

Software product initiative prioritization with analytic hierarchy process in Doctor to Doctor application

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Abstract - Doctor to Doctor (D2D) is a mobile application for doctors. To gain competitive advantage, D2D has numerous initiative idea and need a systematic way to prioritize the development. The purpose of this research is to create a prioritization model which consists of criteria and weighting to help the decision-makers in D2D to select which initiative to pursue. Literature study, interviews with key decision-makers in the company, questionnaires to company experts, and a questionnaire to practitioners in the industry were done to determine the criteria and prioritization technique. Three criteria of demand, business sustainability, and complexity were found to support the prioritization process using Analytical Hierarchy Process (AHP). Among the ten sub-criteria, the sub-criteria with the highest global weights are competitive advantage, profitability margin, and user demand. The model was tested on three alternatives which are Pairing TD, Webinar 360, and Multi-country. Quantitative rating and criteria weight calculation was applied to the initiatives, resulting in Webinar 360 as the highest priority initiative.

Keywords - Initiative, requirement prioritization, MCDM, multi-expert, software development, analytic hierarchy process

I. INTRODUCTION

Doctor to Doctor (D2D) is a mobile application in Android and iOS that helps doctors improve and update their skills. Doctor to Doctor is published by PT Global Urban Esensial (PT GUE). The application provides health-related webinars, journals, articles, and events that doctors can participate in. Entering 2021, the product leadership for Doctor to Doctor prioritized 23 backlogs to be developed over the year. At the end of the first quarter of 2021, thirteen new initiatives were proposed based on the stakeholders' needs and demands. On the other hand, the capacity of the development team was around three to five initiatives per quarter.

The development capacity was insufficient to develop all the initiative ideas. Cases such as this were not uncommon in software companies and technology startups. Competition and growing user's need compel companies to keep on inventing and adding new features to either keep up with the competition or to move ahead of the competition.

Adding more resources is one way to increase the development velocity but it is not the preferred solution

due to the increase in cost and training required. Therefore, companies need to prioritize their development effort to best utilize their limited resources. Prioritization is something that must be done by Doctor to Doctor not only to minimize the cost but even more, to decide the order of which initiative to pursue to give maximum value and competitive advantage to the product and the company.

Currently, the method of prioritizing initiative development is done with three criteria which are demand, margin, and complexity which are rated with high, medium, and low rating. The selected criteria are the ones with high demand, high margin, and low complexity. The problem arises when there are multiple results with the same ratings as this method is lacking depth in evaluation and weight of criteria. Using the existing process, demand criteria which should have been the core consideration are measured equally with complexity in selecting the prioritization.

Several methods have been researched and can assist in prioritization. Multi-criteria decision making (MCDM) is the field that studies how decisions are taken by considering multiple criteria [1]. Several papers have discussed the prioritization consideration in project portfolio [2]–[4] and compare various methodologies in multi-criteria decision making [5]–[7] but no specific research has been done for software requirement prioritization in the initiative level of agile software development.

The research started with interviewing key experts in the company to uncover the criteria that were considered when making the initiative priority decision. A literature study was done to enrich the criteria with other aspects that were not mentioned in the current consideration criteria. In deciding the decision-making method to use, a literature study was coupled with a survey done to industry practitioners. Questionnaires and interviews were done with company experts to gather expert judgment on the importance of criteria. Lastly, the model was tested by calculating the priority for three initiatives using quantitative rating.

In deciding the priority for software initiative development using AHP in Doctor to Doctor, three main criteria of demand, business sustainability, and complexity were used. These criteria were further broken down into sub-criteria which are user demand, medical

association demand, pharmaceutical company demand, management demand, strategic fit, profitability margin, synergy, competitive advantage, technical complexity, and operational complexity. Pairwise comparison was done for each criterion and sub-criterion to get the global weight for each sub-criterion. The quantitative rating was defined to quantify the measure of each sub-category for easier judgment and calculation.

II. LITERATURE REVIEW

In identifying the criteria to be considered, the currently used criteria were analysed and clarified. The current criteria were demand, margin, and complexity. The criteria demand was broken down into four sub-criteria based on the stakeholders of the product which are user, medical association, pharmaceutical companies, and the management.

Interview with the account manager gave insight that competitive advantage is something that is sought after when deciding feature initiatives. Margin and competitive advantage are combined to be business sustainability criteria. Studies by Berander[5], Jarzebowicz & Sitko[6], and Meskendahl[3] suggested that strategic fit and synergy should also be considered and is added to the business sustainability criteria.

Complexity is broken down into technical complexity and operational complexity. Technical complexity measures the effort in realizing the initiative, while operational complexity measures the effort in running the initiative.

