

ANALYSIS AND DESIGN OF VOICE ASSISTANT FOR INDONESIAN BANKING TRANSACTION

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ABSTRACT

The number of FinTechs in Indonesia requires banks to have the right strategy to attract new customers and retain their customers. Therefore, banks are competing to create more innovative products and services than their competitors. Several banks in developed countries such as U.S. Bank, Barclays U.K. and OCBC Singapore have innovated by implementing voice assistants for financial transactions so that customers can transact anytime and anywhere easily. However, no banks in Indonesia provide voice assistant services for financial transactions such as transfers and bill payments. Even studies on this feature have never been conducted in Indonesia. Therefore, this study analyzes the feasibility of developing voice assistants for banking financial transactions in Indonesia using the PESTLE framework. The authors then propose a service model and application design by adapting the Design Science Research (DSR) methodology. The study results provide a service model that includes checking balances and recent transaction history, adding bank contact, checking the amount of credit card bills, internal bank transfers, interbank transfers, e-wallet top-ups and bill payments. The study results also found three challenges that will be faced by the Bank in implementing voice assistant services. Those are determining the most secure authentication system, the level of accuracy of voice assistants in capturing user voice commands that need to be tested and education to customers that is accurate, clear, and transparent.

Keywords: *Bank, Banking Transaction, Dialogflow, Pestle Analysis, Voice Assistant*

1. INTRODUCTION

The concept of Industry 4.0 refers to automation, artificial intelligence, Internet of Things (IoT), data analytics, and machine-to-machine and human-to-machine communications [1]. Industry 4.0 creates a very tough global competition in almost all fields, including the banking industry. Coupled with the emergence of various FinTech companies, banks are developing new functions and services [2]. Arwin Rasyid, a former CEO of CIMB Niaga, who succeeded in bringing CIMB Niaga into the fifth-largest bank by assets in Indonesia, wrote in his book that banks must build a new paradigm in formulating innovations and services [3]. Currently, financial services are controlled by fintech and neo-banks. Neo bank does not have a physical branch office, but they provide digital banking services, such as online transfers, online payments and credit. With capital and access to technology, fintech and neo-banks have become market leaders in the financial services industry [3]. Seeing this dynamic, banks are relevant to preparing and implementing many technological

innovations to remain competitive and dominate the market.

It is predicted that there will be more people doing financial transactions via computers, smartphones, voice commands and augmented reality in the future compared to people who come to transact directly at bank offices [2]. Gartner estimates that the number of customer interactions involving technology such as machine learning applications, chatbots, and mobile messaging will increase from 15% in 2018 to 70% in 2022 [4]. Tractica, a market intelligence company that focuses on human interaction with technology, reports that the use of virtual digital assistants will increase from 145.2 million users worldwide in 2017 to more than 1 billion users annually by 2025 [5].

The development of digital banking services that have become massive lately uses virtual/voice assistants in banking transactions. Several studies have discussed and proposed voice assistant designs for financial transactions. Kaur et al. (2019) established “Voice Pay” as a personal banking assistant using voice authentication [6]. Vassilev et al. (2020) propose a voice assistant

design for financial and commercial transactions equipped with two authentication factors [7]. In 2020, Tejas Rajurkar et al. has also successfully proposed a personal voice assistant for the PayPal application [8]. Several developed countries have also implemented voice assistants for financial transactions, including the U.S Bank, ING Australia, Barclays UK, KEB Hana Bank Korea, and OCBC Singapore [9]. There is still some debate about data protection, trust and privacy issues in using voice assistants, including their use in banking transactions in the developed country market itself. Take, for example, as discussed in the research of Lau et al. (2018), Lambertsson (2017) and Darda (2019) [9][10][11].

The application of technology has also been widely practiced in the banking industry in Indonesia. A survey conducted by McKinsey in 2017 shows that digital penetration in Indonesian banking is currently in line with other developing countries in Asia, 1.6 times the 2014 figure and now reaching 58% [12]. The enthusiasm of Indonesian consumers towards digital banking is very high. Some 55% of non-digital customers expressed interest in using digital banking in the next six months; this is the second-highest figure after Myanmar for Developing Countries in Asia [12].

Related to implementing voice assistants in Indonesian banking, among the top 5 largest commercial banks, they already have a voice assistant service as a virtual customer service. That application can serve customers 7/24 hours. However, these voice assistants are currently limited to serving customer complaints and questions regarding information about bank products already available on the bank's website.

