Smart school strategic design for information systems using framework ward & peppard in smk negeri 1 tampaksiring

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Abstract: Vocational School (SMK) is a formal institution which is aimed at producing graduates who are ready for the 21st century workplace. In order to do this, SMK Negeri 1 Tampaksiring has been improving the quality of the human resources through the implementation of technology in the learning process. It is started by updating the information systems and other supporting facilities like integrating planning, or blueprint, in regard to school information systems. These become a necessity in order to be aligned with the vision, mission and objective of SMK Negeri 1 Tampaksiring. A model design by Ward and Peppard was applied to analyze school internal conditions and activities inside the school. Furthermore, several tools namely SWOT analysis, value chain analysis, five force factor analysis, McFarrland Grid, and Critical Success Factor (CSF) analysis were used to analyze the purpose. The findings revealed that formation of Information and Communication Technology (ICT) and IT strategy required to design Local Area Network (LAN), e-Learning, and AplikasiBuku Point in its preliminary stage for the success of SMK Negeri 1 Tampaksiring. These results implies that SMK Negeri 1 Tampaksiring has pioneered itself to become a smart school.

1. Introduction

Strategic planning according to [1] is a continuous systematic process of making risky decisions by utilizing as much anticipatory knowledge as possible, organizing systematic efforts to implement these decisions and measuring the results through organized and systematic feedback.

Smart schools are schools that implement technology-based solutions in order to improve the efficiency of school management and also teaching and learning processes in order to enhance the quality of school [2]. Being smart school gives the school several benefits. First, the availability of an education data and information management system. Second, there is integrated educational data and information to support the decision-making process. Last, the availability of complete educational data and information for all school stakeholders [3].

Furthermore, Ward and Peppard method through the evaluation of IS/IT Strategic Planning was employed to give comprehensive assessment and understanding of the current situation both in the school environment and also both internal and external IS/IT environments. Through a deep understanding of current conditions, it will be possible to find alignment between the management strategy and IS/IT strategy to produce a system application portfolio product and a roadmap of future IS/IT development [4].

SMK Negeri 1 Tampaksiring is one of the national standards schools in Bali. This school has utilized information systems and information technology to carry out processes in the education sector.
information system currently used only focuses on three main areas, namely academics, general administration, and finance. To achieve its vision and mission goals, SMK Negeri 1 Tampaksiring requires a business strategy that is complemented by an IS/IT strategy to develop schools to a higher standard [5]. Therefore, the research was focused on answering what business strategy which would be best suited to be implemented.

2. Research Method
This description and stage about the relationship or between the concepts was figured in the following conceptual framework. In this case, strategic planning for information systems and information technology at SMK Negeri 1 Tampaksiring was analyzed through Ward and Peppard model of analysis. Therefore, the conceptual framework in this study can be described in figure 1 [6].

![Figure 1. The conceptual framework.](image)
2.1 Analysis Stages
In this stage, activities were carried out as follows:

2.1.1. Identification of Organizations. This stage identified aspects of the organization including profile, vision, mission and objectives of SMK Negeri 1 Tampaksiring.

2.1.2. External School Environment Analysis. At this stage, analysis was carried out on the factors outside the organization that can influence the organization's strategy. The purpose of the analysis in this section was to identify the political aspects, economic aspects, social aspects, and technological aspects commonly known as PEST analysis. Using this PEST analysis, it was expected that factors related to SI development activities could be identified. Five Forces Porter analysis was used for the identification of competitors and market share affecting the business activities of SMK Negeri 1 Tampaksiring [8].

2.1.3. Internal School Environment Analysis. Critical Success Factor (CSF) Analysis provides an overview of any critical aspects in each of SMK Negeri 1 Tampaksiring's business activities and processes that affect the company's performance in achieving its vision and mission as well as business success. Value chain analysis was also used to describe the activities in SMK Negeri 1 Tampaksiring [9].

2.1.4. Internal IS/IT Environmental Analysis. At this stage, the current IS/IT conditions used to support the organization's operational activities would be analyzed.

- IS/IT Organizational Structure
  Analysis of existing human resources.

- Current Application Portfolio
  Analysis of application mapping that SMK Negeri 1 Tampaksiring had currently owned and incorporated into the current portfolio of applications.

