Jurnal Teknik Informatika C.I.T Medicom, Vol. 12 No. 2, September (2020) p-ISSN 2337-8646 e-ISSN 2721-561X

Contents lists available at Publisher Institute of Computer Science (IOCS Publisher)

Jurnal Teknik Informatika C.I.T Medicom

journal homepage: www.medikom.iocspublisher.org/index.php/JTI

Method of Systematic Literature Review for Identification of Lecture Scheduling Information Systems

Yuggo Afrianto[1,*], Berlina Wulandari[2], Novita Br Ginting[3], Suratun[4]

[1,2,3,4]Department of Informatic Faculty of Engineers, Ibn Khaldun University, 16162, Bogor, Indonesia

*Email: yuggo@uika-bogor.ac.id **
** Corresponding author*

ARTICLE INFO

Article history:
Received: 27/01/2020
Revised: 31/01/2020
Accepted: 01/02/2020
Available online 01/03/2020

Keywords:
SLR,
Scheduling,
Information Systems,
Search Method.

ABSTRACT

Lecture scheduling becomes a problem for every university if it is still conventional in its management. Various methods of developing information systems and algorithms that can be applied to solve scheduling problems. The contribution of this research is to find a search method that has not been widely used in scheduling problems. The SLR method was used in the study. The results show that the information system for lecture scheduling can be a solution in making computerized lecture schedules based on the web, with the findings of various similar studies, there are also systems development methods that can be used such as Rapid Applications Development.

1. Introduction

Information systems in an organization continue to develop, it is said to be conventional if recording and filing is in hardcopy, in the present era it has begun to be computerized so that all business processes that occur are carried out and assisted using computers. With the advancement of information systems, every organization is competing to create complex and useful information systems for their business processes. Information systems provide daily transaction data processing needs that support the organization's operating functions to store, retrieve, modify and process the information received so that an organization can achieve its stated goals.[1][2][3] [4].

Lecture scheduling becomes a problem for every university if it is still conventional in its management. In planning the learning process the study program requires a mechanism that can facilitate the lecture scheduling process. Various methods of developing information systems, from structured to object-based methods. Based on this development method, it will be determined which device the information system will run on. Such as web-based, mobile, or desktop[1], besides that, it is necessary to find an algorithm that can solve the lecture scheduling problem which is still not widely used.

From some of the problems above, this study identifies possibilities that can be done in conducting further research. The identification process uses the Systematic Literature Review (SLR) method. By using the SLR method, a systematic review and identification of journals can be carried out in which each process follows the steps or protocols that have been set. In addition, the SLR method can avoid subjective identification and it is hoped that the identification results can add to the literature on the use of the SLR method in journal identification.[5][6].

2. Method

In Figure shown. Stage 1 is planning where step 1 identifies needs in the review literature. As determining the objectives of the literature review research, look for similar literature research on lecture schedulers, which have been discussed in the Introduction section. Step 2 compile an SLR protocol that contains a plan of procedures and methods selected in the study. Stage 2 is the implementation of the procedures and methods specified in the SLR protocol, and Phase 3 is to create a report on the results of the Phase 1 and 2 research.

