Design of decision support system for business feasibility study using SMART method

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Abstract. The business feasibility study is critical to be used as the main foundation to avoid and prevent the occurrence of unwanted risks related to losses in businesses run by business people in the services, trade, and manufacturing sectors. Through a business feasibility study, business actors will get an initial description of the feasibility or inadequacy of a business plan to be implemented, so that businesses get a prediction of decisions about the business to be carried out. Utilization of information technology in terms of business feasibility study decision support systems will help businesses to improve quality, productivity, efficiency, effectiveness, minimize risk, and solve business-related problems that will be run. This research aims to design a business feasibility study decision support system to assess the feasibility of implementing business in services, trade, and manufacturing. Decision-making method in a decision support system designed using Simple Multi Attribute Rating Technique (SMART), where the decision making criteria is based on economic feasibility studies with several predetermined attributes, namely Break Even Points (BEP), Net Present Value (NPV), Internal Rate of Return (IRR), Average Rate of Return (ARR), Benefit/Cost Ratio (B/C Ratio) and Payback Period (PP) and Profitability Index (PI). The results of this research are in the form of a business feasibility study decision support system that can be used to assess the extent of the benefits that can be obtained in carrying out business activity and is a material for consideration in making a decision, whether to accept or reject a planned business idea measured by benefits to be received, both financial and social benefits.

1. Introduction
Business Feasibility Study is a study of whether a proposed business idea, if implemented can run and develop according to its objectives or not. The object or subject of the feasibility study is the proposed project/business idea. The proposed business idea is reviewed, researched, and investigated from various aspects, whether it meets the requirements to be able to develop or not [1,2]. Business Feasibility Study is an activity to assess the extent of the benefits that can be obtained in carrying out business activity and is a material consideration in making a decision, whether to accept or reject a planned business idea, so as to give a feasible or not feasible a business idea if viewed from the benefits generated (benefits) from the business idea both from the perspective of financial benefits and social benefits [3,4].

Business Feasibility Study to assess the feasibility of implementing a business is one of the right first steps, for those of you who want to explore the business world. Especially in the fields of trade, services,
even manufacturing, and many others [5, 6]. The application of a feasibility study to assess the feasibility of implementing a business is very important to be made as a strong main foundation to avoid and prevent the things that you do not want as a business person in the future, which is related to the disadvantage of your business [7]. By using this feasibility study, it is not unmistakable that you will get an initial description of the feasibility or improper business. So you can get the results of a decision regarding whether or not to continue your business. Utilization of information technology in terms of Business Feasibility Study can help humans in increasing productivity, effectiveness, efficiency, quality, and problems-solving, in this case, as a worthy decision supporting a business [8–12].

This research aims to design a business feasibility study decision support system using the Simple Multi Attribute Rating Technique (SMART) for assessing the feasibility of implementing business in services, trade, and manufacturing [13–16]. The criteria for decision making are based on multi-attribute economic principles, including Break Even Points (BEP), Net Present Value (NPV), Internal Rate of Return (IRR), Average Rate of Return (ARR), Benefit/Cost Ratio (B/C Ratio), Payback Period (PP) and Profitability Index (PI). By using the decision support system, potential investors or management can more easily and quickly receive information about the feasibility of the business.

2. Methods
The decision-making method used is the Simple Multi Attribute Rating Technique (SMART), where the multi-attribute decision-making technique is used to support decision-makers in choosing between several alternatives. Each decision-maker must choose an alternative in accordance with the objectives that have been formulated. Each alternative consists of a set of attributes, and each attribute has values. This value is averaged on a certain scale. Each attribute has a weight that describes how important a certain scale. Each attribute has a weight that describes how important an attribute is compared to other attributes [13]. Weighting on SMART uses a scale of 0 to 1, making it easier to calculate and compare values for each alternative. The weighting is used to assess each alternative in order to obtain the best alternative.

The framework of this research can be seen in Figure 1.
The stages in the SMART method are as follows [13]:

- Determine Attributes, determination of attributes based on decision making based on economic principles;
- Determine the Weight of Attributes, give weight to each attribute that has been determined in the previous stage with a range of weight values of 1 to 100;
- Normalization of Attribute Weight, determine the weight normalization of each attribute;
- Provide parameter values for each attribute, provide quantitative values for each attribute;
- Define Utility Value, convert parameter values for each attribute into the default value of the attribute;
- Determine the Final Value, obtained by multiplying the results of normalization attribute weights with utility values;
- Decision Making, the determination of decisions based on a comparison between the final value for each attribute with a minimum limit of eligibility on each of these attributes.

