Rating Technique Exploiting Rank (SMARTER) is a multi-criteria decision-making method. This multi-criteria decision-making technique is based on the theory that each alternative consists of a number of criteria that have values and each criterion has a weight that describes how important it is compared to other criteria [3].

The research entitled "Decision Support System for Providing Industrial Equipment Assistance Using the Smarter Method Based on Web GIS" aims to determine the acceptance of tool assistance to the micro-industry, the calculation result of the system that has been built is 0% meaning that the system that has been made can be said to be suitable for use because of errors. relatively less than 50% [4].

The research entitled "Decision Support System for Determining Recipients of Unfit for Housing Assistance Using the Smarter and Topsis Methods in Rawakalong Village" aims to determine the priority of residents who are given financial assistance. The results of this study where the candidate recipient of the grant that has the highest calculation value is the priority that must be prioritized, the highest value is 0.8039, followed by the second recipient with an assessment result of 0.7122, the third recipient with an assessment result of 0.7096, the fourth recipient with an assessment result assessment of 0.7086 to the fifth recipient of the assessment results of 0.4454 [5].

Furthermore, another study entitled "Decision Support System for Determining Suppliers of Building Materials Using the Smart Method (Simple Multi-Attribute Rating Technique) at Bintang Keramik Jaya Store", aims to produce a Decision Support System for Determining Suppliers of Building Materials Using the SMART (Simple Multi-Attribute Rating Technique) Method. At Toko Bintang Keramik Jaya in the hope of objective supplier selection. By using the Visual Basic 6.0 programming language and the database using Microsoft Access. In this study, the data collection techniques used were literature study, observation, and interviews. The results of this study There are 4 criteria used, namely the quality criteria of goods that have very high quality, high quality, and low-quality sub-criteria. Competitive price criteria with very competitive, competitive, and less competitive sub-criteria. The payment time criteria have sub-criteria ≥ 12 months, $\geq 4 - < 12$ months, and $0 - < 4$ months. Then the service criteria have sub-criteria of good, sufficient, and less [2].

The research entitled "Employee Discipline Decision Support Support System Using The Simple Multi-Attribute Rating Technique (Smart) Method" aims to determine the level of

discipline of staff and employees at STIKes and STMIK Hang Tuah Pekanbaru. From the application of this method, it was found that 120 people got Very Good evaluation results, 11 people got Fair results, and 2 people got Do Coaching results. A decision support system using the SMART method can identify the level of discipline of staff and then give directions to staff who receive the evaluation results. Conduct coaching to be more disciplined and improve the quality of human resources at STIKes and STMIK Hang Tuah Pekanbaru [6].

Another study entitled "Decision Support System for Performance Assessment of Education Personnel Using the SMARTER Method" Aims to Give Rewards to Education Personnel. The results of this study, from several criteria used for the selection process using the alternative SMARTER method with the name A4 with a final utility value of 64.25%[7].

In this study, the determination of the whitening of study permits and teacher learning assignments using the SMARTER method is expected to be able to produce information that is relatively fast, and precise and can be done without time constraints with the help of web-based applications.

2. Research Method

The research method is an activity to observe a problem or understand the object to be studied, then further analyzed and found a solution so that conclusions can be drawn on the problem to be studied.

2.1 Decision Support System

Decision Support System is a computer-based system whose job is to assist in the decision-making process by utilizing a certain method or model, so as to obtain the desired results.

The concept of a Decision Support System (DSS) or Decision Support System (DSS) was first expressed in the early 1970s by Michael S. Scott Morton with the term Management Decision Systems [8].

2.2 SMARTER

The SMARTER (Simple Multi-Attribute Rating Technique Exploiting Ranks) method is a multi-attribute decision-making process mathematical calculation method developed in 1994 by Edward and Baron. This multi-criteria decision-making process method is based on the theorem that each alternative is formed from several criteria that have values and each criterion has a weight that shows the level of importance of these criteria when compared with other criteria [9][10].

