

# Decision support system for determining the activities of the study program using the Preference Selection Index

D Puspitasari<sup>1</sup>, I D Wijaya<sup>2</sup> and M Mentari<sup>3,\*</sup>

<sup>1</sup> Dept. of Informatics Engineering, State Polytechnic of Malang, Malang, Indonesia

<sup>2</sup> Dept. of Informatics Engineering, State Polytechnic of Malang, Malang, Indonesia

<sup>3</sup> Dept. of Informatics Engineering, State Polytechnic of Malang, Malang, Indonesia

\*must.mentari@polinema.ac.id

**Abstract.** Each year the study program carries out activities that have been planned through departmental meetings. However, study program activities that are not on target will result in less accreditation scores. Accreditation is a government effort to guarantee the quality of educational institutions. The value of accreditation determines the main assets in the field of education, the quality of study programs and the feasibility of graduates. Therefore, this study tries to provide a ranking formula for study program activities based on the assessment of study program accreditation forms. The system is built using one of type multi-criteria decision making (MCDM), namely the Preference Selection Index (PSI). PSI method using statistical concepts until preference index as a reference for alternative ranking. This developed system can help the department to recommend the main activities that can be done to support the efforts of the study program in achieving optimal accreditation values. Finally, it was concluded that the PSI method is the right method for problems that require decision support with a large number of attributes, such as the criteria used in recommendations for study program activities that have been adapted to the study program accreditation form assessment matrix.

## 1. Introduction

The process of evaluating and assess the quality of study programs is carried out by the assessment team using a standard that has been set and is called an accreditation form. Accreditation forms are assessment instruments that provide a reference to the value of accreditation based on several aspects. One aspect of the accreditation forms is all activities carried out in the study program. Study program activities especially for diploma study programs have activities that must be selected according to the highest level of importance and assessment score. This is because the teaching and learning process of diploma study programs has more time which is 60% practice and 40% theory. Therefore the activities carried out must be selected, useful and targeted.

The selection of activities that are right on target and in accordance with the accreditation forms requires the help of a system that can automatically decide based on several accreditation forms evaluation criteria, which activities must be majority conducted first or not. There is a method for calculating automatically the activities that the study program will carry out. Study program activities that are not on target will result in a lack of accreditation scores. In addition, if there are activities that are not appropriate and are always carried out every year, it will result in wasted labour, funds, and



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

effort. Some research on DSS is still being carried out until now, some of which are done by Vytautas et al [1]. This study contains an assessment of some neglected areas in the city of Vilnius using the COPRAS method. The sequence of the abandoned cities was successfully carried out in this study with the overall weight of the character in the form of quantitative data. Another study on SPK Multi Criteria Decision Making (MCDM) was conducted by Dožić et al [2]. The selection of aircraft types in regional airlines is a problem raised in this study. There are two methods used, namely the Analytic Hierarchy Process (AHP) and the Even Swaps Method (ESM). The AHP method was also carried out by Attri et al, regarding the life cycle stages of manufacturing production [3]. In addition to using AHP, other methods are also used and will compare which sequence of methods gives the best results according to computational time, simplicity, mathematical calculation required, requirements of weights or assignment of importance between attributes, and introduction of extra parameters. There are 11 methods that are compared, AHP occupies the best position 3 based on these criteria, while the method that occupies the highest position is Preference Selection Index (PSI). Based on some of the research described above, this research will develop DSS to determine study program activities in accordance with the accreditation forms of study programs using the PSI method.

## 2. Literature review

### 2.1. Borang accreditation (forms accreditation)

*Borang* is a tool for collecting and disclosing data and information used to assess the feasibility and quality of tertiary institutions. Self-evaluation is an attempt of a tertiary institution to find a picture of performance and condition through assessment and analysis carried out by the tertiary institution itself. The assessment and analysis can be carried out by utilizing peer experts from outside the tertiary institution, so that the self-evaluation can be carried out objectively. The assessor team conducted an assessment of the adequacy of the forms and a self-evaluation report prepared by the tertiary institution, followed by a field assessment.

