CHATBOT

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Selecting ChatBot Platform for Health Enterprise Training: A Fuzzy AHP Approach

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***Abstract* —This study departs from the issue on how to select Chabot platform to deliver virtual training in a health enterprise environment. In-house training is aimed at improving man power knowledge and skill required to achieve health enterprise objectives. During Covid-19 pandemic, traditional face-to-face training has been difficult to conduct due to many health-related limitations. In order to deal with such issues, medical team at health enterprise seeks to apply Chatbot platform that might be used to deliver in-house training via online appropriately. Considering many aspects to be considered in selecting several Chatbot platforms, Fuzzy Analytic Hierarchy Process is proposed in this study to deal with the issue. It is finally recommended to use Carik platform to deliver in-house training in the corporation.**

Key words -. Chatbot, health, enterprise, training, fuzzy AHP.

I. INTRODUCTION

Man power is the most important assent within any organizations. The higher capacity of man power owned by a corporation for example, the more probability the company to successfully achieve its goal and objectives. Delivering various trainings to maintain and improve the quality of man power, have been considered as effective solution. Moreover, in some cases, attending managerial related training is often chosen to evaluate whether or not staffs to get promoted for higher level position [1].

During Covid-19 pandemic era, sending staffs to attend trainings outside the corporation are difficult to be delivered as previously. This is even more serious issues for health practitioners as they are the front liner in combating Covid-19 spread in the society. As a result, corporations prefer to deliver such trainings within their office or known as in-house training [2]. In house training is believed safer rather than delivering it outside as previously from Covid-19 perspectives.

Chatbot based in house training is a logical consequence of digitizing health enterprise program (figure 1). In the program, all aspects of health enterprise should be streamlined and interconnected digitally particularly in reducing human intervention at all areas of health services in particular due to Covid-19 pandemic.

Fig. 1 Digitizing health enterprise

Chatbot technology is a novel approach to replace human communication using computer machine [3]. Using Chatbot has been widely seen in Indonesian e-commerce and digital services in the last years. Considering its benefits, health enterprise seeks to explore Chatbot usage in replacing in-house training previously done in face to face format.

There are several Chatbot technologies have recently introduced in Indonesia market. However, only three of them are considered in this study.

However, making proper selection is another daunting task for decision makers of health enterprise. Therefore, this study aims to offer the application of Fuzzy Analytic Hierarchy Process in selecting Chatbot technology for delivering in-house training.

This paper is structured as follows. After introduction in the first section, literature review on various Chatbot technologies is presented in section 2. Methodology used in the study is in section 3, while obtained data and its analysis are discussed in depth in section 4. Finally, the conclusion part ends the paper.

II. LITERATURE REVIEW

This section describes Chatbot technology and ISO 9126 Software Metrics as the view point to approach the study.

A. Chatbot Technology

According to Shawar & Atwell [4], chatbot is an artificial intelligence approach with Natural Language Processing (NLP) to represent human alike conversation in machine response. Its advantages mostly regarding the ability to mimic human interaction through a conversation based communication to replace frequently asked question commonly found in any information systems or in the form of call center or email operated by staffs [5].

Natural Language Processing (NLP) allows chatbot to have knowledge in seeking information to customers and engage

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with them throughout conversation dialogs [5][6]. Other research stated a framework of chatbot affects the design, therefore, affecting the knowledge base of the chatbot since the accuracy of the response of chatbot depends on the knowledge base [7].

In order to interact with customers, chatbots are utilized by fashion brand to provide timely answer, deliver wide and deep information to reduce uncertainty and provide customer satisfaction with accurate, credible and competent [8]. Chatbots provides availability that can be accessed by customers 24/7 without looking at common working hours [6].

According to Rieke [9], availability of chatbot means when other options of customer service is not offered from the business for a specific time duration. Although human language skills are easily translated to human-chatbot interaction, the content and quality of such conversation differ significantly. Despite all the limitation in imitating the intelligent of human conversation, many people are willing to have extensive interactions with chatbot [10].