SMARTER (Simple Multi-Attribute Rating Technique Exploiting Rank) is used for weighting because the SMARTER (Simple Multi-Attribute Rating Technique Exploiting Rank) method has advantages when weighting the criteria, the weight calculation is carried out using the rank order centroid (ROC) technique, with the distance ROC technique consistency of each criterion will be maintained [5],[11]

The ROC weight formula is generated by a simple mathematical calculation of priority. The basic understanding is represented by using two variables, namely variable A and variable B. If ranking A is priority no.1, then the weighting value must be between 0.5 and 1 so that the midpoint of interval 0.75 is used as the value of the estimated weight, which becomes the basic principle of minimum commitment. Then the weight on variable B is 0.25 (midpoint of 0 and 0.5). The procedure is described as follows (if there are K criteria) [10].

The following is a weight calculation formula using the ROC formula:

$$W_K = \frac{1}{K} \sum \frac{1}{i} \tag{1}$$

In Formula (1) above, it explains W as the weight of the criteria as the initial benchmark value to be searched. Then K is a variable that shows the number of criteria that

have been determined. Then for k is a sequence of existing criteria. The following is a description of Formula (1).

$$\text{If } w_1 > w_2 > \dots > w_k \text{ then,} \tag{2}$$

$$W_1 = \frac{1 + \frac{1}{2} + \frac{1}{3} \dots \frac{1}{k}}{K} \tag{3}$$

$$W_2 = \frac{0 + \frac{1}{2} + \frac{1}{3} \dots \frac{1}{k}}{K} \tag{4}$$

$$W_3 = \frac{0 + 0 + \frac{1}{3} \dots \frac{1}{k}}{K} \tag{5}$$

$$W_K = \frac{0 + \dots + 0 + \frac{1}{k}}{K} \tag{6}$$

In general, the above formula is written as follows [4]:

$$W_{Kr} = \frac{1}{Kr} \sum_{i=kr}^{kr} \frac{1}{i}$$

Information:

- W_{Kr} = Criteria weighting value
- Kr = Number of criteria
- i = Alternative value

2.3 Intelligence

In the intelligence process, researchers collect data needed in granting study permits and study assignments. Furthermore, determining the criteria for whitening study permits and study assignments, then calculations are carried out using the data that have been collected, so that conclusions can be drawn at the end of the results that have been processed using the SMARTER method.

2.4 Design

Design aims to provide an overview of the system to be built, in the design of the system design used a Flowchart.

A flowchart is an analytical technique used to explain aspects of information systems clearly, precisely, and logically. Flowcharts use a series of standard symbols to describe transaction processing procedures used by a company, standard flowchart symbols commonly used and issued by ANSI and ISO [12].

Flowcharts are widely used to relate the overall structure and flow of a system to end users. Because Flowcharts can offer a physical display that plays an important role in the linkage of hardware and media data. A flowchart is a flowchart that describes a logical sequence of a problem-solving procedure.

2.5 Choice

Choice is the process of determining the value of a variable based on the needs that will be used and then given to each criterion and compared with the criteria that will be used for calculations using the SMARTER method.

2.6 Implementation

The system that has been in accordance with what was previously planned, is then implemented in the process of making a Decision Support System Web application using the SMARTER method.

3. Findings

Building a Decision Support System for Determining the Whitening of Study Permits and Learning Tasks for Teachers in East Kalimantan Province with the Web-Based SMARTER Method was built or developed with the intention of being able to produce the right solution.

The following is a table of criteria, sub-criteria, and weights that have been determined based on the data that has been obtained previously.

Table 1. Criteria, Sub Criteria, and Weights

| SN | Criteria | Weight (Wj) |
|----------|---------------------------------|--------------|
| 1 | Education | 0.521 |
| | Diploma | 0.521 |
| | Bachelor | 0.271 |
| | Master | 0.146 |
| | Doctor | 0.063 |
| 2 | Age | 0.271 |
| | < 25 – 30 Year | 0.521 |
| | 31 – 35 Year | 0.271 |
| | 36 – 40 Year | 0.146 |
| | > 40 Year – 58 Year | 0.063 |
| 3 | Position | 0.146 |
| | Teacher | 0.521 |
| | Education Personnel | 0.271 |
| | Vice Principal | 0.146 |
| | Principal | 0.063 |
| 4 | University Accreditation | 0.063 |
| | A | 0.611 |
| | B | 0.278 |
| | C | 0.111 |

Table 2. Criteria and Sub Criteria Weighting Process

| Criteria | Priority | Criteria Weight | ROC |
|--------------------------|----------|----------------------------------|-----|
| Education | 1 | $(1/1+1/2+1/3+1/4)/4$ = 0,521 | |
| Age | 2 | $(1/2+1/3+1/4)/4$ = 0,271 | |
| Position | 3 | $(1/3+1/4)/4$ = 0,146 | |
| University Accreditation | 4 | $(1/4)/4$ = 0,063 | |

Giving weight to each sub-criteria of the existing criteria, using the Rank Of Centroid calculation process in the same way to get the weight value of each criterion.