### 2.2. Preference Selection Index (PSI)

According to Hall, a system is a series of two or more interrelated components or subsystems that unite to achieve the same goal [4]. The PSI method has been developed by Maniya and Bhatt to solve the MCDM problem [5]. PSI does not require assigning important relative values between criteria. Some stages to solve Multicriteria Decision Making (MCDM) problems using the PSI method are as follows:

- Define the problem
- Formulate a decision matrix

$$X_{ij} = \begin{bmatrix} 1 & 2 & 3 & \dots & \dots & N & \text{Attribute} \\ X_{11} & X_{12} & X_{13} & \dots & \dots & X_{1N} & 1 \\ X_{21} & X_{22} & X_{23} & \dots & \dots & X_{2N} & 2 \\ X_{31} & X_{32} & X_{33} & \dots & \dots & X_{3N} & 3 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ X_{M1} & X_{M2} & X_{M3} & \dots & \dots & X_{MN} & M \end{bmatrix} \quad (1)$$

- Decision matrix normalization  
Benefit

$$N_{ij} = \frac{x_{ij}}{x_j^{\max}} \quad (2)$$

Cost

$$N_{ij} = \frac{x_j^{min}}{x_{ij}} \quad (3)$$

- Calculate the average value of data that has been normalized

$$N = \frac{1}{n} \sum_{i=1}^n N_{ij} \quad (4)$$

- Determine the variant of the preference value

$$\phi_j = \sum_{i=1}^n [N_{ij} - N]^2 \quad (5)$$

- Determine the deviation from the preference value

$$\Omega_j = [1 - \phi_j] \quad (6)$$

- Calculates the overall preference value

$$\omega_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} \quad (7)$$

- Calculates the preference selection index

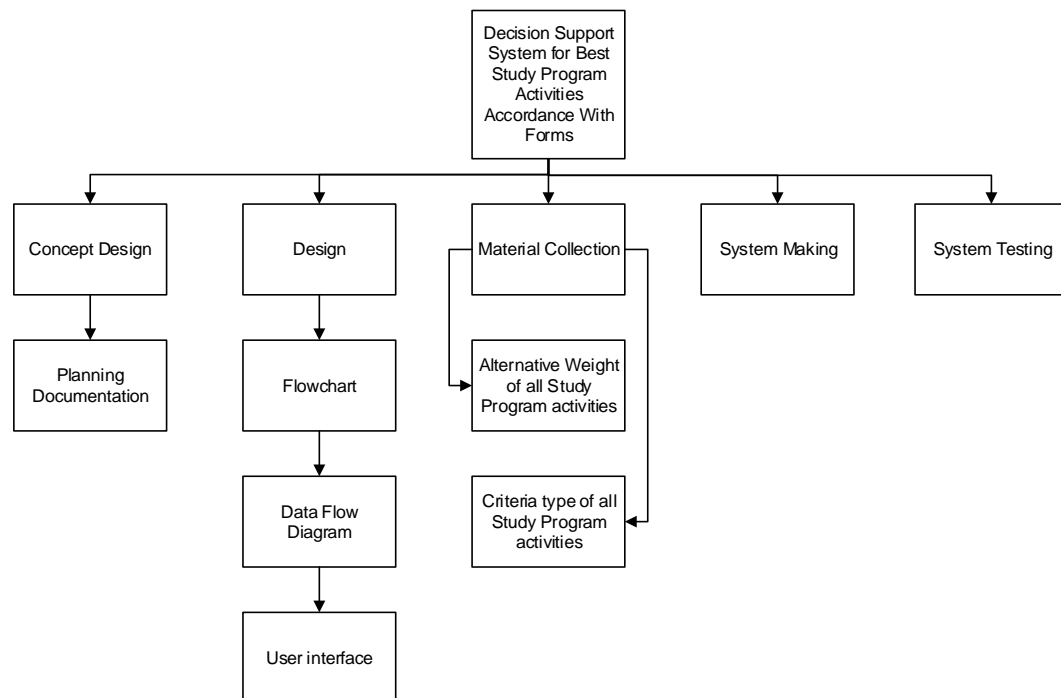
$$\theta_i = \sum_{j=1}^M X_{ij} \times \omega_j \quad (8)$$