As a foundation to this study, we address the research by Valtolina et.al. [11] who perform extensive evaluation on how chatbot might be useful and effective solution for healthcare practitioners. Therefore, it is argued in this study that in order to achieve the objective, selection of chatbot technology platform is a top priority.

B. ISO 9126 SOFTWARE METRICS

ISO 9126 is international standard for analysing the quality of software. In ISO 9126, software metrics might be assessed from six criteria called functionality, reliability, usability, efficiency, maintainability and portability [12]. Each of these criteria consists of several sub criteria as shown in Figure 1.

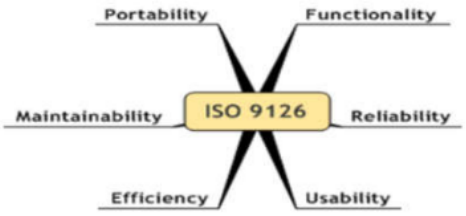

Fig. 2 ISO 9126

Functionality, means that software system must include all necessary features to accomplish the required task. Reliability, means the system must maintain a specified level of performance in case of software faults with the minimum crashes possible. Sensitive data should be protected and correctly recovered. Usability, means the system must be implemented in such a way to allow easy understanding of its functioning and behavior. Efficiency, means the system response-time must be as short as possible for user satisfaction. Maintainability, means system modifications and enhancements are crucial for long implementation of the software systems. Portability, means the ability of the software to be installed and run in different hardware and operating system environments [12].

III. METHODOLOGY

As the study falls into multi criteria decision making problem, Analytic Hierarchy Method (AHP) combined with Fuzzy Set Theory is the core methodology to tackle the issue. AHP is the most common MCDM methodology used in academic and industry case studies [13].

The fuzzy set theory was introduced by Zadeh to deal with fuzziness issues in many control systems applications. Fuzzy set theory improves AHP by making it able to handle uncertainty and inconsistent judgment as a nature of human decision making [14].

In fuzzy set theory, triangular fuzzy numbers are represented with a triplet (L, M, U) for Lower, Medium and Upper numbers of fuzzy numbers. Figure 3 shows basic concept of the membership triangular fuzzy numbers.

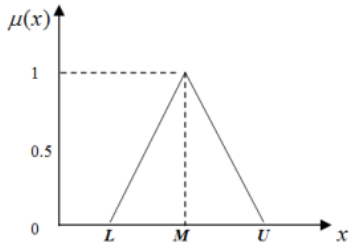

Fig. 3. Fuzzy triangular membership function

These fuzzy numbers may be calculated by means of a formula, either by using them explicitly on the basis of the decision-maker's interpretation or by taking them from linguistic variables on a verbal scale.

TABLE I
Fuzzy linguistics variable.

No	Linguistic variables	L	M	U
1	Equally Important	1	1	1
2	Slightly Important	1	2	3
3	Important	2	3	4
4	Very Important	3	4	5
5	Absolutely Important	4	5	6
6	Equally Important	5	6	7
7	Slightly Important	6	7	8
8	Important	7	8	9
9	Very Important	9	9	9

Table 1 shows the linguistic variables and their associated fuzzy scales as well as reciprocal scales which will be used in the calculation processes using fuzzy set theory in conjunction with the Analytic Hierarchy Process. The LMU values derived from paper by Kaganski, et.al [14].

On the ground of aforementioned fuzzy AHP, we establish the decision making hierarchy. It has three layers, namely goal, criteria and alternatives. As depicted in figure 3, the goal is selecting the Chatbot technology for health enterprise in-house training, the criteria is based on ISO 9126 point of view namely reliability, usability, efficiency, maintainability and portability (functionality is omitted since the chatbot technology offer similar functionality). Then final layer is the alternatives of three Chatbot technologies to be chosen.

