The Design and Development of an Academic-Result Transfer System: A Case Study in Thailand

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***Abstract*—This research aimed to design and develop an academic-result transfer system for the Faculty of Business Administration, Rajamangala University of Technology Isan, Thailand. The objectives of this research were to increase the efficiency and save time in academic-result transfer process. The proposed system could operate online as a web application. There are seven majors of the Faculty of Business Administration that put this system into practice with the students in the credit transfer program during 2020–2021 academic years. The proposed system saved a lot of time and helped make the academic-result transfer work more conveniently and quickly. Moreover, the results of academic-result transfer were accurate. The concepts put forth by Jacob Nielsen were applied in users' satisfaction evaluation. The students, staffs, and instructors of all seven majors who were responsible for academic-results transfer gave the overall satisfaction scores of the proposed system at a very good level ($\bar{x}$ = 4.35, S.D. = 0.52). In addition, this research was registered as the intellectual property in literary works.**

***Index Terms*—Academic-results transferring, information system, credit transfer**

I. Introduction

Every academic year, there are transfers of academic results of new students enrolled in credit transfer programs of Accounting, Finance, General Management, Industrial Management, and Marketing Majors, Faculty of Business Administration, Rajamangala University of Technology Isan. Credits accepted for transferred were those of business administration and general education courses. Students who want to transfer their credits are those who graduated from College of Innovative Skills, Rajamangala University of Technology Isan as well as students who graduated from other vocational colleges around the country.

In transferring of academic results, there were complicated conditions and regulation. Currently, academic-results transfer could be done usually by having students fill in their academic results in a paper request form provided by the university. Academic advisors or instructors assigned to oversee academic-results transfer would provide initial advice. The instructor in charge would examine and correct, if any, the results of academic-results transfer accordingly. The paper form would then be passed to responsible officers for another review. If there was any need for correction, the form would be sent back to the instructor in charge to correct. There would be iteration of review and correction until the information was completely correctly. The iteration process took time. Moreover, data were easily subject to human errors. During the period of COVID-19 pandemic, social distancing and reducing exposure to the disease were very important, thus working via online system was really emphasized.

Although there were a variety of credit transfer systems developed depending upon requirements of programs in the universities by the following developers, namely Suksawat [1], Nooyimsai and Khunthanarungroj [2], Rermrerk and Chairungsee [3], Thipphawan [4], Jankham *et al*. [5], Azizan *et al*. [6], Cheung *et al.* [7], Gleeson [8], Nurdiana *et al*. [9], those credit transfer systems had complicated conditions and regulations according to the context of each program.

Due to the aforementioned problems, it led to the conceptualization in designing and developing academic-result transfer system for business administration and general education courses for students in the Faculty of Business Administration, Rajamangala University of Technology Isan, Nakhon Ratchasima, to provide system for transferring credits obtained from previous vocational certificate or high vocational certificate or university levels to meet criteria and regulation set according to the Regulations of Rajamangala University of Technology Isan on the transfer of academic results 2019 [10]. The proposed system could help reduce steps and time consumed in the process. In addition, the system would be convenient to use, could be accessed from anywhere, at any time, could operate on multiple devices through internet, and decrease the use of paper. Its byproduct was the database of students whose credits transferred from other institutions which could be useful for other purposes in the future. The remainder of this paper is organized as follows. Section II describes the methodological aspects of this study. Section III explains the results of the study both the academic-result transfer system and its quality assessment. Finally, Section IV concludes the study in all aspects including recommendations and future work.

II. Methodology

This research and development study aimed to develop an academic-result transfer system for the Faculty of Business Administration, Rajamangala University of Technology Isan. The researcher studied and designed the system based on data on students' credit transfer courses in Academic Years 2020 to 2021 to develop a prototype for the operation in the following academic year. Conditions and criteria applied to the system derived from Regulations of Rajamangala University of Technology Isan on the transfer of academic results B.E. 2019. The design of system was based on System Development Life Cycle or SDLC [11] concept which can be divided into six phases as follows:

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A. Phase 1 (Problem Definition and Feasibility Study)

Phase 1 was to define the problem and conduct feasibility study with the following procedural steps.

Step 1 collecting students and academic record data, examples of transcript from students in credit transfer programs in Academic Year 2019.

Step 2 classified courses and criteria for credit transfer for business administration and general education courses and conducted review of literature and related concepts.