### 3. Research methods

#### 3.1. Dataset

The study was conducted using a dataset in the form of a list of activities majoring in information technology in 2018, the type of research that is similar to the following year a total of 25 activities. The activity carried out in 2019, is also a dataset in this study to be used as a benchmark for the success of the PSI method in supporting activity selection decisions. And the reality is that in 2019 there will be a reduction in the number of activities in the field of information technology for state polytechnic of Malang by 18 activities. Both tables have columns with the name "standard". This means that all annual activities in the information technology department have been adjusted to the standard 7 accreditation forms assessment. In addition, the determination of alternative weights for each criterion (criteria taken from the 7 standard accreditation forms assessment form) was taken from the accreditation committee of the study program D3 Informatics Management in 2019.

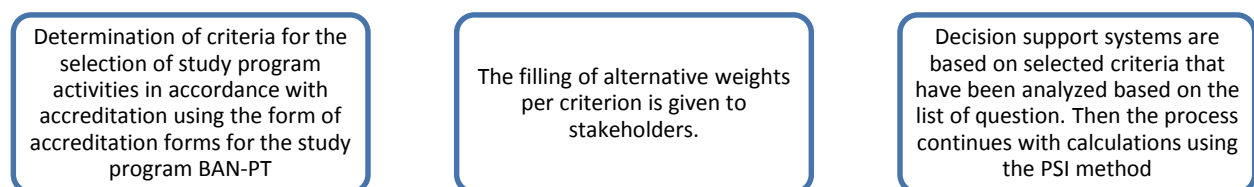
Research Design shown in Figure 1. Making work structures that will be applied to this system using the concept and flow of the Software Development Life Cycle and described in accordance with the work that must be done when making this system. In accordance with Figure 1 Decision Support System begins with the design of concepts that are adjusted with planning documentation. After that proceed with the design process in the form of flowcharts, DFDs and the creation of a user interface that will be used. Then the material collection stage is carried out to find out the alternative weights of all study program activities and the criteria weights for all study program activities.



**Figure 1.** Work breakdown structure.

### 3.2. Research step

Research Step shown in Figure 2. It research initialization with Determination of criteria for the selection of study program activities in accordance with accreditation using the form of accreditation forms for the study program BAN-PT. The row is a list of the activities of the majors in 2018, while the columns are adjusted to the points of each standard on the assessment form for BAN-PT accreditation.



**Figure 2.** Decision support system for determining the activities.

### 3.3. Result validation

The validation of the results in this study was carried out by comparing the rankings obtained in the list of activities of the State Polytechnic of Malang, Information Technology Department in 2018, with activities planned and carried out in 2019 for the same department.

## 4. Results and discussion

### 4.1. PSI results for standard 1, 2 and 3

The results of PSI calculations on standard 1, 2, 3 shown in table 1, table 2, table 3 show that in 2018 the activities that were in the bottom 3 were one of the activities "Peningkatan Layanan Kepada Mahasiswa - PELEPASAN".

**Table 1.** Bottom three DSS results using the PSI method for standard 1(from 2 evaluators).

No	Code	Alternative Name	Year	PSI	No	Code	Alternative Name	Year	PSI
1	A1_16	Perencanaan Monitoring dan Evaluasi PBM (Genap 2017/2018)	2018-2019	0.06088407	1	A1_19	Peningkatan Tata Kelola Organisasi di Prodi	2018	0.047518308
2	A1_1	Perencanaan Monitoring dan Evaluasi Kegiatan Jurusan dan Prodi D4 TI dan D3 MI	2018	0.056296914	2	A1_21	Lomba Tingkat Nasional "Logic Programming"	2018-2019	0.047518308
3	A1_12	Peningkatan Layanan Kepada Mahasiswa - PELEPASAN	2018-2019	0.056296914	3	A1_12	Peningkatan Layanan Kepada Mahasiswa - PELEPASAN	2018-2019	0.029698942