Some people see prioritization as a simple task that could be solved with intuition while others see it as a complex task with multiple things to consider. Single aspect prioritizations are usually simple and easy to decide. On the other hand, the decision regarding initiative prioritization rarely involves a single aspect or criteria.

Multi-criteria decision making (MCDM) such as Multi-Attribute Utility Theory (MAUT), Analytic Hierarchy Process (AHP), or Case-Based Reasoning (CBR) are some of the popular methods [8]. Some characteristics of MAUT are that it considers uncertainty and could include preference, on the other hand, it requires a high number of inputs, making it challenging to implement in small companies such as a startup. CBR is an adaptable method that can improve over time, making it suitable for fast-changing and agile business situations. Unfortunately, inconsistency often happens when comparing with the previous situation using CBR. AHP, on the other hand, is also scalable like CBR and it does not require a large amount of data as MAUT does. AHP offers better consistency with a certain degree of tolerance to inconsistency, making it an accurate yet flexible method.

In deciding the initiative prioritization, flexibility in criteria, accuracy, and ease of use are important factors. Methods such as Numerical Analysis (NA) or MoSCoW have predefined criteria, making it inflexible. Other

methods such as Eisenhower Matrix or RICE do not have weighting to reflect the relative importance of the criteria. While methods such as Wiegers' or Cumulative Voting involved complex calculations that made it impractical to be used in a fast-paced environment such as a startup. AHP offers advantages in criteria setting, weighting, and ease of use, making it the most appropriate method for software initiative prioritization.

III. METHODOLOGY

The research was conducted through a mixture of qualitative and quantitative research. Literature review as the main source of reference was done to obtain the basic theory and validation. An in-depth interview with product leadership was done as pre-test research to get an overview of the current prioritization method.

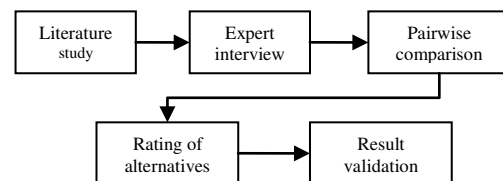


Fig. 1. Research methodology.

To implement the AHP calculation, questionnaires to nine experts within the company were used to get the priority judgment of pairwise comparison. These experts are the founder of PT GUE (1), division head of D2D (2), account manager of PT GUE (3), partnership department head (4), pharma department head (5), operations department head (6), technical department head (8), product manager of D2D (7), and product owner of D2D (9). To reflect the different importance of each expert's opinion, the judgment from each expert was weighted differently based on their power and interest as shown in Figure 2.

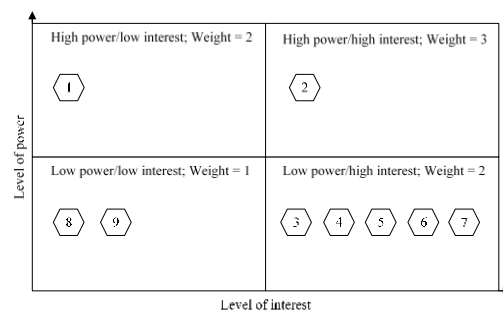


Fig. 2. Expert weight categorization.

Due to the limitation of the research that was done during the Covid-19 pandemic, the questionnaires were done online. To ensure the understanding of each expert, video call and video recording was utilized as a mean to brief the respondents on how to use the questionnaire that was developed based on the AHP template by Goepel [9].

To test the model, experts on each sub-criterion were consulted to assess the quantitative rating of the sub-criteria for each alternative. Finally, the company CEO, founder, division head, and head of HR were involved in a discussion to validate the resulting model and prioritization result.

III. RESULTS

The priority of initiative development in D2D was decided on three main criteria: demand, business sustainability, and complexity. Demand is broken down to the main stakeholders of the product which are users or doctors, medical associations, pharmaceutical companies, and the management. Business sustainability is measured by its fit to the company's short and long-term strategies, the margin of profit from initiative execution, synergy with other features or products, and the level of competitive advantage that the initiative brings. Lastly, the complexity factor consists of technical complexity in developing the feature and the daily operational complexity in executing the feature. Pairwise comparison from multiple experts was used to determine the appropriate weight for criteria and sub-criteria, the result is shown in Table I.