Data collection in this study were conducted by compilation of documents related to Regulations of Rajamangala University of Technology Isan on the transfer of academic results B.E. 2019 revised based on the resolution of Academic Council of Rajamangala University of Technology Isan as well as obtaining of data about course titles, course number, credits of each course, and conditions for credit transfer from officials, responsible persons or those with work experiences on academic-results transfer.

B. Phase 2 (Analysis)

Phase 2 was to analyze problems in academic-results transfer process, all people involved in each step, additional regulations of each major, as well as problems occurred during the process that students as users, instructors, and university personnel encountered from previous years.

C. Phase 3 (Design)

Phase 3 was to take results obtained from logical analysis to design the system, reports, user interface, data dictionary, as well as create system framework and design rule-based used in credit transfer of courses according to the regulations.

The conceptual framework for design and development of academic-result transfer system for the Faculty of Business Administration, Rajamangala University of Technology Isan could be shown in Fig. 1.

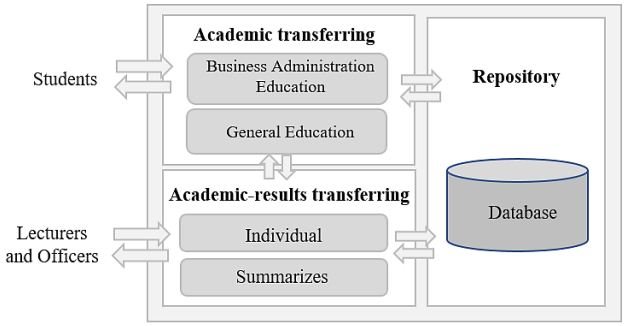

Fig. 1. Conceptual framework for development of academic-result transfer system for the Faculty of Business Administration.

D. Phase 4 (Development)

This phase involved program development by creating algorithm or programming to establish the system including testing of the proposed system. The tool used for the system development should fit with the technology currently utilized. The system was developed by using ASP.NET technology of Visual Basic language along with the database system created by MS SQL Server 2019.

E. Phase 5 (Implementation)

Phase 5 was the step of applying the newly developed academic-result transfer system in the real settings and evaluating its efficiency. The system was implemented for students enrolled in credit transfer programs in seven majors offered by the Faculty of Business Administration, namely, Accountancy major, Finance major, Marketing major, Management major, Industrial Management major, Logistics Management major, and Information Technology and Digital Business Innovation major, in Academic years 2020 and 2021.

A questionnaire was used as a tool for the evaluation of system efficiency. The questionnaire was tested for its validity by three experts who examined correctness of questions and consistency with the research objectives. The consistency was determined by calculating item objective congruency (IOC) Index. The researcher then revised the questionnaire based on experts' advice before using it in the real settings. The questionnaire was divided into two parts as follows:

Part 1 was consisted of close-end questions for evaluating five aspects of usability according to a concept put forth by Nielsen [12], namely, Learnability, Efficiency, Memorability, Errors, and Satisfaction.

This research applied 5-level Likert's Scale [13] criteria for the system quality assessment as shown in Table I.

TABLE I: RATING CRITERIA OF SYSTEM QUALITY ASSESSMENT

Qualitative	Quantitative
Very good	4.21–5.00
Good	3.41–4.20
Fair	2.61–3.40
Poor	1.81–2.60
Very poor	1.00–1.80

Part 2 Recommendations those experts had towards the system

When the system was implemented in the real settings, an expert team of 5 consisted of university officers and academic advisors with experiences in overseeing academic-results transfer answers the questionnaire and provide opinions for the system quality assessment. After the completion of assessment, the researcher analyzed those assessment data by using arithmetic mean for descriptive statistics and standard deviation for measuring data dispersion and make the conclusion about the software developed.

- Arithmetic Mean can be calculated from the following formula

$$\bar{x} = \frac{\sum x}{n} \quad (1)$$

where $\bar{x}$ is arithmetic mean; $\sum x$ is total sum of data; n is total number of data.

- Standard Deviation can be calculated from the following formula

$$S = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \quad (2)$$

where S is standard deviation; x is value of each data point of the sample; $\bar{x}$ is arithmetic mean; n is total number of data.

F. Phase 6 (Maintenance and Documentation)

Phase 6 was for setting the maintenance process after the system was installed and preparing users' manual.