**Table 2.** Bottom three DSS results using the PSI method for standard 2(from 2 evaluators).

No	Code	Alternative Name	Year	PSI	No	Code	Alternative Name	Year	PSI
1	A2_3	Pengembangan Profil Prodi D-III MI (PSMI)	2018	0.145366445	1	A2_8	Peningkatan Kualitas Tugas Akhir Mahasiswa	2018-2019	0.056361239
2	A2_20	Peningkatan Layanan Kepada Mahasiswa - DDM	2018-2019	0.134665859	2	A2_23	Peningkatan Kualitas Mata Kuliah Praktikum	2018-2019	0.056361239
3	A2_12	Peningkatan Layanan Kepada Mahasiswa - PELEPASAN	2018-2019	0.109024833	3	A2_13	Peningkatan Kompetensi (Hardskill) dan Softskill Mahasiswa	2018-2019	0.052208306

**Table 3.** Bottom three DSS results using the PSI method for standard 3(from 1 evaluator).

No	Code	Alternative Name	Year	PSI
1	A3_7	Peningkatan Layanan Kepada Mahasiswa - DDM	2018-2019	0.480172066
2	A3_9	Penyelenggaraan Kuliah Tamu Bidang Teknologi Informasi dan Pengembangan Karakter	2018	0.422788145
3	A3_3	Peningkatan Layanan Kepada Mahasiswa - PELEPASAN	2018-2019	0.375071133

#### 4.2. PSI results for Standard 4

List of activities included in this standard is different from the activities in standards 1 to 3. The results of PSI calculations on standard 4, shown in table 4, show that in 2018 the activities that were in the bottom 3 were one of the activities "Pemutakhiran Dokumen Borang Program Studi ". But, in 2019. this activity is still the main activity that will be carried out for activities that are in accordance with standard 4 according to the results of the choice index value is still above 1.5 for all activities.

**Table 4.** Bottom three DSS results using the PSI method for standard 4(from 2 evaluators).

No	Code	Alternative Name	Year	PSI	No	Code	Alternative Name	Year	PSI
1	A4_1	Pemutakhiran Dokumen Borang Program Studi	2018	1.828507394	1	A4_2	Pelatihan dan Sertifikasi Kompetensi untuk ..	2018	1.92076066
2	A4_2	Pelatihan dan Sertifikasi Kompetensi untuk Tenaga Pendidik (PSTI)	2018	1.728456642	2	A4_3	Pelatihan dan Sertifikasi Kompetensi untuk Tenaga ...	2018	1.92076066
3	A4_4	Peningkatan Kualitas Mata Kuliah Praktikum	2018-2019	1.60857827	3	A4_1	Pemutakhiran Dokumen Borang Program Studi	2018	1.66213357

#### 4.3. PSI results for standard 5

List of activities included in this standard is different from the activities in standards 1 to 4. The results of PSI calculations on standard 5, shown in table 5, show that in 2018 the activities that were in the bottom 3 were one of the activities "Evaluasi dan Penyempurnaan Dokuman ". But, in 2019. this activity is still the main activity that will be carried out for activities that are in accordance with standard 5 according to the results of the choice index value is still above 1.5 for all activities.