Table 3. Registrant Calculation

| No | Nama | | Criteria | Weight | Sub Criteria | Weight | Score Utility | Score Real | Results | Rank |
|----|---------------------|----|-----------------------|--------|---------------------------|--------|---------------|------------|---------|--------|
| 1 | Herdi an syah | 01 | Educ ation | 0.521 | Diploma | 0.521 | 0.2714 | - | - | 0.7830 |
| | | 02 | | | Bachelor | 0.271 | 0.1412 | - | - | |
| | | 03 | | | Master | 0.146 | 0.0761 | 2 | 0.1521 | |
| | | 04 | | | Doctor | 0.063 | 0.0328 | - | - | |
| | | 05 | Age | 0.271 | < 25 – 30 Year | 0.521 | 0.1412 | 4 | 0.5648 | |
| | | 06 | | | 31 – 35 Year | 0.271 | 0.0734 | - | - | |
| | | 07 | | | 36 – 40 Year | 0.146 | 0.0396 | - | - | |
| | | 08 | | | > 40 Year – 58 Year | 0.063 | 0.0171 | - | - | |
| | | 09 | Position | 0.146 | Teacher | 0.521 | 0.0761 | - | - | |
| | | 10 | | | Education Personnel | 0.271 | 0.0396 | - | - | |
| | | 11 | | | Vice Principal | 0.146 | 0.0213 | 2 | 0.0426 | |
| | | 12 | | | Principal | 0.063 | 0.0092 | - | - | |
| | | 13 | Accr edita tion | 0.063 | A | 0.611 | 0.0385 | 4 | 0.0235 | |
| | | 14 | | | B | 0.278 | 0.0175 | - | - | |
| | | 15 | | | C | 0.111 | 0.0070 | - | - | |

Information:

- Utility Value = Criteria weight value x sub-criteria weight
- value Real Value = Input value
- Result = Utility Value x Real Value
- Rank = Total sum of the result values

The registrant Herdiansyah Samarinda has 4 criteria, namely the value of Education, Age, Position, and Accreditation. Herdiansyah input Master for Education, < 25 – 30 Years for Age, Deputy Principal for Position, A for Accreditation. Result Value for Education criteria utility value X real value, $0.0761 \times 2 = 0.1521$, Age $0.1412 \times 4 = 0.5648$, Position $0.0213 \times 2 = 0.0426$,

Accreditation $0.0385 \times 4 = 0.0235$, the SMARTER score is the sum of the result scores for each criterion, $0.1521 + 0.5648 + 0.0426 + 0.0235 = 0.7830$

3.1 Design

Design aims to provide an overview of the system to be built, in the design of the system design used is a Flowchart. See figure 1.

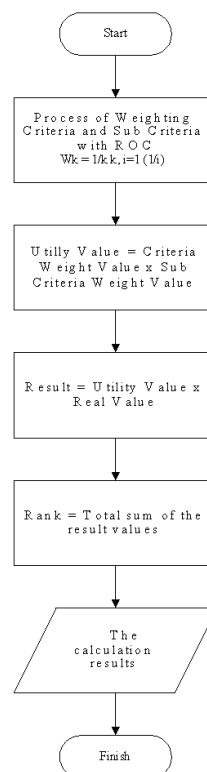


Figure 1. SMARTER Calculation FlowChart

3.2 Choice

1. Identification of problems, so that the decisions to be taken are more focused and do not deviate from the goals to be achieved.
2. Determine alternatives, criteria, and sub-criteria used in making decisions.
3. Give a rating for each criterion and sub-criteria

4. Calculating weights using ROC weighting for each criterion, this depends on the rating given in step 3.
5. Calculating weights using ROC weighting for each sub-criteria, this depends on the rating given in step 3.
6. Calculate the final weight of each criterion, by multiplying the results of step 4 by the results of step 5.
7. Provide an assessment of all criteria for each alternative. Values are given in 0-100 where 0 is the minimum value and 100 is the maximum value.
8. Calculate the utility of each alternative using the maximum equation
9. Decide. If only one alternative will be selected, the alternative with the greatest utility value will be chosen.