III. Results

The results of this study in developing academic-result transfer system for the Faculty of Business Administration using system development life cycle (SDLC) concept were divided into two parts. The first part presented the outcome of academic-result transfer system development and the second part revealed the system quality assessment results, details as follows:

A. Outcome of Academic-Result Transfer System, Faculty of Business Administration

1) Result of design and development of database system

Database system design was done by analyzing relationship and designing database based on High-Level Conceptual Data Model using entity relationship (ER) Diagram [14]. Details of designing academic-result transfer system showing entity, attribute, and relationship was displayed in Fig. 2.

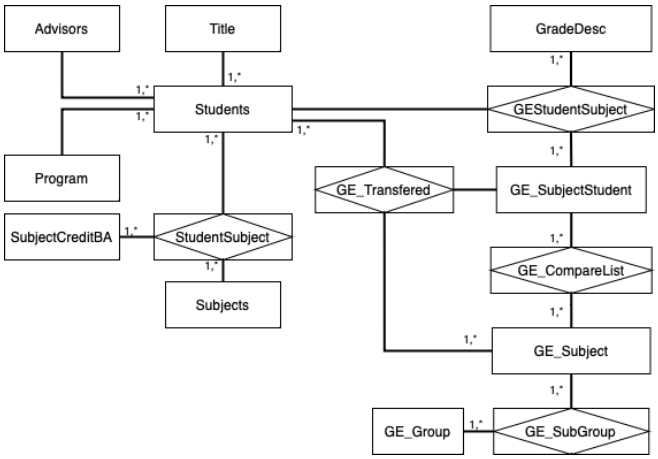

Fig. 2. Entity relationship diagram showing database of academic-result transfer system, faculty of business administration.

Fig. 2 showed entity relationship of database of academic-result transfer system, Faculty of Business Administration and detailed attributes of each entity. Data dictionary was created to provide details about data collected for each entity.

2) Results of development of academic-result transfer system, faculty of business administration

The academic-result transfer system for the Faculty of Business Administration was a totally new system development. It could be accessed through web browsers such as Chrome, Microsoft Edge, Firefox or Safari. The website for the system was developed and divided into two modules as shown below.

a) Module for student-related implementation

In this module, students could login to the system through web browsers, as shown in Fig. 3, by filling in 13-digit student identification number which has already been imported to this system by system officers. Student information could be retrieved from the university's education service system (ESS). In case students did not have data recorded in the system, they could click at "register" button to apply for being users in the system and fill in student identification number, name title, first name, last name, study major, study group, name of previous academic institution graduated, and previous academic certification earned. After registration, students could not immediately login to the system, but had to wait for approval after having data verified by system officers or academic advisor.

The steps of registration and approval for being registered user would be automatically notified to students via LINE group of academic-results transfer system website. Therefore, all students must be member of the LINE application group which could be done by scanning quick response (QR) code of the group appeared on the webpage in order to receive information from the system.

Fig. 3. First page of the system for student users.

Once students logged in the system, the main page of website would appear to provide operation menus for users. The student-related implementation module could be divided into four steps, namely 1) personal information, 2) business administration (BA) courses, 3) general education (GE) courses, and 4) results of academic-results transfer. Students could work with the system step by step, or could select to go to a specific step. The details of each step are as follows:

Step 1—Personal information. This menu or step was for students to fill in personal data required by the system and upload academic transcript from previous institution. The file for uploading could be in either PDF or image formats. Students could be able to update their own information until their advisor restricted the update. The update restriction would be applied only while advisors were processing the credit transfer or in the process of verifying results of academic-results transfer. Therefore, if students needed to update their information, they should inform their advisor in advance so that advisor could allow for their access to the system. During the time of updating information restriction, it would affect the update of data in other menus or steps as well.

Step 2—Business administration (BA) courses. This menu or step was for students to indicate courses in business administration subjects they wanted to have academic results transferred. Students could enter multiple BA course titles at once, if they had academic results from courses eligible for

credit transfer. BA courses, eligible for credit transfer according to the regulations, were courses that would display while they were typing the course titles.

Step 3—General education (GE) courses. This menu or step was for students to indicate courses in general education subjects they wanted to have academic results transferred and enter to the system. The whole process was similar to that of BA courses credit transfer.

Step 4—Results of academic-results transfer. This menu or step allowed students to look into the results of academic-results transfer they requested. In this step, it only displayed results of BA courses credit transfer according to the rule-based set and designed with details described earlier in the database design. An example for results of academic-results transfer was shown in Fig. 4.