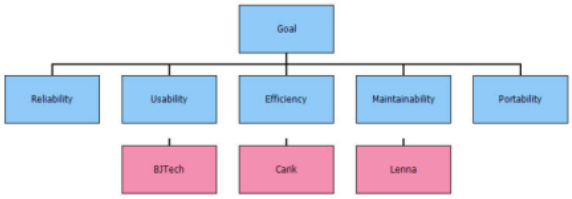

Fig. 4 Digitizing health enterprise

The three Chatbot technologies represented as alternatives are BJtech Chatbot, Carik Chatbot and Lenna Chatbot.

BJtech, is an AI-based conversation platform developed by by a company based in Indonesia. Using BJtech Chatbot technology, users allowed to develop any chatbots according to their needs through messaging applications.

Carik Chatbot, on the other hand, offers many features from simple QA systems to auto-answer features, and even able to learn new information intelligently.

Finally, Lenna Chatbot is a platform to establish smart chatbots easily and efficiently. Through its simplicity and features, chatbots will have conversational user experiences.

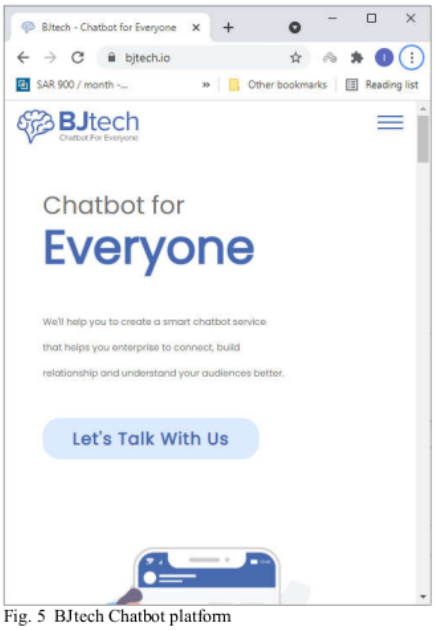

Fig. 5 BJtech Chatbot platform

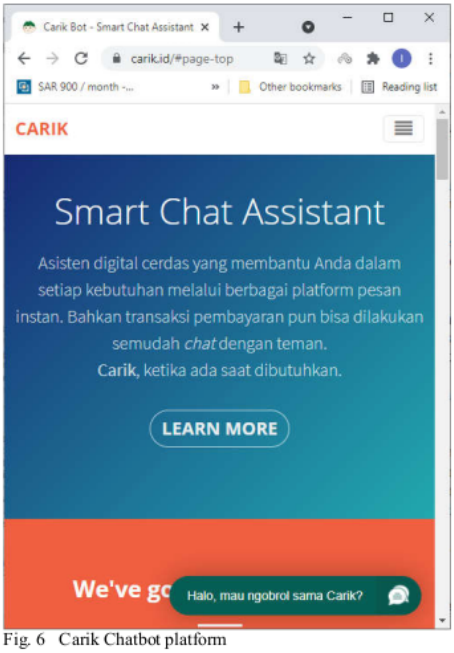

Fig. 6 Carik Chatbot platform

Fig. 7 Lenna Chatbot platform

IV. Analysis and Discussion

In this step, pair wise comparison conducted by decision maker to make rational selection in two level of hierarchy. First of all, pairwise comparison among criteria with respect

to the goal. Secondly, pairwise comparison among available chatbot framework options with respect to each of criterion. The results are as follows.

As depicted in table 1, based on fuzzy AHP analysis, five criteria obtained its own weight. Figure 5 which represent table 1 clearly shows that reliability, maintainability and efficiency regarded as most important factor in that order by having weight of 0.462, 0.282, and 0.252 while usability only accounted for 0.005 and 0 for portability.

The findings indicate reliability as the top priority to consider by decision maker in selecting chatbot framework for corporate in-house training. Reliability is urgently needed since all training materials should be transformed appropriately into chatbot systems, and thus it must be perfectly supporting all corporate needs in training.

