Implementing SWOT analysis in engineering education

I Fardani*, I H Agustina and F A Jauzi
Regional and City Planning Department, Bandung Islamic University, Jl. Tamansari, Bandung, Indonesia

*irland.fardani@unisba.ac.id

Abstract. Information Technology-Based Education Management is an education system where the education management system includes the management of teaching and learning process data, student management of teacher and education staff as well as school infrastructure is carried out using Information Technology (IT). Several studies have discussed factors about what influences teachers in using IT, which is access to resources, quality of software and hardware, ease of use, incentives to change, support, and collegiality in their school, school, and national police. Problems arise when the teaching and learning process does not change while the world of IT change very rapidly, and people automatically follow the change of IT, because of that the world of education must adapt to this change. The purpose of this research is to see how IT can be implemented in the education environment and analyzed using SWOT. The result is that the Education and School services in Bekasi Regency is in quadrant 4, this showing that education in Bekasi Regency is in a very unfortunate situation, the organization faces various internal threat and weakness. For this reason, the need for an agenda activities related to planning, organizing, implementing and controlling the academic management system for elementary and junior high school in Bekasi Regency is implemented by Information Technology-based education procedures.

1. Introduction
Advances in information technology have changed the way people spend time, and how to do things, the benefits can be very broad. Now emerging new forms of change in the activities of people's lives as a result of the advancement of Information Technology, including the world of education. The world of education is among the most benefited from the advancement of Information Technology (IT) because it receives extraordinary benefits. The existence of technology becomes an inseparable component in the teaching/learning process [1]. One of the advantages of Information and technology in education that visually impaired people can more be educated because of the easiness of IT to use for them [2]. However, the readiness of the education world to absorb technological advances is still questionable, like how the students can use the e-learning system [3], many technological innovations in the education world have been made [4], but many education actors are not ready to adopt it [5], this is because there is no study from the government when preparing the application of information technology in the field of education.

One method that can be used to see the condition of an Education problem is to use the Strength Weakness Opportunities Threat (SWOT) analysis. The SWOT analysis can analyze the Education curriculum [6], e-learning method design [7], or the role of government in managing education. There are several inhibiting components for IT that can be applied in the education world in developing
countries, including infrastructure issues, government policies, politics, economic factors, and cultural factors [8]. In Bekasi regency, there has never been a study about the analysis of readiness of implementing IT in education.

This paper focuses on how to make a strategic policy step in the management of Education on the basis of an information system that has not been done by many related parties, to facilitate the delivery of information about the education available in Bekasi, especially for primary and secondary school education.

2. Method

2.1. SWOT analysis

SWOT analysis is a technique in dissecting cases as strengths, weaknesses, opportunities, and threats. Tendencies (trends) or occur by threatening the development or sustainability of the organization. SWOT analysis is used to find profits and improve the situation. Looking for profit is done by expansion, improving the situation by solving various problems encountered. The impact of conducting a SWOT analysis is the existence of basic conclusions. SWOT analysis is usually used to analyze internal and external factors to produce a decision support analysis [9].

In accordance with the focus of the study, after the identification of Internal Factors of strength (strength), weakness (Weaknesses), opportunities or opportunities (External Factors Opportunities), and threats (Threats) were found, then the Key Success Factors were assessed. To determine the success factors of the mission as strategic factors or key success factors, it is necessary to assess each identified factor.

To state the role and function of information technology in education (e-learning), it is necessary to analyze the SWOT method (strength, weakness, opportunity, and threat). The SWOT analysis stage is [10]:

- Identification of external and internal factors
- Give the variable value by weighting and rating from 1 to 5. The weight is multiplied by the rating of each factor to get a score for these factors.