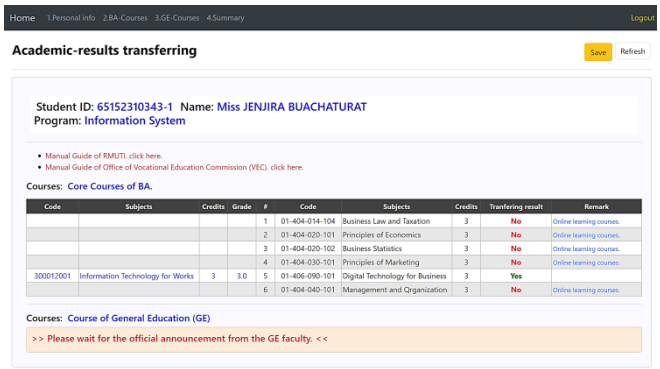

Fig. 4. Webpage showing academic results transfer of BA courses.

The official results of academic-results transfer for both BA and GE courses, however, would be later notified after the request was verified by academic advisor via the system website and also by system officers or advisor via LINE group.

b) Module for academic advisors and system officers

This module is for advisors or system officers' use. They could login to the system by entering username and password. Once they logged in, the main page of this module would appear with six operation menus as shown in Fig. 5 below.

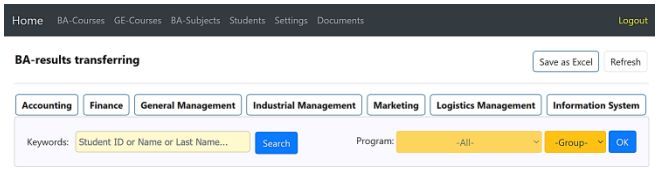

Fig. 5. Operation menus for academic advisors and system officers module.

1) BA credit transfer. This was a menu to validate results of academic results transfer in BA subjects. When users chose this menu, they could choose any course title to display a list of students and results of their credit transfer automatically according to the regulations set for credit transfer. Information about courses in this menu obtained from students previously described in the student-related module. Academic advisors could examine whether students correctly filled in information about courses requested for credit transfer. They could open to see the academic transcript and made corrections of courses requested for credit for each student individually. While advisor was examining the credit transfer requests, the system would not allow students to make any updates. Steps in correction or management of the list of course titles eligible for credit transfer were the same as those of students.

2) GE credit transfer. This menu was for validating results of academic results transfer of courses in GE subjects. When users chose this menu, users could select any course title to display the list of students similar to that of BA credit transfer. The updates and credit transfer of courses in GE subjects, however, would be done exclusively by advisors. The website would only arrange lists of subjects and course titles automatically, as shown in Fig. 6.

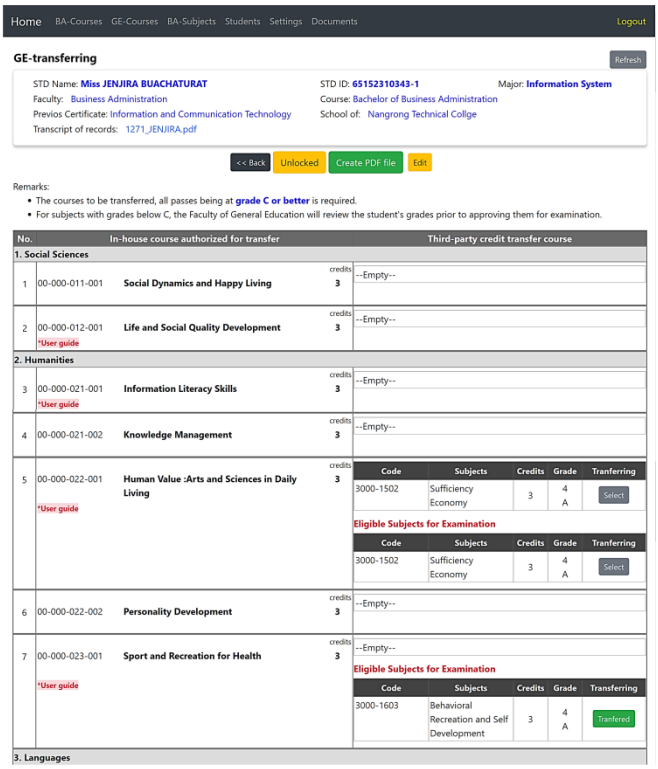

Fig. 6. Webpage showing results of academic results transfer for GE courses.