TABLE II
Results for criteria

Criteria	Weight
Reliability	0.462
Usability	0.005
Efficiency	0.252
Maintainability	0.282
Portability	0

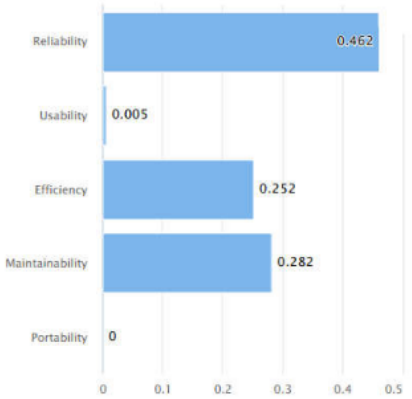

Fig. 8 Results for criteria

Then, the following tables represent pairwise comparison of the available alternatives of chatbot framework with respect to each of five criteria.

TABLE III
Portability criteria

Alternatives	Weight
BJTech	0.333
Carik	0.333
Lenna	0.333

As shown in the table above, from the perpective of portability, all options, BJTech, Carik and Lenna obtain the same weight of 0.333. In other words, they are considered equal from portability perspective.

The next analysis is pairwise comparison of the available alternatives of chatbot framework with respect to maintainability.

TABLE IV
Maintainability criteria

Alternatives	Weight
BJTech	0
Carik	1
Lenna	0

It is clearly seen in the table above, According to the Maintainability, Carik is the first priority, while other frameworks are considered lack of maintainability aspect. Furthermore, pairwise comparison is conducted for the available alternatives of chatbot framework with respect to efficiency.

TABLE V
Efficiency criteria

Alternatives	Weight
BJTech	1
Carik	0
Lenna	0

Table 5 shows BJTech outperforms other two frameworks in satisfying efficiency aspect of a chatbot framework for delivering in-house training for corporate. Likewise, pairwise comparison is then conducted for the available alternatives of chatbot framework with respect to usability.

TABLE VI
Usability criteria

Alternatives	Weight
BJTech	0.333
Carik	0.333
Lenna	0.333

As shown in the table above, According to the Usability criteria, all chatbot frameworks BJTech, Carik and Lenna are considered offering equal usability aspects by obtaining similar weight of 0.333. In other words, they are considered having similar usability aspect in delivering chatbot based in-house training.

TABLE VII
Reliability criteria

Alternatives	Weight
BJTech	0
Carik	0.669
Lenna	0.331

As shown in the table above, According to the Reliability, Carik is the first priority. Next priorities are assigned to Lenna and BJTech according to the obtained weights.

Finally, based on all results obtained previously, the final weights for all alternatives are calculated. The final results shown in table shows that Carik framework accounted for the highest total weight of 0.593, followed by Lenna framework (0.254) and BJTech (0.155). Figure represent the results visually.

TABLE VIII
Final alternative results

Rank	Alternatives	Weight
1	Carik	0.593
2	BJTech	0.254
3	Lenna	0.155

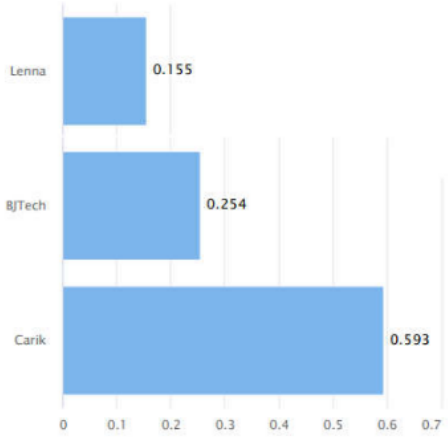

Fig. 9 Graphical final alternatives results

V. CONCLUSION

This study presents a decision making analysis in answering the question on how to select Chatbot platform to deliver in-house training in health enterprise.

A new decision hierarchy is proposed which consists of goal, criteria and alternatives layers. The criteria is derived from ISO 9126 of software quality, while the alternatives consists of three Chatbot technologies in Indonesian language, namely BJtech, Carik and Lenna. Using Fuzzy Analytic Hierarchy Method approach, the decision making is conducted and analysed.

Finally, it is concluded that Carik chatbot is selected as the most intuitive chatbot platform in developing in-house training for health enterprise.

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