3. Results and discussion

3.1. Decision making

The stages of decision making are based on the SMART method, as follows:

3.1.1. Determine attributes. Decision-making criteria are based on economic feasibility studies with several predetermined attributes, namely:

- Break Even Points (BEP): the break even point where the position of the amount of revenue and costs is equal or balanced so that there are no gains or losses in a company [17];
- Net Present Value (NPV): the difference between the present value of cash inflows and the present value of cash outflows over a period of time [18];
- Internal Rate of Return (IRR): the rate of return of the project capital analyzed [19];
- Average Rate of Return (ARR): the average return value of investment carried out [20];
- Benefit/Cost Ratio (B/C Ratio): a measure of the ratio between income and total production costs [21];
- Payback Period (PP): the time period of return of investment that has been issued through profits derived from a business [20];
- Profitability Index (PI): a comparison between the value of future net cash flows and the value of the investment [20].

3.1.2. Determine the weight of attributes. The weight values for each attribute can be seen in Table 1.

| Attribute Code | Attribute | Weight |
|---------------|-----------|--------|
| C1            | BEP       | 82     |
| C2            | NPV       | 80     |
| C3            | IRR       | 76     |
| C4            | ARR       | 78     |
| C5            | B/C Ratio | 72     |
| C6            | PP        | 79     |
| C7            | PI        | 77     |
| **Total Weight** | **544**    |        |
The weight normalization can be seen in Table 2.

### Table 2. Normalization of attribute weight.

| Attribute Code | Attribute | Normalization of Attribute Weight |
|----------------|-----------|-----------------------------------|
| C₁             | BEP       | 0.151                             |
| C₂             | NPV       | 0.147                             |
| C₃             | IRR       | 0.140                             |
| C₄             | ARR       | 0.143                             |
| C₅             | B/C Ratio | 0.132                             |
| C₆             | PP        | 0.146                             |
| C₇             | PI        | 0.141                             |

3.1.4. Parameter values. The parameter values for each attribute are not given because each criterion is quantitative (benefit attribute).

3.1.5. Utility values. Define Utility Value uses the following equation [13]:

\[
u_i(a_i) = \frac{(c_{\text{out}} - c_{\text{min}})}{(c_{\text{max}} - c_{\text{min}})}\] (2)

Utility Values for each attribute shown in Table 3.

### Table 3. Utility values.

| Attribute Code | Attribute | Utility Values                          |
|----------------|-----------|----------------------------------------|
| C₁             | BEP       | Benefit Attribute (bigger is better)   |
| C₂             | NPV       | Benefit Attribute (bigger is better)   |
| C₃             | IRR       | Benefit Attribute (bigger is better)   |
| C₄             | ARR       | Benefit Attribute (bigger is better)   |
| C₅             | B/C Ratio | Benefit Attribute (bigger is better)   |
| C₆             | PP        | Benefit Attribute (bigger is better)   |
| C₇             | PI        | Benefit Attribute (bigger is better)   |

3.1.6. Determine the final value. The Final Value is obtained from the following equation [13]:

\[
u(a_i) = \sum_{j=1}^{m} w_j * u_j(a_i)\] (3)

3.1.7. Decision making. The feasibility of a business is determined based on all the attributes that have been defined. Based on utility values, the criteria that must be fulfilled are determined so that a business idea is said to be feasible if the final value for each criterion is greater than the minimum standard specified.

3.2. Design of decision support systems

At this stage, the Business Feasibility Study decision support system design is carried out, covering system modelling and system development.
3.2.1. System modeling

Figure 2. System modeling.

Figure 2 shows the modeling system using the Use Case Diagram, where there are four main activities in the system, namely Access the System, Company Profile Data Entry, Financial Parameter Data Entry, and Decision Making.

3.2.2. System development

Figure 3. System development.

Figure 3 shows the interface of the decision support system for the business feasibility study. There are three main menus, namely Company Profile, Financial Parameters, and Decision Making.

4. Conclusions
The SMART method can be used to determine the feasibility of a business. Analysis conducted on the feasibility of the business is based on financial projections consisting of projections of the cost of goods manufactured, cost of goods sold, profit or loss, balance sheet, and cash flow. Based on these projections, it can be assessed whether a business is feasible or not based on financial attributes, namely Break Even Points (BEP), Net Present Value (NPV), Internal Rate of Return (IRR), Average Rate of Return (ARR), Benefit/Cost Ratio (B/C Ratio), Payback Period (PP) and Profitability Index (PI). Thus by using this
Decision Support System, prospective investors or management can more easily and quickly receive information about the feasibility of the business to be implemented.

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