In transferring academic results in GE subjects, advisors could only choose a course for credit transfer once for each course title. Courses already chosen would not be used for credit transfer of other course titles. The selection of courses eligible for credit transfer must be done in accordance with the regulation of the transfer of academic results. Users could study from related documents or clicked at the button 'display course' of the system to see conditions required for credit transfer for a particular course.

After advisors finished consideration of academic-results transfer in GE courses, the system would automatically generate the report of academic results transfer of GE courses in PDF format.

3) BA courses. This menu was to manage the list of courses used for academic results transfer in BA courses. System officers or academic advisors can add other course(s) and set the course titles eligible for academic results transfer by themselves.

4) List of students. This menu was for examining list of students as well as assigning their right to access to the system or revoke their right to access to the system.

5) Help. This menu was to set how to turn on or turn off the system and announcement of news or information via LINE group automatically.

6) Related documents. This menu was to open and study documents related to academic results transfer. Users could also download documents for study.

B. Results of the Quality Assessment of the Academic-Result Transfer System, Faculty of Business Administration

The results of analysis of data obtained from the questionnaire to assess the quality of the academic-result transfer system showing arithmetic mean and standard deviation and quality level by each question were shown in Table II.

TABLE II: QUESTION STATEMENT AND RESULTS OF THE QUALITY ASSESSMENT

No.	Question statement	$\bar{x}$	$S.D.$	Level
1.	It did not take long for you to start to learn how to use this new website.	4.17	0.41	Good
2.	You could use this website very well by yourself without any assistance from specialists.	4.00	0.63	Good
3.	The website could display the results of operation quickly.	4.33	0.52	Very good
4.	The website could display the results of credit transfer correctly.	4.50	0.55	Very good
5.	The website could help facilitate academic-results transfer very well.	4.67	0.52	Very good
6.	You could easily memorize patterns and methods of how to use the system.	4.33	0.52	Very good
7.	When you used the website again, you could promptly use it without having to learn how to use the system again.	4.17	0.75	Good
8.	You did not find any errors while using the website.	4.17	0.41	Good
9.	The website used clear messages for communication	4.33	0.52	Very good
10.	The website used suitable graphics and color for displaying results.	4.67	0.52	Very good
11.	The layout of page compositions such as menu, graphs, were suitable.	4.67	0.52	Very good
12.	Overall, what was your satisfactory level for this website?	4.17	0.41	Good
Total		4.35	0.52	Very good

Table II revealed that the result of overall quality assessment of using the website was at a very good level ($\bar{x}$ = 4.35). Details of analysis to evaluate usability of the website in 5 aspects were shown below.

1) Learnability of software users

When considering Questions 1 and 2, it was indicated that users did not take a long time to learn how to use the new website, with the good quality assessment level ($\bar{x}$ = 4.17) and users could use the website very well without having assistance from specialists, also with the good quality assessment level ($\bar{x}$ = 4.00). In all, the assessment of learnability by users was at the good quality level ($\bar{x}$ = 4.08).

2) Efficiency of website usage

When considering Questions 3–5, it was indicated that the website developed could display results of its operation quickly, with the very good quality assessment level ($\bar{x}$ = 4.33); the website could display the results of credit trans correctly, with the very good quality assessment level ($\bar{x}$ = 4.50); and the website could help facilitate academic-results transfer very well also with the very good quality assessment level ($\bar{x}$ = 4.67). Overall, the assessment for the efficiency of website was at the very good quality level ($\bar{x}$ = 4.50).

3) Assessment of memorability

When considering Questions 6 and 7, it was indicated that users could easily memorize patterns and methods of how to use the website, with the very good quality assessment level ($\bar{x}$ = 4.33) and users were able to promptly use the system again without having to re-learn, with the good quality assessment level ($\bar{x}$ = 4.17). In summary, the assessment for memorability was at the very good quality level ($\bar{x}$ = 4.25).

4) Assessment for errors

When considering Question 8, it was indicated that users did not find any errors while using the website, with the good quality assessment level ($\bar{x}$ = 4.17).

5) Assessment for the users' satisfaction

When considering Questions 9–12, it was indicated that the website using clear messages for communication, the website using suitable graphics and colors for displaying results, and the webpages having good compositions layout at the very good quality assessment level, with arithmetic means of quality level at 4.33, 4.67 and 4.67 respectively. The satisfaction of the website assessed by users was at the good quality level ($\bar{x}$ = 4.17). In all, the assessment for the users' satisfaction was at the very good quality assessment level ($\bar{x}$ = 4.46).