2.2. Sampling method

The statistical approach is used to determine the number of selected samples that will be taken as a source of information; the method used is to use the Slovin formula [11], which is:

\[ n = \frac{N}{1 + Ne^2} \]

Where
- \( n \) : number of sample
- \( N \) : number of population
- \( e \) : error tolerance= 0.25

3. Result and discussion

3.1. Result

Based on the calculation of the number of samples using the Slovin approach, it was found that the minimum sample that had to be taken in this study was 9 districts, using the area sampling technique, which has a pattern that is almost the same as stratified sampling. The district that we collect the sample is Cikarang Pusat, Cibarusah, Setu, Cibitung, Cikarang Barat, Tambun Selatan, Babelan, Cabangbungan, Sukatani and North Cikarang. From the distribution of questionnaires and analysis in 9 sub-districts in Bekasi district, the resulting SWOT analysis can be seen as in the table below, table 1.
### Table 1. Education SWOT analysis.

| SWOT            | External Factor                                                                 | weight | rating | weight score |
|-----------------|---------------------------------------------------------------------------------|--------|--------|--------------|
| **Strength**    | Internet network has entered into all schools                                   | 0.417  | 5.000  | 2.083        |
|                 | The program / software is already running                                       | 0.433  | 4.000  | 1.732        |
|                 | Human Resources who are skilled in their fields                                 | 0.350  | 3.000  | 1.050        |
| **Total**       |                                                                                 |        |        | 4.867        |
| **Weakness**    | Computer facilities are still lacking                                            | 0.241  | 4.000  | 0.964        |
|                 | Human Resources Personnel are still lacking                                      | 0.356  | 4.000  | 1.424        |
| Education        | Management of the Education Authorities is not yet optimal in its sub-districts | 0.420  | 4.000  | 1.680        |
| Authorities      | Education data in Bekasi Regency cannot be accessed directly by the public     | 0.200  | 3.000  | 0.600        |
| **Total**       |                                                                                 |        |        | 4.668        |
| **Opportunity** | Make it easy to move the information from district to central government        | 0.471  | 4.000  | 1.884        |
|                 | Equitable education information                                                  | 0.329  | 3.000  | 0.987        |
|                 | Educational data will be updated to the latest every year                       | 0.289  | 2.000  | 0.578        |
|                 | All data regarding education will be easily controlled                          | 0.311  | 4.000  | 1.244        |
| **Total**       |                                                                                 |        |        | 4.693        |
| **Threat**      | Human Resources educators and educational abilities are not evenly distributed  | 0.456  | 4.000  | 1.824        |
|                 | Educational competitiveness                                                      | 0.491  | 4.000  | 1.932        |
|                 | Prone to hacking in the IT field                                                | 0.379  | 3.000  | 1.137        |
| **Total**       |                                                                                 |        |        | 4.893        |
| **Strength**    | Internet network already exists                                                 | 0.385  | 5.000  | 1.923        |
| School          | The application can be easily accessed                                           | 0.300  | 5.000  | 1.500        |
|                 | Skilled operators in their fields                                                | 0.431  | 3.000  | 1.293        |
| **Total**       |                                                                                 |        |        | 4.716        |
| **Weakness**    | There is overlapping work from the operator                                     | 0.444  | 4.000  | 1.778        |
|                 | Student data are incomplete (parental background)                               | 0.500  | 5.000  | 2.000        |
|                 | The available funds are inadequate to meet the needs of the education system    | 0.284  | 3.000  | 0.852        |
| **Total**       |                                                                                 |        |        | 4.630        |
| **Opportunity** | There is no cheating information from the region (transparent)                  | 0.625  | 5.000  | 3.125        |
|                 | Equitable education information                                                  | 0.375  | 3.000  | 1.125        |
| **Total**       |                                                                                 |        |        | 4.250        |
| **Threat**      | Operators must work extra                                                       | 0.571  | 4.000  | 2.286        |
|                 | Educational competitiveness                                                      | 0.429  | 3.000  | 1.286        |
|                 | Prone to hacking in the IT field                                                | 0.379  | 3.000  | 1.137        |
| **Total**       |                                                                                 |        |        | 4.709        |

### Figure 1. SWOT quadrant.
From table 1, we can draw the SWOT quadrants, as illustrated in figure 1. The SWOT analysis of the application of information and technology in education has a result that is in quadrant 4. This position proves a weak organization and faces big challenges. The suggested tactic is Defense Strategy, meaning that the internal conditions of the organization are in a dilemma alternative. Therefore the organization is advised to use a strategy of survival, controlling internal performance so as not to fall further. This tactic is maintained while continuing to improve.