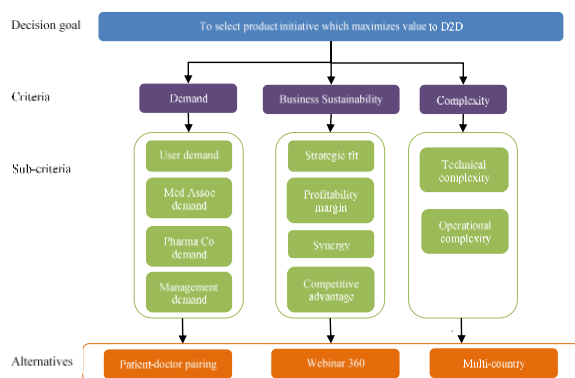


Fig. 3. Product initiative prioritization model.

A quantitative rating technique was used to quantify the value of sub-criteria. Rating for each sub-criterion was divided into four to five groups of equal range with a maximum rating of 100. For example, in profitability margin the rating is 20 if the company is losing money from the initiative, 40 if it is break-even, 60 if it got less than 20% margin, 80 if the margin is between 20% to 40%, and 100 points for initiatives with more than 40% profitability margin.

Three alternatives were evaluated to test the validity of the model. Patient-doctor pairing in Teman Diabetes (Pairing TD), an initiative that allows diabetic patients to be paired with a doctor who will monitor their health, was the first alternative to be tested. Webinar 360, an initiative to utilize 360-degree video in webinars, was the second alternative. Lastly, Multi-country which is the modification of the application to make it ready for international release was the last alternative to be

evaluated. The priority illustrated in Figure 4 was obtained after evaluating the alternatives against the quantitative rating and global weight.

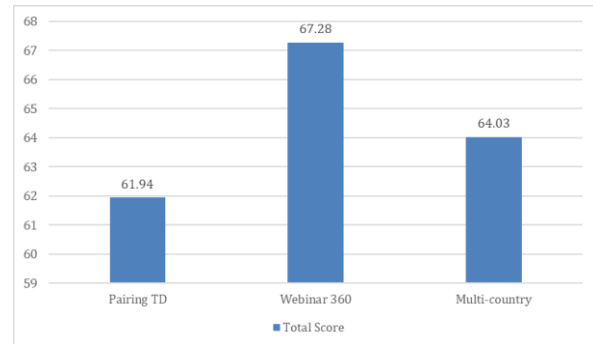


Fig. 4. Prioritization result of three alternatives.

TABLE I
WEIGHTING OF CRITERIA AND SUB-CRITERIA

Main criteria	Sub-criteria	Global Weight	Rank
Demand (30.54%)	User demand (42.11%)	12.86%	3
	Medical association demand (17.54%)	5.36%	9
	Pharmaceutical company demand (25.58%)	7.81%	7
	Management demand (14.76%)	4.51%	10
Business sustainability (54.26%)	Strategic fit (21.27%)	11.54%	4
	Profitability margin (28.11%)	15.25%	2
	Synergy (20.24%)	10.98%	5
	Competitive advantage (30.38%)	16.48%	1
Complexity (15.20%)	Technical complexity (7.31%)	7.31%	8
	Operational complexity (7.89%)	7.89%	6

IV. DISCUSSION

Competitive advantage is currently the most important criterion for the experts due to the product stage that D2D is in. Currently, D2D is in the growth phase and it is trying to find its form and set it apart from the competitor. It is also trying to gain the position of market leader and top-of-mind product that is currently held by the competitor. Therefore, gaining a competitive advantage is desirable by the experts.

Among the sub-criteria in criteria demand, only user demand was significantly higher than the other demand and is the third-highest importance. The other sub-criteria which are medical association demand, pharmaceutical company demand, and management demand is ranked 9, 7, and 10 or last ranking, respectively. This finding emphasizes that the user is the most important stakeholder and that D2D is a customer-centric –instead of a product-

centric– product that puts users and their problems at the center [10].

V. CONCLUSION

In determining the priority for the initiative in software development, AHP was proposed as an accurate method. The complexity of the initial setup for AHP is acceptable as initiatives are high-level requirements that are few and rarely change. The proposed criteria for AHP prioritization for software development initiatives were demand, business sustainability, and complexity. The sub-criteria of each criterion might differ based on the nature of the product being evaluated. For D2D, the criteria and sub-criteria are:

- Demand: user demand, association demand, pharmaceutical company Demand, and management demand
- Business sustainability: strategic fit, profitability margin, synergy, and competitive advantage
- Complexity: technical complexity and operational complexity

Among the 10 sub-criteria, competitive advantage, profitability margin, and user demand were most important and were given higher weight in prioritization compared to other sub-criteria.

Validation to company leadership showed that the selected criteria and sub-criteria along with their weighting was aligned with the expected prioritization. The given criteria, sub-criteria, quantitative rating, and weighting should be regularly evaluated to reflect the changes in business and knowledge of decision-makers.

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