- Business Process Analysis
  Mapping business processes into a model that described the flow of information that occurs in the company's business activities.

- Infrastructure IS/IT
  Analysis of IS/IT infrastructure in SMK Negeri 1 Tampaksiring which includes hardware, software, and network infrastructure.

2.1.5. External IS/IT Environmental Analysis. This stage identified the latest IS/IT technology developments and future technological trends.

- Latest IS/IT Technology Trends
  Analyzed the latest emerging technology trends, especially those that can be applied to organizations.

- Technology that was being used by users and stakeholders.
  Analysed the opportunities and possibilities of using technology to improve the quality of service in the future.

- School Condition Analysis
  This analysis was an identification of school conditions based on the results of the analysis of the business environment and IS/IT environment as a whole to map the company's current position. SWOT analysis is used to map strengths, weaknesses, opportunities, and threats to organizations, as it is very important to formulate future IS/IT strategies in SMK Negeri 1 Tampaksiring.
2.2 IS/IT Strategy Determination Stage
This stage was the process of determining the IS/IT strategy that would be carried out based on the results of analysis of the business environment and IS/IT environment, both internal and external. The result was the need for information and IS/IT solutions.

2.3 IS/IT Strategy Formulation Phase
This stage consists of several activities such as the following.

2.3.1 IS/IT Strategy Mapping. Mapping IS/IT strategies created based on SI strategies, IT strategies, and IS/IT management strategies.

2.3.2 Future Application Portfolio. Formulate a portfolio of upcoming applications and map them into the Mc.Farfan Strategy Grid matrix.

2.3.3 Implementation Plan. Make implementation of the formulaic results of IS/IT development strategy plan in the form of development roadmap for the next 4 years. The final result of the whole stage is to produce a strategic IS/IT plan for SMK Negeri 1 Tampaksiring. The participants of the study were chosen among the teacher and the school administration staff. SWOT analysis with a quantitative approach was carried out to evaluate the internal factors that were the strengths and weaknesses of the company to be identified in the IFAS matrix (Internal Factor Analysis Summary), while external factors that became opportunities and threats were identified by the EFAS matrix (External Factor Analysis Summary).

The results of the combined two matrices produced a SWOT diagram reflecting the company's position. The company's position determined business strategy planning at SMK Negeri 1 Tampaksiring based on SWOT matrix.

3 Result and Discussion
The data used in this analysis was the data of the questionnaire results disseminated through the questionnaire form at the time of FGD conducted at SMK Negeri 1 Tampaksiring[7]. The weight and rating determination in the IFAS analysis were determined by the participant based on the points that had been determined as follows.

3.1 Weight and Rating Conditions on Strength Factors
The weight value scale was determined from 0.0 (not important) to 0.1 (very important) and the weight value assessment should not exceed 1. The rating value scale was determined starting from a value of 1 = weak, 2 = moderate, 3 = strong and 4 = very strong.

3.2 Weight Strength and Rating on Weakness Factors
The weight value scale was determined from 0.0 (not important) to 1.0 (very important) and weighting should not exceed 1. The rating value scale was determined starting from a value of 1 = strongly weak, 2 = moderately weak, 3 = fairly weak and 4 = little weak. Data from participants was processed using Microsoft Excel. Each participant's weight was divided into total weights so as to gain the initial weight.
Table 1. Internal and External Evaluation report.