3.2. Discussion
After knowing the position, the next is the suggestion and solution for the Education Authorities. The policy strategy taken based on SWOT is quadrant IV, meaning that this is a very disadvantageous situation; the organization faces various internal threats and weaknesses. So the strategy that must be taken is to optimize the strength (S) to face challenges (T), meaning that the internet network is strengthened with optimal applications by holding training courses for educators and education staff so that the capabilities are evenly distributed and can compete in the education world in general.

On the other hand, the policy strategy taken based on SWOT is quadrant IV for the schools, meaning that despite facing various threats, this organization still has internal strength. The strategy that must be applied is to use the power to take advantage of long-term opportunities using a diversification (product/market) strategy.

4. Conclusion
Bekasi District Education Office has a strategic point in quadrant IV, meaning that organizations face various internal threats and weaknesses. The strategy orientation that must be taken is FOCUS optimizing strength (S) to face challenges (T). Elementary and Middle Schools (SD, SMP, and PAUD) have a strategic point in quadrant IV, the same as the strategic conditions of the Education Office.

Therefore, the strategic policy orientation that must be taken is to focus like the education office but applied in the School scope.

Changes in the organizational structure and new governance of the Bekasi District Education Office since 2016, as well as the development of primary and secondary education laws and regulations, the Bekasi District Education Office has opportunities and challenges in structuring and adjusting education management towards achieving the established quality standards of education.

Bekasi Regency is ready in the management of information technology-based education because Bekasi Regency has met the standards to run an information technology-based education. The standards in implementing this program are:

- Availability of Internet Networks
- Hardware and Software
- Human Resources (HR)

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References
[1] Christensen R 2016 Teacher Indicators for Technology Enhanced Teaching and Learning: Expanding Outcomes from EDU SummIT 2015 1028–1035
[2] Ashraf M M, Hasan N, Lewis L, Hasan M R and Ray P 2016 A Systematic Literature Review of the Application of Information Communication Technology for Visually Impaired People Int J Disabil Manag. 11 pp 1–18
[3] Mosa A A, Naz’ri bin Mahrin M and Ibrahimm R 2016 Technological Aspects of E-Learning Readiness in Higher Education: A Review of the Literature Comput Inf Sci. 9 1 pp 113
[4] Serdyukov P 2017 Innovation in education: what works, what doesn’t, and what to do about it? J Res Innov Teach Learn. 10 1 pp 4–33
[5] Tondeur J, Pareja Roblin N, van Braak J, Voogt J and Prestridge S 2017 Preparing beginning teachers for technology integration in education: ready for take-off? Technol Pedagog Educ. 26 2 pp 157–177

[6] Bhardawaj P 2018 International Journal of Advance and Innovative Research 5 4 pp 269–272

[7] Kamrozzaman N A, Badusah J and Ruzanna W M 2019 Coggle: SWOT Analysis in Lifelong Learning Education Using Online Collaborative Mind-Mapping Int J Asian Soc Sci. 9 1 pp 139–147

[8] Bork A 2003 Barriers to using technology for education in developing countries Proceedings, ITRE 2003 - Int Conf Inf Technol Res Educ. 1990 pp 521–522

[9] Ghazinoory S, Esmail Zadeh A and Memariani A 2007 Fuzzy SWOT analysis J Intell Fuzzy Syst. 18 1 pp 99–108

[10] Leiber T, Stensaker B and Harvey L C 2018 Bridging theory and practice of impact evaluation of quality management in higher education institutions: a SWOT analysis. Eur J High Educ 8 3 pp 351–365

[11] Kosasi S, Prabowo H and Budiastuti D 2017 Improving information performance of schools in higher education through IT service management 2017 5th Int Conf Cyber IT Serv Manag CITSM