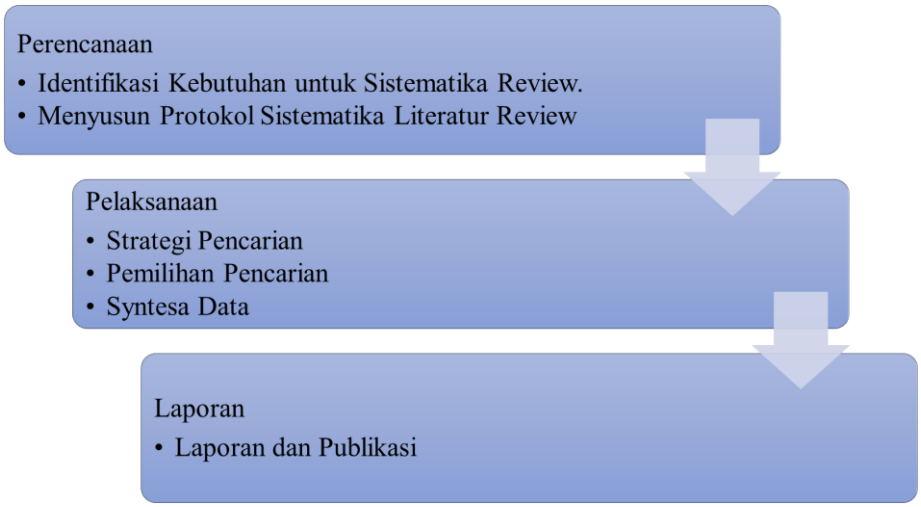

Fig1. SLR stages

In Figure shown. Stage 1 is planning where step 1 identifies needs in the review literature. As determining the objectives of the literature review research, look for similar literature research on lecture schedulers, which have been discussed in the Introduction section. Step 2 compile an SLR protocol that contains a plan of procedures and methods selected in the study. Stage 2 is the implementation of the procedures and methods specified in the SLR protocol, and Phase 3 is to create a report on the results of the Phase 1 and 2 research.

3. Results and Discussions

A. Research purposes

The object of this research is lecture scheduling. Taking the lecture scheduling topic as the object of research has the following reasons:

1) The need for an information system for scheduling lectures that is conventional in nature and there are frequent delays in scheduling and there are still conflicting course schedules, in the implementation it becomes computerized.
2) The selection of lecture scheduling methods uses a variety of search methods in the Informed Searching Algorithm.

B. Research Question (RQ)

RQ (Research Question) or research questions are made based on the needs of the selected topic. RQ is made based on the criteria of Population, Intervention, Comparison, Outcomes, and Context, abbreviated as PICOC [1]. The PICOC results for the preparation of the RQ are shown in Table 1.

Table 1.
PICOC

Population	Information Systems, Lecture Scheduling Systems, Artificial Intelligence Algorithms
Intervention	Lecture Scheduling Information System Design, Hard and Soft Contraint Indicators in Course Scheduling, Search Methods in scheduling, systems development methods in information systems
Comparison	n / a
Outcomes	Lecture Scheduling Information System using artificial intelligence methods for informed searching
Context	Lecture Scheduling and Decision Maker Faculty of Engineering and Science

The results of the preparation of PICOC, obtained research questions that were built into the study, as shown in Table 2.

Table 2.
Research Questions (RQ)

ID	Research question	Aim
RQ1		Obtain indicators used for hard parameters (must be met) and soft constraints (strived to be met) so as to

ID	Research question	Aim
	What constraint indicators are used for hard (must be met) and soft (attempted to be fulfilled) in course scheduling?	achieve the agreed goals as close as possible.
RQ2.	What scheduling methods are widely used to complete the course scheduling development?	Obtain what methods are used to complete the course scheduling development.
RQ3	What application platforms are often used in lecture scheduling information systems?	Get an application platform that will be used in the lecture scheduling information system.
RQ4	What information system development methods are widely used for information system application development?	Obtain a search method for information system application development.
RQ5	Which journals are the most significant in scheduling?	Identify the most significant journals
RQ6	What topics and trends do researchers choose about scheduling?	What topics and trends do many researchers choose about scheduling.

The RQ results in table 2, can be drawn into a mind map to identify the systematic literature review about lecture scheduling information systems using artificial intelligence algorithms in the search method, and what constraint indicators are used for course scheduling, shown in Figure 2.