3.3 Determining Criteria and Sub-Criteria

The criteria and sub-criteria used in the Decision Support System for Determining the Whitening of Study Permits and Teaching Tasks for East Kalimantan Province Teachers with the Web-Based SMARTER Method are:

1. Education:
 - (1) Diploma, with a weighted value of 0.521
 - (2) Bachelor, with a weighted value of 0.271
 - (3) Masters, with a weight value of 0.146
 - (4) Doctor, with a weight value of 0.063
2. Age
 - (1) < 25 Years - 30 Years, with a weight value of 0.521
 - (2) 31 Years – 35 Years, with a weight value of 0.271
 - (3) 36 Years – 40 Years, with a weight value of 0.146
 - (4) > 40 years – 58 years, with a weight value of 0.063
3. Position
 - (1) Teacher, with a weight value of 0.521
 - (2) Education Personnel, with a weighted value of 0.271
 - (3) Deputy Principal, with a weighted value of 0.146
 - (4) Principal, with a weighted value of 0.063
4. University Accreditation
 - (1) A, with a weight value of 0.611
 - (2) B, with a weight value of 0.278
 - (3) C, with a weight value of 0.111

3.4 Implementation

The following is a web-based application page display for a decision support system for Determining the Whitening of Study Permits and Teacher Learning Assignments using the SMARTER method.

1. Bleaching Page

The bleaching page contains the results of a verified teacher list and the calculation contains data on the number, name, school origin, education, age, position, accreditation, status, and results at the East Kalimantan Provincial Education and Culture Office. See figure 2.

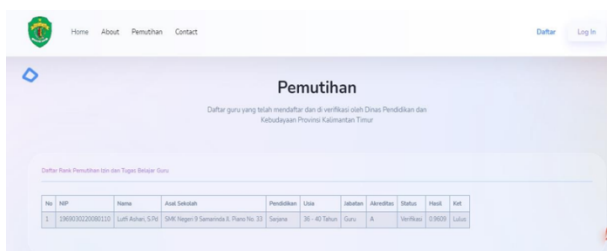


Figure 2. Bleaching Page Display

2. Teacher Data Input Page

Figure 3 is a page that functions to manage teacher data information such as number, nip, name, jk, address, cellphone number, email, education, school origin, username and status. On this page, the admin can deactivate and activate teacher data and delete teacher data.

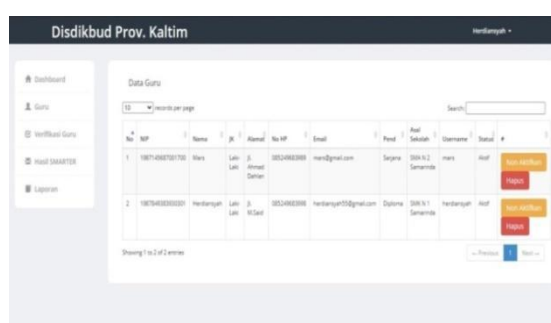


Figure 3. Teacher Data Input Page

3. Teacher Verification Page

Figure 4 is the teacher data verification page, containing data number, nip, name, school origin, education, diploma, position, SK Jab, SK Accreditation and status.

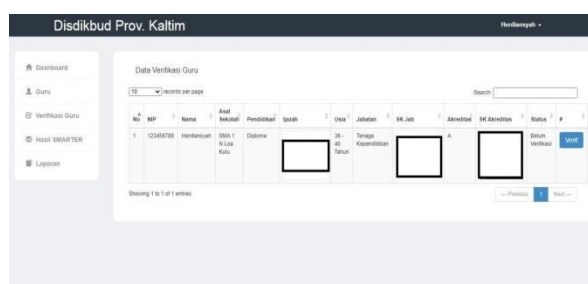


Figure 4. Teacher Verification Page

4. Calculation Results of the SMARTER Method

In Figure 5 is the data from the SMARTER selection, containing data no, ID, name, school origin, education, age, position, accreditation, status and results.