| Internal Factor | Weight | Rating | Weight x Rating |
|-----------------|--------|--------|-----------------|
| **Strength (S)**|        |        |                 |
| (S1) Very strategic school location. | 0.107071825 | 3.6 | 0.385459 |
| (S2) Implementing the National Curriculum with Accreditation A | 0.105935461 | 4.0 | 0.423742 |
| (S3) Teachers with bachelor or master of education degree | 0.105941952 | 3.6 | 0.381391 |
| (S4) Internet bandwidth is adequate. | 0.105941952 | 3.8 | 0.419731 |
| (S5) Very complete Educational Facilities | 0.096287920 | 3.2 | 0.308121 |
| **Total Strength** | 0.525692752 | 1.918444039 | |
| **Weakness (W)** |        |        |                 |
| (W1) Network infrastructure needs development | 0.095164325 | 3.6 | 0.342592 |
| (W2) Additional application is required to facilitate school activities | 0.088875017 | 3.4 | 0.302175 |
| (W3) Lab Technicians Don't Exist Yet | 0.095604250 | 3.0 | 0.286813 |
| (W4) The development of information systems still involves few teachers | 0.102417640 | 3.0 | 0.307253 |
| (W5) The section that specifically handles Systems and Information Technology does not yet exist | 0.092246017 | 3.2 | 0.295187 |
| **Total Weaknesses** | 0.474307249 | 1.534019551 | |
| **Total strengths and weaknesses** | 0.102417640 | 1.534019551 | |
| **Opportunities (O)** |        |        |                 |
| (O1) The application of national curriculum produces qualified graduates | 0.109791727 | 3.4 | 0.373291871 |
| (O2) Full support from parents of students who are on the School Committee | 0.110928090 | 3.2 | 0.354496989 |
| (O3) Good relationships with parents and local communities to achieve their goals | 0.110928090 | 3.6 | 0.399341126 |
| (O4) Improvement of the quality of teachers through trainings | 0.092832627 | 3.2 | 0.297064407 |
| (O45) In addition to academic education, character education is also provided to increase the potential of students | 0.115730327 | 3.4 | 0.393483113 |
| **Total Opportunities** | 0.540210862 | 1.818150407 | |
| **Threat (T)** |        |        |                 |
| (T1) Competition between Public Schools that have the same competencies | 0.092193479 | 3.2 | 0.295019134 |
| (T2) Public perception that vocational school is still inferior to high school | 0.087907484 | 3.2 | 0.281303947 |
| (T3) The trend of technology and information development is growing rapidly. | 0.108392354 | 3.0 | 0.325177062 |
| (T4) Government policy on education can change at any time. | 0.101630746 | 2.6 | 0.264239938 |
| (T5) Political and security influence | 0.071974997 | 3.0 | 0.215924991 |
| **Total Threat** | 0.459789138 | 1.381665072 | |
| **Total Opportunities and Threats** | 0.540210862 | 1.818150407 | |
Based on the results shown in the SWOT quadrant diagram, it could be explained that the position of SMK Negeri 1 Tampaksiring was in quadrant I (positive, positive). This quadrant represented strong internal conditions and supportive environment to take advantage of existing opportunities, so that the appropriate direction, goals, and strategies for growth strategies of the company were objective.

3.3 The Results of Identification of IS/IT Needs and Solutions Based on Value Chain Analysis of SMK Negeri 1 Tampaksiring

The results of IS/IT Needs and Solutions Based on SMK Negeri 1 Tampaksiring Value Chain Analysis can be seen in Table 2.

Table 2. Value Chain Analysis.

| Activities                        | Needs                                      | Solution                                                                 |
|-----------------------------------|--------------------------------------------|-------------------------------------------------------------------------|
| Admission of New Students         | New student data.                          | New Student Admissions Information System.                              |
| Teaching and Learning Process     | Academic Data on Student Learning Development Results. | 1) Academic Information System.  
                                          |                                                                     | 2) Student Learning Development Information System.               |
| Commencement and Graduation       | Data of graduating students.               | 3) E-Learning.                                                           |
| Administration                    |                                            | 1) Graduation System.                                                   |
| Promotion and Socialization       | 1) Cooperation Data.                       | 2) Alumni Information System.                                            |
| Activities                        | 2) Promotional Activity Data.              | 1) Promotional Information System.                                       |
|                                   |                                            | 2) Public Relations Information System.                                 |
|                                   |                                            | 3) Website.                                                             |
| Counseling Services               | 1) Student Data.                           | Counseling Information System.                                          |
|                                   | 2) Learning Progress Data.                 |                                                                        |
| Management of Facilities and      | 1) Facility Usage Data.                    | Facility and Infrastructure Management Information System.               |
| Infrastructure                    | 2) Asset Maintenance Data.                 | Financial Management Information System.                                |
| Financial Management              | Debit and credit of fund transaction data. |                                                                        |
| Human Resources Management        | HR Recruitment and assessment data.        | 1) Personnel Information System.                                         |
|                                   |                                            | 2) HR Assessment Information System.                                    |
3.4 The Results of Identification of IS/IT Needs and Solutions Based on Five Force Porter Analysis at SMK Negeri 1 Tampaksiring