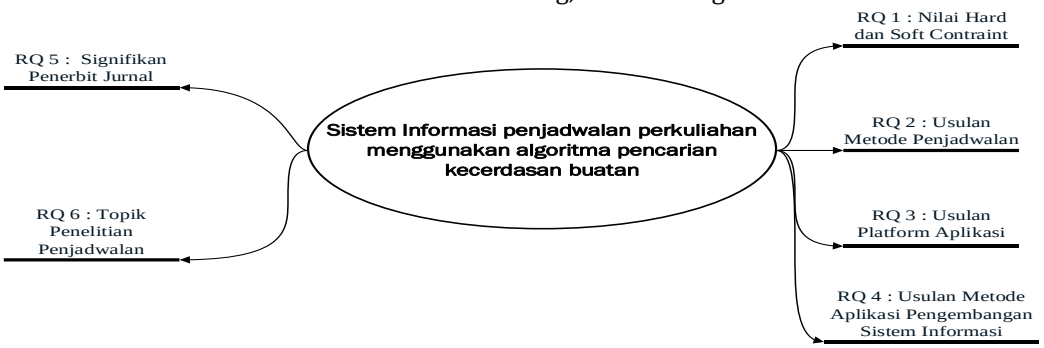

Fig 2. Literature Research Mind Map

C. Literature Search Process

Relevant sources for answering the Research Question (RQ) and other related references [8]. The search process is carried out in several stages, such as selecting a digital repository, defining the search string, performing a search, refining the search string and retrieving the initial list of major studies from the digital repository that match the search string. Before starting the search. The most popular literature databases in the field were searched to have the widest possible set of studies. A broad perspective is required for broad literature coverage such as the Scopus repository (scopus.com) and google scholar (scholar.google.com)[8]. The search string is developed by the following steps:

1) Identify search terms from PICOC, especially from Population and Intervention
2) Identify the search term from the research question
3) Identify search terms in titles, abstracts, and relevant keywords
4) Identify synonyms, alternative spellings, and antonyms for search terms
5) The search string construction uses search terms that are identified using the Boolean AND and OR operators [9].

D. Inclusion and Exclusion Criteria

The inclusion and exclusion criteria of this stage are carried out to decide whether the journal found is suitable for use in research or not. A study is eligible to be selected if there are the following study criteria:

1) The data used is in the period 2014–2019.
2) Data obtained through the Scopus website for journals in English.
3) Data obtained through the google scholar site for journals in Indonesian.
4) The data used is only journal type.
5) The data used is only journals obtained by PDF files.
6) The data used is only related to information systems or information systems.
7) The data used is only related to Scheduling Lectures or Scheduling Lectures or Time Table Lectures.

E. Quality Assessment (QA)

The results obtained from the inclusion and exclusion criteria, the data obtained will still be evaluated based on the following QA criteria questions:

1) QA1: Does the journal paper discuss Constraint Indicators in course scheduling?
2) QA2: Does the journal paper write a method for completing the course scheduling development?
3) QA3: Does the journal paper write down what application platform is used in the lecture scheduling information system?
4) QA4: Does the journal paper write what information system development methods are used?
5) QA5: Does the article come from the publisher of a relevant journal?
6) QA6: What topics and trends do researchers choose about scheduling?

F. Data collection

The result of data collection is the stage where data for research are collected [4]. Data is collected from journals from Scopus and Google Scholar. Data collection in the study was obtained through several stages, including:

1) Observation (Observation) is the stage of collecting data through direct observation to the source, namely: Scopus and Google Scholar using publish or perish software.
2) Documentation is the stage where the data that has been collected is stored into Mendeley, NVIVO 12, and Office devices for processing and documentation.

The following are the steps for collecting data from observation to documentation obtained through Scopus and Google Scholar. The use of publish and perish tools is shown in Figure 3.

1) Open publish or perish software
2) Choose a search through the Scopus and Google Scholar databases.