Figure 5. Calculation Results of the SMARTER Method

4. Conclusion

From the results of the experiment using 4 input criteria for one of the applicants, the Outcome Value for the Education criteria utility value X real value, $0.0761 \times 2 = 0.1521$, Age $0.1412 \times 4 = 0.5648$, Position $0.0213 \times 2 = 0.0426$, Accreditation $0.0385 \times 4 = 0.0235$. From the sum of each criterion using the SMARTER method, the result is 0.7840. The decision to whiten study permits and teacher learning assignments using the SMARTER method is good, with the application of web-based applications producing relatively fast, precise, and appropriate information for whitening teacher study permits and assignments, and can be done without time constraints with the application of web-based applications.

5. Suggestion

- a. For further research, it is possible to make decisions using a comparison of decision support system methods to see the accuracy of the system in determining the bleaching of study permits and teacher assignments.
- b. Subsequent system developments can use an android/ios mobile-based system so that the assessment process becomes easier.

References

- [1] P. Gubernur *et al.*, "Gubernur kalimantan timur," no. 2, 2019.
- [2] M. I. Ukkas, H. Pratiwi, and D. Purnamasari, "Sistem Pendukung Keputusan Penentuan Supplier Bahan Bangunan Menggunakan Metode Smart (Simple Multi Attribute Rating Technique) Pada Toko Bintang Keramik Jaya," *Sebatik*, vol. 16, no. 1, pp. 34–43, 2016, doi: 10.46984/sebatik.v16i1.73.
- [3] H. Pratiwi, *Penjelasan sistem pendukung keputusan*, no. May. 2020. [Online]. Available: <https://www.researchgate.net/publication/341767301%0APENJELASAN>
- [4] R. Septiana Razak, Sutardi, and T. LM, "Sistem Pendukung Keputusan Pemberian Bantuan Alat Industri Menggunakan Metode SMARTER Berbasis Web SIG," *semantik*, vol. 2, no. 1, pp. 297–308, 2016.
- [5] H. Ardiansyah, M. B. S. Juniarto, and S. Machfud, "Sistem Penunjang Keputusan Penentuan Penerima Dana Bantuan Rumah Tidak Layak Huni Dengan Metode Smarter Dan Topsis Pada Desa Rawakalong," *J. SAINTEKOM*, vol. 10, no. 1, p. 26, 2020, doi: 10.33020/saintekom.v10i1.98.
- [6] R. Fahlepi, "DECISION SUPPORT SYSTEMS EMPLOYEE DISCIPLINE IDENTIFICATION USING THE SIMPLE MULTI ATTRIBUTE RATING TECHNIQUE (SMART) METHOD," vol. 1, no. 2, pp. 103–112, 2020.
- [7] D. P. Utomo and B. Purba, "Sistem Pendukung Keputusan Penilaian Kinerja Tenaga Kependidikan (TENDIK) Dengan Menggunakan Metode SMARTER," *J. Komtika (Komputasi dan Inform.)*, vol. 5, no. 2, pp. 140–152, 2021, doi: 10.31603/komtika.v5i2.5619.
- [8] A. Saleh, "Penerapan Metode Simple Multi Attribute Rating Technique Exploiting Rank

- dalam Sistem Pendukung Keputusan Rekrutmen Asisten Laboratorium Komputer,” *J. Masy. Telemat. dan Inf.*, vol. 8, no. 1, pp. 2–6, 2017.
- [9] T. Elizabeth, “Sistem Pendukung Keputusan Pemberian Potongan Harga Pada Toko Bangunan Dunia Baru Menggunakan Metode SMARTER,” *JATISI (Jurnal Tek. Inform. dan Sist. Informasi)*, vol. 9, no. 2, pp. 1608–1620, 2022, doi: 10.35957/jatisi.v9i2.2521.
- [10] W. G. Pradhana and A. Y. Chandra, “Sistem Pendukung Keputusan Diskon Asuransi Dengan Metode Smarter,” *J. Teknol. Dan Sist. Inf. Bisnis*, vol. 3, no. 2, pp. 431–441, 2021, doi: 10.47233/jteksis.v3i2.299.
- [11] Y. Yunita, “Implementasi Metode Simple Multi-Attribute Rating Technique Exploiting Rank (SMARTER) Pada Sistem Pendukung Keputusan,” *Kntia Unsri*, vol. 4, pp. 57–60, 2017.
- [12] KRISMIAJI, *No Title*. Yogyakarta: UPP STIM YKPN, 2010, 2015. [Online]. Available: <http://balaiyanpus.jogjaprovo.go.id/opac/detail-opac?id=256950>