On the other hand, banking transaction services using voice assistants are expected to help customers with visual impairments. Currently, Indonesian banking is still considered exclusive by blind people. The number of blind people in Indonesia, according to the Indonesian Ministry of Health in 2017, is 1.5% of the entire population [13]. This gap felt by blind people was reported on the Ombudsman of the Republic of Indonesia website in 2018 [14]. Other news, such as that released by Tempo.co in October 2018, also discussed the difficulties of the visually impaired when dealing with banks [15]. Most of the obstacles are the signatures of the visually impaired, which are often inconsistent and therefore rejected by Bank officials. Therefore, digital banking services must be developed to become services that are also blind-friendly. It follows the regulations stated in POJK Number 1/POJK.07/2013 concerning Consumer

Protection in the Financial Services Sector and POJK Number 76/POJK.07/2016 concerning Improving Financial Literacy and Inclusion in the Financial Services Sector for Consumers or the Community. The two POJKs state that banks are required to provide extraordinary services to consumers with special needs, such as the blind, deaf, and elderly aged 60 years or more [16][17].

In short, voice assistants have the potential to assist customers in financial transactions. Research and discussion about it have taken place in research and media in developed countries. However, this technology has not been implemented in Indonesian banking. No bank in Indonesia provides voice assistant services for banking transactions such as transfers and bill payments. Also, no research analyzes the use of voice assistants for financial transactions in Indonesian banks or the proposed model and application design. It is in these areas that this research focuses its focus.

Therefore, this study wants to analyze the feasibility of voice assistant technology for banking financial transactions in Indonesia and proposes a model and design system that can be implemented. This analysis needs to be done because it also remembers the different behavior of Indonesian society from Westerners, and there are also Indonesian government regulations regarding banking transactions.

This article presents an analysis based on the PESTLE framework, including political, economic, social, technology, legal, and environmental factors that could impact implementing voice assistant for Indonesian banking transactions. Then, from the analysis results, we propose a service model and application design with a prototype built using the Design Science Research (DSR) methodology. An analysis of the potential challenges faced by the bank will complement this research. Nevertheless, testing the accuracy of voice assistants in capturing orders for banking transactions was not covered in this study.

The results of this study become a strategic study and a starting point for banks in developing and designing voice assistants for banking transactions. The analysis results are also an additional reference for regulators in evaluating and compiling regulations related to this feature. This innovation also provides a solution to create equal opportunities for customers with disabilities to access banking services in Indonesia.

2. LITERATURE REVIEWS

2.1 Human-Computer Interaction (HCI)

Quoting from Gerard Jounghyun Kim's book *Human-Computer Interaction: Fundamentals and Practice*, "Human-Computer Interaction (HCI) is a cross-disciplinary field (for example, engineering, psychology, ergonomics, design) that deals with theory, design, implementation, and evaluation of human methods for use and interact with computing devices" [18]. Just like the name, HCI focuses on the interaction between the computer and the human being its user. The goal of HCI is to produce a system that is easy to use, efficient, safe and functional [18]. To achieve this goal, researchers have established the basic principles of good HCI design. According to Kim, these are the main HCI principles: identify users, understand their tasks, reduce user memory load, consistency, remind users and refresh user memory, prevent users from making mistakes, and natural [18]. The application of HCI in the banking sector includes the emergence of Automatic Teller Machines (ATM) services, phone banking, SMS banking, internet banking and mobile banking.

2.2 Customer Relationship Management (CRM)

There are many definitions of Customer Relationship Management (CRM) put forward by researchers. Francis Buttle defines CRM in terms of 4 characteristics [19]. CRM as a strategy is a customer-centered business strategy to win and retain customers that benefit the company. CRM is the automation of customer-facing processes such as sales, marketing, and customer service in operations. CRM in analytics is a customer database that companies can use to achieve business goals. Rozitta Chittaie (2012) wrote that CRM theorists stated that CRM has four aspects: customer identification, customer attractiveness, customer retention, and customer development [20].

CRM is one of the ways the bank creates good relationships with customers or prospective customers. Creating good relationships with customers is the key to the bank's success in maintaining customers. M. Nur Rianto Al Arif & Titin Nurasiah (2016) wrote in their article that, in general, Banks use CRM for four aspects, namely Customer Lifetime Value (CLV), service excellence, customer satisfaction and customer loyalty [21].