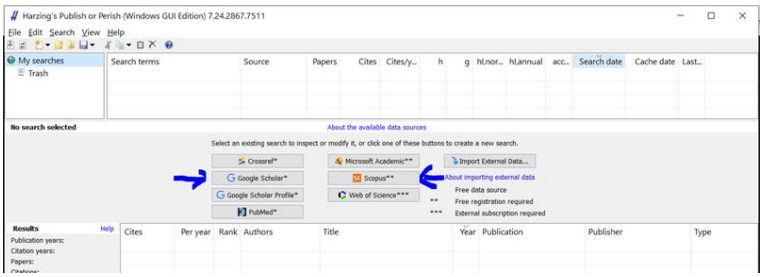

Fig 3. Journal Search With Publish Or Perish

3) In the search attribute, choose 2014–2019 to determine the source year, publication name "Journal" for Scopus source and "Journal" for google scholar source, keywords "information systems AND | scheduling OR time table | AND lectures AND artificial intelligence AND search methods AND software development models "for scopus resources and" information systems AND scheduling AND lectures AND artificial intelligence AND search methods AND software development models ". After that click Search, it will display the title, year of publication, and the name of the author. The results displayed by the Scopus search process are 198 articles in English and 33 articles in Google Scholar, as shown in Figure 4.

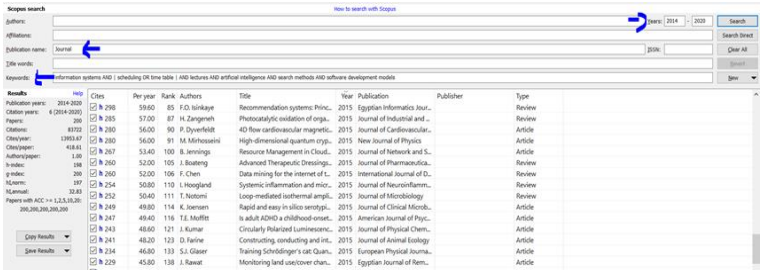

Fig 4. Keyword Search Results

4) The results of data collection based on the search process are combined between search results from Scopus and Google Scholar. Based on the inclusion criteria for journal types and the number of articles published, the journal is a PDF type, and the journal contains content about scheduling lectures or time table lectures, as shown in Table 3.

Table 3.
Google Scholar and Scopus Data Search Results

Inclusion Criteria	amount
Total Journal Results Year Range and Keyword Search	231

Inclusion Criteria	amount
PDF Journal Total	219
Total Journal There is the word "Scheduling Lectures OR Scheduling Lectures OR Time Table Lectures"	209

G. Results of Selection for Inclusion and Exclusion Criteria.

In total, 231 journals went through the search process. After the data were selected based on inclusion and exclusion criteria using the keyword "Lecture Scheduling OR Scheduling Lectures OR Timetable Lecturer", there were a total of 209 documents which were then reselected with a QA quality assessment to answer each RQ that had been determined based on the frame of mind. QA Assessment Quality Results Based on the predetermined QA criteria, to find out the number of journals that fulfill each QA of 209 documents can be seen in Table 4.

Table 3.
Quality Assessment (QA)

Quality Assessment (QA)	amount
QA1. Does the journal paper discuss the Constraint Indicator in course scheduling?	1
QA2. Does the journal paper write a method for completing lecture scheduling?	2
QA3. Does the journal paper write what application platform is used in the lecture scheduling information system?	4
QA4. Does the journal paper write what information system development methods are used?	2
QA5. Does the article come from the publisher of a relevant journal?	231
QA6. What topics and trends do researchers choose about scheduling information systems?	20

H. Data analysis

Overall, there were 209 journals that went through a search process and were reselected based on inclusion and exclusion criteria, then these journals were synthesized based on QA. The results at this stage show the answer for each RQ, as follows:

1) Constraint indicators are used to meet hard (must be met) and soft (seek to fulfill) in class scheduling (referring to RQ1).
   From the QA results, there is 1 relevant journal article discussing the Constraint Indicator in lecture scheduling which is used to answer the first RQ with the query "hard + constraint" OR "soft + constraint", as shown in Figure 5.

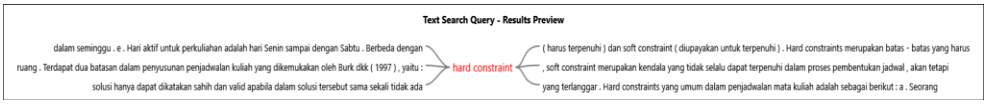

Fig 5. Constraint RQ indicator 1

Based on the journal [10] what is obtained is mentioned the hard constraint indicators are:

a. A lecturer can only teach courses for one location at a certain time.
b. A student can only attend lectures for one location at any given time.
c. A location (room) can only be used for one course at a certain time.
d. A course with a weight of 3 credits is scheduled with one meeting a week.
e. Active days for lectures are Monday to Saturday.