**Table 5.** Bottom three DSS results using the PSI method for standard 5(from 2 evaluators).

No	Code	Alternative Name	Year	PSI	No	Code	Alternative Name	Year	PSI
1	A5_1	Evaluasi dan Penyempurnaan Dokumen Kurikulum Sesuai Panduan DIKTI (PSTI)	2018	2.793021513	1	A5_5	Peningkatan Kualitas Mata Kuliah Praktikum	2018-2019	0.591788056
2	A5_2	Evaluasi dan Penyempurnaan Dokumen Kurikulum Sesuai Panduan DIKTI (PSMI)	2018	2.793021513	2	A5_1	Evaluasi dan Penyempurnaan Dokumen .....	2018	0.555082735
3	A5_4	Perencanaan Monitoring dan Evaluasi PBM (Genap 2017/2018)	2018-2019	2.101489529	3	A5_2	Evaluasi dan Penyempurnaan Dokumen .....	2018	0.555082735

#### 4.4. PSI results for standard 6

List of activities included in this standard is different from the activities in standards 1 to 5. The results of PSI calculations on standard 6, shown in table 6, show that in 2018 the activities that were in the bottom 3 were one of the activities "Peningkatan Tata kelola Organisasi Prodi".

**Table 6.** Bottom three DSS results using the PSI method for standard 6(from 1 evaluator).

No	Code	Alternative Name	Year	PSI
1	A6_1	Pengembangan Profil Prodi D-IV TI (PSTI)	2018	2.156838029
2	A6_2	Pengembangan Profil Prodi D-III MI (PSMI)	2018	2.156838029
3	A6_5	Peningkatan Tata Kelola Organisasi di Prodi	2018	-10.13167196

#### 4.5. PSI results for standard 7

List of activities included in this standard is different from the activities in standards 1 to 6. The results of PSI calculations on standard 7, shown in table 7, show that in 2018 the activities that were in the bottom 3 were one of the activities "Peningkatan Tata kelola Organisasi Prodi".

**Table 7.** Bottom three DSS results using the PSI method for standard 7 (from 2 evaluators).

No	Code	Alternative Name	Year	PSI	No	Code	Alternative Name	Year	PSI
1	A7_1	Perencanaan Monitoring dan Evaluasi Kegiatan Jurusan dan Prodi D4 TI dan D3 MI	2018	0.69593062	1	A7_3	Peningkatan Publikasi dan Peran Serta ...	2018	0.409468439
2	A7_5	Pemutakhiran Dokumen Borang Program Studi	2018	0.653769179	2	A7_4	Peningkatan Kerjasama dengan .....	2018	0.376214701
3	A7_6	Peningkatan Tata Kelola Organisasi di Prodi	2018	0.36024016	3	A7_6	Peningkatan Tata Kelola Organisasi di Prodi	2018	0.372508306

#### 5. Conclusion

According to the facts, there are 25 departmental activities in 2018, and there will be a reduction in 2019 to 18 activities. These activities are increasingly reduced because many activities that are considered not too important if carried out alone and must be combined with other activities. For instance, according to the results of PSI recommendations from standard 1, 2, and 3 shows that one of the activities included in the bottom 3 is "Peningkatan Layanan Kepada Mahasiswa (Pelepasan)". In accordance with the reality in 2019 this activity does not stand alone and is combined with "Pembekalan Mahasiswa" activities. Following research number [3]. PSI method is appropriate and competent for the decision making problems having a large number of conflicting attributes like data study in this research.

#### Acknowledgments

Authors want to thank all colleagues from State Polytechnic of Malang in the Information Technology Department, State Polytechnic of Malang for the participation in this research.

#### References

- [1] Vytautas B, Marija B and Vytautas P 2015 Assessment of neglected areas in Vilnius city using MCDM and COPRAS methods *Procedia Engineering* **122** 29-38
- [2] Dožić S and Kalić M 2015 Comparison of two MCDM methodologies in aircraft type selection problem *Transportation Research Procedia* **10** 910-919
- [3] Attri R and Grover S 2015 Application of preference selection index method for decision making over the design stage of production system life cycle *Journal of King Saud University-Engineering Sciences* **27**(2) 207-216
- [4] Hall J A 2001 *Sistem Informasi Akuntansi Buku 1* (Jakarta: Penerbit Salemba Empat)
- [5] Maniya K and Bhatt M G 2010 A selection of material using a novel type decision-making method: Preference selection index method *Materials & Design* **31**(4) 1785-1789