The results of IS/IT Needs and Solutions Based on Five Force Porter Analysis at SMK Negeri 1 Tampaksiring are shown in Table 3.

| Analysis of Five Force Wear | IS/IT Needs | IS/IT Solution |
|-----------------------------|-------------|----------------|
| Threat of Replacement Products of Home Schooling | Innovation in Learning Media. | 1) E-Learning. |
| The Threat of New Competitors of Similar Educational Institutions. | Adequate IT facilities. | 2) Interactive Learning Media. |
| The Strength of The Buyer's Service and The Quality of Good Education. | An information system that can provide services to students and parents. | 1) IT Infrastructure Improvement. |
| Strength of Community Suppliers and Kindergarten Graduates. | Information about smk negeri 1 tampaksiring profile and excellence. | 2) Improving HR Quality in IT. |
| Threat of Similar School Competitors located very close to SMK Negeri 1 Tampaksiring | Latest Technology and Information Systems Trends. | 1) Help Desk Support. |
| Government policy exempts tuition fees for public schools. | Website. | 2) Online Payment. |

3.5 IS/IT Strategy Formulation Results

The purpose of IS strategy recommendations was to know how each working unit in SMK Negeri 1 Tampaksiring could utilize the information system in achieving its objectives. After identifying the needs and solutions of IS /IT that have been done before, there was a potential need for information systems that could be implemented against SMK Negeri 1 Tampaksiring, which can be seen in Table 4.

| App Name | Application Functions | Users |
|----------|-----------------------|-------|
| E-learning | Distance Learning | 1. Curriculum |
| Attedance Student | Attendance for Students or Teachers if they do not do the teaching process | 2. Public relations |
| Assesment | Application for Midterm Assessment (PTS), Final Semester Assessment (PAS) and School Exam | 3. Student body |
| MPD | Managing Student Transcript | 4. School admin |
| SIM-Ekskul | To Know the Extracurricular activities and its members | 1. Curriculum |
| Budgeting | To Create a School Budget Work Plan | 2. Public relations |
| LPSE | For Procurement of Goods and services | 3. SARPRAS |
| | | 4. DU/DI |
| | | 5. School admin |
| | | 1. SARPRAS |
| App Name   | Application Functions                                                                 | Users                      |
|-----------|----------------------------------------------------------------------------------------|----------------------------|
| SIMDA     | To record inventory goods and assets in schools                                          | 2. School admin            |
|           | For civil servant staffing databases                                                    | 1. SARPRAS                 |
| SIMPEG    | Finger scan attendance of Teachers and Employees                                         | 2. School admin            |
| Attendance|                                                                                       | 1. School Admin            |
|           |                                                                                       | 1. School admin            |
| BPD       | Calculating Student Violation Points                                                    | 1. Student body            |
|           |                                                                                       | 2. Student Counselling     |
| Achievement| Application to record student achievement                                               | 1. Student body            |
|           |                                                                                       | 2. Student Counselling     |
| ALUMNI    | This app is for alumni logging                                                         | 1. Student body            |
|           |                                                                                       | 2. Student Counselling     |
| PIP       | Information for Indonesia Pintar program                                                | 1. Student body            |
|           |                                                                                       | 2. Student Counselling     |
| PRAKERIN  | Information for Prakerin Activities                                                     | 1. Student body            |
|           |                                                                                       | 2. Student Counselling     |
| WEBSITE   | School Activities Documentation                                                        | 1. Curriculum              |
|           |                                                                                       | 2. Public relation         |
|           |                                                                                       | 3. Student                 |
|           |                                                                                       | 4. School admin            |
| MOU       | School Cooperation with DU / DI Parties                                                 | 1. Public relations        |
|           |                                                                                       | 2. Student body            |
|           |                                                                                       | 3. School admin            |
| BKK       | Job opportunities facilities for students and DU/DI parties looking for workers in schools | 1. Public relations        |
|           |                                                                                       | 2. Student body            |
|           |                                                                                       | 3. School admin            |
| CCTV      | School Environment Monitor                                                             | 1. SARPRAS                 |
| PMP       | School Quality Assurance                                                                | 1. Curriculum              |
|           |                                                                                       | 2. Public relations        |
|           |                                                                                       | 3. Student body            |
|           |                                                                                       | 4. School admin            |
| Guest Book| Digital Guestbook Recap                                                                | 1. Public relation         |
| JRS       | Parents and student’s suggestion for the school                                         | 2. School admin            |
|           |                                                                                       | 1. Public relation         |
| Mail      | Incoming and outgoing mail applications                                                | 1. School admin            |
| SKL       | Temporary Certificate of graduation, before diploma is issues                          | 1. Curriculum              |
|           |                                                                                       | 2. Public relations        |
|           |                                                                                       | 3. Student body            |
|           |                                                                                       | 4. School admin            |
| DAPODIK   | Application for Dapodik School                                                          | 1. Curriculum              |
|           |                                                                                       | 2. Public relations        |
|           |                                                                                       | 3. Student body            |
|           |                                                                                       | 4. School admin            |