As for soft constraints are:

a. Lecturers can ask for a specific teaching time they want.
b. Placement of the schedule for the time that has been requested by the lecturer is adjusted to the priorities of the lecturer.

2) The method used to complete lecture scheduling (refers to RQ2).
   From the QA results, there are 2 relevant journal articles discussing the method used in course scheduling to answer the second RQ by querying "method + scheduling" OR "scheduling + method", as shown in Figure 6.

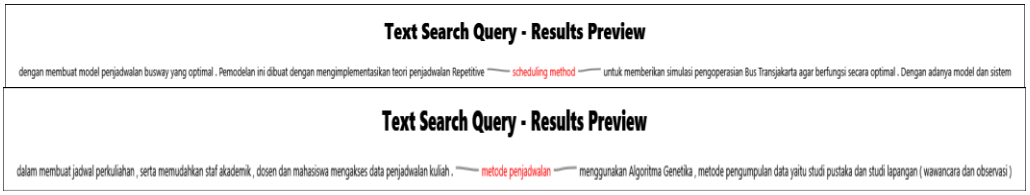

Fig 6. RQ Scheduling Method 2

In the journal, it is stated that according to (Laksono, 2016) and (Affandi, 2017) genetic algorithms can be used as a method of solving lecture scheduling problems.

3) What application platforms are often used in lecture scheduling information systems (refer to RQ3).
From the QA results, there are 45 relevant journal articles discussing the application platform used in course scheduling to answer the third RQ by searching for a commonly used platform for an application, such as web, mobile, desktop with query "web + based" OR "web + based" OR "based + mobile" OR "mobile + based" OR "based + desktop" OR "desktop + based", as shown in Figure 7.

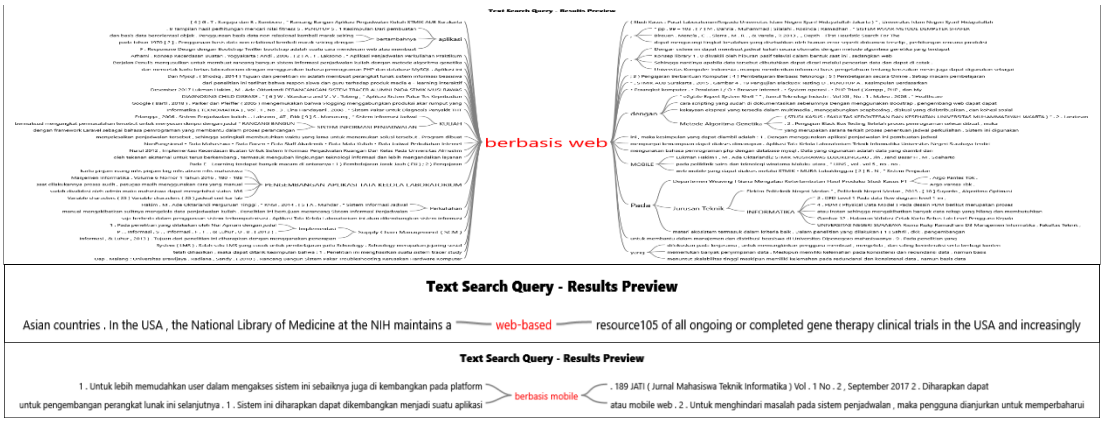

Fig 7. RQ Scheduling Application Platform 3

The number of these three platforms was obtained as shown in Table 5.

Table 5.
Total Usage of Scheduling Application Platform

Platform	amount
Mobile	2
The web	43
Desktop	0

Based on Table 5, it can be concluded that many application platforms developed for scheduling applications are web-based.