IV. CONCLUSION

The objectives of this study on the development of an academic-result transfer system for the Faculty of Business Administration were to design and develop the academic-result transfer system for students enrolled in credit transfer programs of the Faculty of Business Administration. The proposed system would be able to transfer academic results from both business administration and general education courses earned from their previous institutions in order to increase efficiency and save time for processing the tasks and could be applied for the credit transfer system in other faculties or universities.

The proposed system could be used in transferring academic results for students enrolled credit transfer programs in all seven majors, namely Accountancy, Finance, Marketing, Management, Industrial Management, Logistics Management, and Information system and Digital Business Innovation. The system has been implemented since Academic Year 2020. In the following Academic Year of 2021, the proposed system saved a lot of time and helped make the academic-result transfer work more conveniently and quickly. Moreover, the results of academic-result transfer were accurate

Although the academic-result transfer system could help facilitate the academic results transfer work, creating rules for individual course credit transfer must be done only by programming. The future improvement is to develop the system to allow for adapting rules for academic results transfer on the webpage by users. Such development will create the flexible system which can be applied for other uses.

Additionally, the system should be further developed to facilitate works performed by other responsible personnel, for example, allowing officers or academic advisors overseeing general education subjects to be able to examine the results of academic-results transfer via the website.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

P.V. conducted a feasibility study, designed and developed the academic-result transfer system; P.K. evaluated the usability of the system and wrote the manuscript; all authors analysed the problem and requirements from all stakeholders and had approved the final version of the manuscript.

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REFERENCES

[1] S. Suksawat, "Development of application for transfer of academic credits," M.S. thesis, Master of Engineering (Computer Engineering), Graduate School, Chiang Mai University, Chiang Mai, Thailand, 2015.
[2] S. Nooyimsai and V. Khunthanarungroj, "Online transfer credit system for student in course of Information Technology Faculty of Science and Technology," Research Reports, Rajamangala University of Technology Srivijaya, Songkha, Thailand, 2015.
[3] A. Rermrerk and S. Chairungsee, "Course credit transfer for undergraduates: A case of Rajamangala of Technology Rattanakosin Wan Klai Kangwon Campus," in *Proc. Graduate School Mini-Conference 2018*, 2018, pp. 1223–1232.
[4] S. Thipphawan, "Development of transfer subject of Faculty of Humanities and Social Sciences at Nakhon Swan Rajabhat University," *Journal of Graduate Review Nakhon Sawan Buddhist College*, vol. 8, no. 2, pp. 337–346, Aug. 2020.
[5] S. Jankham, K. Tangjai, T. Kunakot, R. Phakdeeyingand, and N. Srihaphanrup," The development of credit transfer system of undergraduate student, Northeastern University," *Journal of Roi Kaensarn Academi*., vol. 5, no. 2, pp. 23–32, December 2020.
[6] N. Azizan, R. Isa, F. Farzana, A. Aziz, and M. Amiruddin, "The development of a web-based credit transfer application (CTA) for higher academic institution: from feasibility study to testing phase," *IOP Conference Series: Materials Science and Engineering*, vol. 1062, no. 1, pp. 1–7, February 2021.
[7] K. Cheung *et al*., "Prototype development of a cross-institutional credit transfer information system for community college transfer students," *Sustainability*, vol. 13, no. 16, 9398, Aug. 2021
[8] D. Nurdiana, A. Susilo, D. Astuti Aprijani, and A. Suryadi, "The development of web-based credit transfer applications in the Faculty of Science and Technology Universitas Terbuka (a case study in the information system program)," *International Journal of Global Operations Research*, vol. 2, no. 4, pp. 150–161, 2021.
[9] J. Gleeson, "The European credit transfer system and curriculum design: Product before process? Studies in Higher Education," *Studies in Higher Education*, vol. 38, no. 6, pp. 921–938, 2013.
[10] *Regulations of Rajamangala University of Technology Isan on the Transfer of Academic Results 2019*, Department of Registration, Rajamangala University of Technology Isan.
[11] O. Aiemsirivong, *System Analysis and Design*, Bangkok, Thailand: SE-EDUCATION, 2017, ch. 2.
[12] J. Nielsen. (2000). Why You Only Need to Test with 5 Users. [Online]. Available: http://www.useit.com/alertbox/20000319.html
[13] R. A. Likert, *New Patterns of Management*, New York: McGraw-Hill Book Company Inc., 1961.
[14] R. Karamagi, *Data Mining and Data Warehouse*. Independently published, 2020, ch. 2.