2.3 Digital Banking

The growing use of technology in providing personalized services to customers has created a new era in the banking industry, namely digital banking. Banks can provide services

according to customer preferences without limitation of place and time through the bank's electronic or digital media and/or through digital media owned by prospective customers and/or Bank customers.

According to the Financial Services Authority (OJK), the definition of electronic banking services is "Electronic Banking Service is a service for Bank customers to obtain information, communicate, and conduct banking transactions through electronic media" [22]. Meanwhile, Digital Banking Services are electronic banking services that optimize customer data to serve faster and easier, according to customer needs, and service processes can be carried out independently by customers [22]. The OJK has regulated the principles of safeguarding customer data and transactions that must be adhered to by Digital Banks in Indonesia in providing electronic banking services [23]:

- Confidentiality
The principle of confidentiality aims to protect the bank customers regarding the financial, transactions and personal data.
- Integrity
The integrity of a bank is reflected in good governance, aimed at maintaining customer data accuracy.
- Availability
The principle of availability ensures that the bank always provides information or resources needed by customers.
- Authentication
In digital banking services, Banks are required to apply transaction authorization that utilizes data and/or information that can be verified, namely in biometrics, including fingerprints, voice, iris and/or other electronic instruments such as QR codes and Near Field Communication (NFC).
- Non-repudiation
The principle ensures that a transaction is irrefutable. It keeps the customer from denying having made a transaction.
- Authorization of control
Banks must ensure that applications accessed by customers as well as systems and databases that provide customer data are protected from tampering and tampering.
- Segregation of duties
Transaction systems and processes must be designed to ensure that employees or third parties who do not have access can enter or authorize and complete a transaction.
- Maintenance of audit trails

Banks must maintain records/logs of all customer transactions to provide clear forensic evidence and assist in resolving disputes with customers.

2.4 Dialogflow

Dialogflow is a natural language understanding platform for designing and integrating chatbot interfaces into mobile applications, web applications, devices, etc. Dialogflow can accept and respond to input in the form of text or speech. Dialogflow provides easy integration to popular messaging applications such as Facebook Messenger, Slack, Twitter, Kik, Line, Skype, Telegram, Twilio and Viber. Even for some voice assistants like Google Assistant, Amazon Alexa and Microsoft Cortana [24].

2.5 Artificial Intelligence (AI)

Artificial Intelligence (AI) enables machines to learn from experience, adapt to new inputs, and perform tasks like humans. The machine learning process can be thought of as a three-step process, analyzing data, building models and taking actions. These three steps are repeated until it produces a model that is closest to the given output. There are three main types of machine learning: supervised learning, unsupervised learning and reinforcement learning [25].

Voice assistant for mobile banking transactions using artificial intelligence techniques with a supervised learning method. In machine learning that involves supervised learning, AI provides several examples of data whose output is known or, in other words, data that has been labeled. The AI engine will use the sample data for training. From the training data, the AI learning algorithm looks for a model that matches the known input-outputs. The model is then used to provide output or new input whose output is unknown [25].

2.6 Natural Language Processing (NLP)

NLP is a branch of computer science and linguistics that studies the interaction between computers and humans using natural language [26]. In general, NLP can be applied to 2 types of applications, namely text-based applications and dialogue-based applications. Voice assistant technology implements the NLP dialogue-based application, which is an application that involves spoken language or voice recognition, or it can also be a dialogue interaction by typing question text [26].

2.7 PESTLE Analysis

PESTLE analysis is a concept in marketing principles that provides an overview of the whole environment and different points of view on a particular idea/plan [27]. PESTLE stands for P for Political, E for Economics, S for Social, T for Technology, L for Law, and E for Environment.

Political factors analyze the political conditions in the country, the policies implemented by the government, and external forces that might influence it [27]. For example, fiscal policy, trade tariffs and taxes levied by the government on merchants and companies affect the income earned by these companies. Economic factors take into account the current economic conditions of the country and the global economy that may change [27]. It can affect the supply and demand for products in the market and result in changes for its business.

Social factors relate to the people's social mindset, cultural aspects, age demographics, gender, and related stereotypes [27]. Sometimes, this analysis must include religious factors (when it comes to products or services of different types) [27]. The technology factor considers the level of technological progress and how much integration the company needs with it [27].

Legal factors relate to all legislative and procedural components in an economy. Additionally, it considers specific regulations that a company may have to comply with to start production/promotion [27]. Environmental factors relate to geographic location and other related environments that can influence the nature of the market [27].