4) The information system development method used for the development of a lecture scheduling information system application (refers to RQ4).
From the QA results, there are 4 relevant journal articles discussing systems development methods used in the course scheduling to answer the fourth RQ with the query "method + development + system" OR "systems + development + method", as shown in Figure 8.

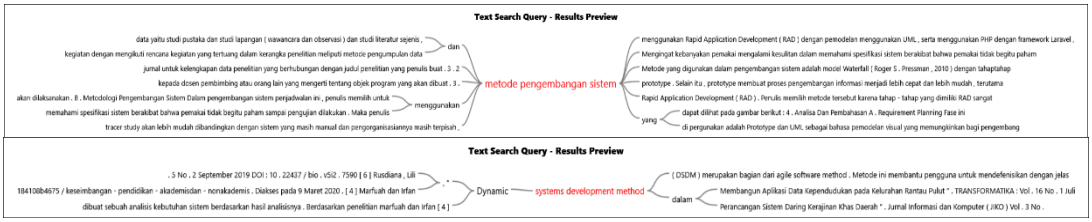

Fig 8. RQ System Development Method 4

From Figure 8 it can be concluded that the system development method used is the rapid application development method (RAD), waterfall, prototype, and agile.

5) The most significant journals are published in scheduling (refer to RQ5).
From the results of data collection, there are 231 relevant journal articles discussing the scheduling of courses to answer the fifth RQ, as shown in Figure 9.

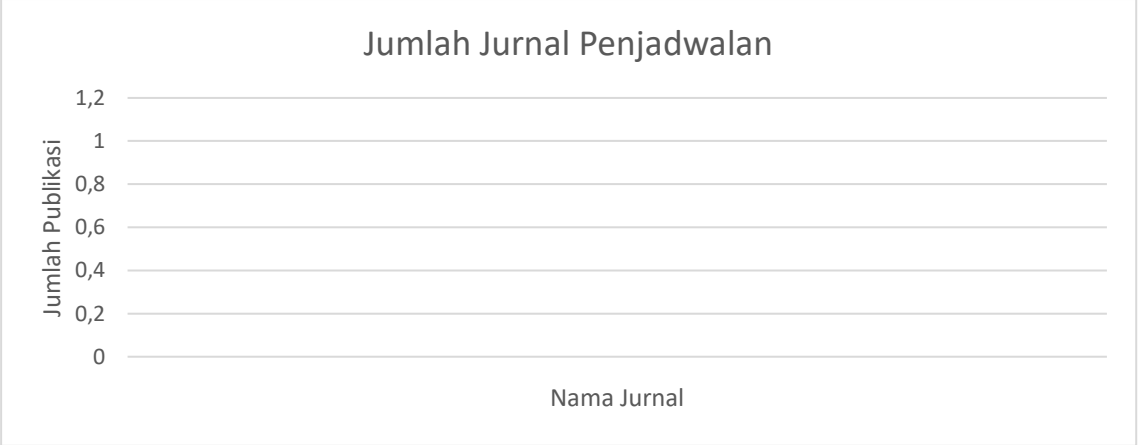

Fig 9. The most significant journals are published in RQ Scheduling Articles 6

From Figure 9 it can be concluded that the most significant journals published in lecture scheduling articles are the IEEE Journal on Selected Areas in Communications with 8 articles and the New England Journal of Medicine with 7 articles in the time range 2014-2019,

6) Topics and trends that most researchers choose about scheduling information systems (refer to RQ6). From the QA results, there are 2 relevant journal articles discussing the topic of course scheduling information systems to answer the sixth RQ with the query "system + information + scheduling" OR "scheduling + information + system", as shown in Figure 10.