### 3.6 Implementation Plan
Based on the previous mapped IS/IT management strategies, it was necessary to implement IS/IT strategy development and IS/IT Management Strategy within the next 4 years (2020 – 2021). This IS/IT strategy implementation plan was a recommendation drawn up in the form of IS/IT development roadmap, but the priority determination of work will be carried out on consideration and decision taken by the management of SMK Negeri 1 Tampaksiring.

The roadmap for the development of IS/IT strategies and IS/IT management strategies can be described in Table 5.
Table 5. Roadmap of IS/IT Strategy Implementation Plan.

| Strategic Plan                  | Years |
|--------------------------------|-------|
| Information Systems            |       |
| Elearning (New)                |       |
| Attendance Student             |       |
| Assessment (New)               |       |
| MPD (Upgrade)                  |       |
| SIM-Ekskul (New)               |       |
| Budgeting (Upgrade)            |       |
| LPSE (New)                     |       |
| SIMDA (New)                    |       |
| SIMPEG (Upgrade)               |       |
| Attendance (Upgrade)           |       |
| BPD (New)                      |       |
| Achievement (New)              |       |
| Alumni (New)                   |       |
| PIP (New)                      |       |
| PRAKERIN (New)                 |       |
| Website (Upgrade)              |       |
| MOU (New)                      |       |
| BKK (New)                      |       |
| CCTV (Upgrade)                 |       |
| PMP (Upgrade)                  |       |
| Guest Book (New)               |       |
| JRS (New)                      |       |
| PMP (Upgrade)                  |       |
| SKL (New)                      |       |
| DAPODIK (Upgrade)              |       |
| Mail (New)                     |       |
| SKL (New)                      |       |

The results of the IS/IT strategy formula had been presented to SMK Negeri 1 Tampaksiring in focus group discussion (FGD). The results of analysis and recommendations of the proposed strategy of IS/IT in the future had been presented and received a good response and approved to be developed in the future by the management of SMK Negeri 1 Tampaksiring.

In this study, there were several obstacles in the implementation of this study, among others as follows.

- The information obtained from the interview results and the source were still considered inappropriate so that several interviews and field observations were conducted to match the information and data provided.
- There was some data and information that could not be dug deeper because SMK Negeri 1 Tampaksiring considers it to be confidential and only given brief exposure.
4. Summary and Suggestions
The strategic planning process of IS/IT towards the business environment and IS/IT in SMK Negeri 1 Tampaksiring is an ongoing process to improve the competitiveness of school institutions. The strategic planning process of IS/IT in this research began from the identification of vision and mission, followed by identification of the internal and external environment of the business, and the internal and external environment of IS/IT. This research then produced future IS business strategy, IT strategy, IS/IT management strategy, application portfolio recommendations that can be implemented in SMK Negeri 1 Tampaksiring implementation plan in the form of roadmap.

The IS strategy resulted in proposals to improve the performance of existing applications and the addition of new applications to support smk negeri 1 Tampaksiring’s business process. The IT strategies recommendations that arise are the development of network infrastructure and the enhancement of hardware and software to support the proposed SI strategy.

The recommendation of IS/IT management strategy that arises is the establishment of an ICT section that is expected to address IS/IT issues and evaluate the process and development of IS/IT that has been created.

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