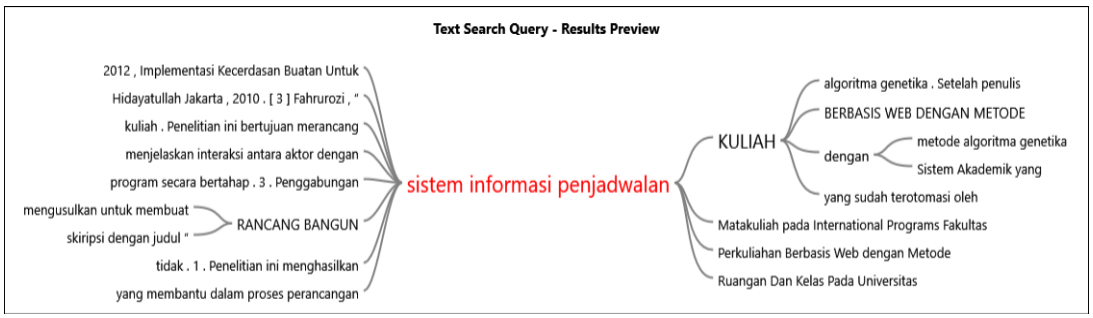

Fig 10. Topic of RQ Scheduling Information System 6

From Figure 8 it can be concluded that the topic of scheduling information systems is used for lectures, courses, lectures, and classrooms.

4. Conclusion

Based on the results of the research conducted, the information system for lecture scheduling can be a solution in making computerized lecture schedules based on the web by finding a variety of similar studies, there are also systems development methods that can be used such as Rapid Application Development. The next challenge is to be able to apply one of the methods in the informed searching algorithm for lecture scheduling problems, because in previous journals many genetic algorithms have been implemented.

Acknowledgment

The author is grateful to the Directorate of Research and Community Service, Directorate General of Research and Development of the Ministry of Research, Technology and Higher Education and the Faculty of Engineering and Science, Ibn Khaldun University who provided funding support for conducting research.

5. References

[1] E. Triandini, S. Jayanatha, A. Indrawan, G. Werla Putra, and B. Iswara, "The Systematic Literature Review Method for Identifying Platforms and Methods for Information System Development in Indonesia," *Indonesia. J. Inf. Syst.*, vol. 1, no. 2, p. 63, 2019.

[2] and AYANH Cahyana, B. Yuwono, "DEVELOPING WEB-BASED INVENTORY INFORMATION SYSTEMS IN PT. THE SUCCESSFUL SUPREME SON, "*Semin. Nas. Inf.*, vol. 1, no. 4, 2015.

[3] EA Hayat, E. Retnadi, and E. Gunadhi, "Designers of Web-Based Population Information Systems," *J. Algorithm*, vol. 11, no. 1, 2014.
[4] Y. Afrianto, NB Ginting, and Y. Nelawati, "INVENTORY INFORMATION SYSTEM P. O. WEB-BASED S (POINT OF SALES) ON CELLULAR COUNTER, "vol. 6, no. 2, pp. 125–134, 2020.
[5] B. Kitchenham and P. Brereton, "A systematic review of systematic review process research in software engineering," *Inf. Softw. Technol.*, vol. 55, no. 12, pp. 2049–2075, 2013.
[6] and APBR Barricelli, F. Cassano, D. Fogli, "End-user development, end-user programming and end-user software engineering: A systematic mapping study," *J. Syst. Softw.*, vol. 149, pp. 101–137, 2019.
[7] L. Latifah and I. Ritonga, "Systematic Literature Review (SLR): Competence of Human Resources for the Development of Islamic Banking in Indonesia," *Al Maal J. Islam. Econ. Bank.*, vol. 2, no. 1, p. 63, 2020.
[8] A. Yaman, A. Yoganingrum, Y. Yaniasih, and S. Riyanto, "Systematic Literature Review on Digital Literature Database: Research Trends, Methodology, and Coverage Fields," *Read J. Documentation And Inf.*, vol. 40, no. 1, p. 1, 2019.
[9] RS Wahono, "A Systematic Literature Review of Software Defect Prediction: Research Trends, Datasets, Methods and Frameworks," *J. Softw. Eng.*, vol. 1, no. 1, pp. 1–16, 2015.
[10] AC Saputra and AS Saragih, "Scheduling Application for Informatics Engineering Departments, Faculty of Engineering, Palangka Raya University with Genetic Algorithms," *Journal of Information Technology*. e-journal.upr.ac.id, 2018.