3. METHODOLOGY

In this research, we used primary and secondary data with qualitative analysis. Primary data were obtained from surveys distributed randomly to bank customers in Indonesia aged 17–55 years. We take respondents in this age group because they are a productive group where some of them want to do all activities efficiently and do more than one activity simultaneously. In addition, the age requirement for someone to open a bank account is that the customer must be at least 17 years old. The survey got the number of respondents who answered was 70 people. The secondary data obtained was from journals, websites and government regulations. After the data was collected, a qualitative analysis was carried out using the PESTLE framework in which there were six main elements, namely Politics, Economy, Social, Technology and Environment.

Furthermore, based on the analysis result, we propose a service model and the application design. The methodology most referenced in innovation research and information systems development is the Design Science Research (DSR) methodology introduced by Alan R. Hevner [28]. Adapting to the DSR model cycle, this research was carried out in stages, as shown in Figure 1. Demonstration and evaluation of the design results were carried out to five stakeholders, namely IT Risk, IT Planning & Architecture, Product Owner, Technical Lead and IT Operation.

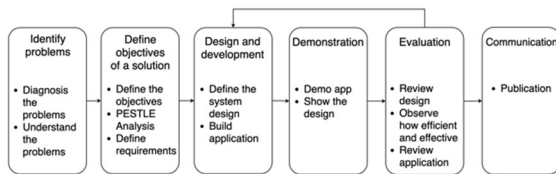


Figure 1: Research Methodology

4. RESULT AND DISCUSSION

4.1 PESTLE Analysis

a. Political

Currently, banks are required to develop business strategies that are more optimal in utilizing advances in information technology to increase the bank's competitiveness. Voice Assistant for mobile banking financial transactions is one of the breakthroughs in applying modern technological developments in the Indonesian banking industry. In line with the development of existing banking technology, up to now, several laws and regulations related to Banking Information Technology have been issued, including the Law on Information and Electronic Transactions and its implementing regulations in the form of Government Regulations concerning the Operation of Electronic Systems and Transactions and Relevant Ministerial Regulation [23]. In addition, the reference standards for assessment related to Information Technology are also constantly being updated, such as the Indonesian National Standard (SNI) for the national scope in Indonesia and the International Organization for Standardization (ISO), Control Objective for Information and Related Technology (COBIT), and the International Electrotechnical Commission (IEC) for international scope [23]. With these provisions, the bank is expected to manage the risks faced effectively in carrying out banking activities supported by Information Technology.

There are government policies that can significantly influence the development of voice assistant services for mobile banking financial transactions. Policies concerning the Implementation of Risk Management in the Use of Information Technology by Commercial Banks are listed in the Financial Services Authority Regulation (POJK) Number 38/POJK.03/2016. The Financial Services Authority (OJK) has considered that basically, the development of information technology can be used by banks to improve the efficiency of operational activities and the quality of bank services to customers. OJK also reminded that the use of information technology in banking activities could also increase the risks faced by banks. Therefore, banks need to implement risk management effectively to control the possibility of additional risk that occurs.

Following POJK Number 38/POJK.03/2016, every electronic banking transaction service must adhere to the principle of controlling customer data and transaction security. It must also be applied in voice assistant services for financial transactions. The integration between voice assistant application and the Bank database is done through a private API. The history of conversations and transactions on the voice assistant application is still stored in the bank's database. It ensures confidentiality and authorization control in the system, database, and application to maintain records/logs of all customer transactions to provide clear forensic evidence and assist settlement if there is a dispute with the customer. Voice assistant services are designed to maintain the principles of integrity, authenticity and non-repudiation. It is to protect customer data and ensure customer security in making transactions using the voice assistant application.

OJK has also regulated the Implementation of Digital Banking Services by Commercial Banks, as stated in POJK Number 12/POJK.03/2018. Digital Banking Services is Electronic Banking Services developed by optimizing customer data to serve customers more quickly, easily, and according to customer needs, and can be carried out entirely independently by customers due to security aspects reference. The aim is to provide easy access to information technology-based banking services without limitation of time and place to encourage better customer financial management. Digital Banking services

provided by the bank include account administration, transaction authorization, financial management, and/or other financial product services [22].

In digital banking services, banks must apply at least 2 (two) factors of authenticity that can be accounted for to verify financial transactions on transactional services [22]. Authentication factors can be in the form of:

- i. What do you know, such as Personal Identification Number (PIN), passwords, identity card numbers and personal data;
- ii. What do you have, such as magnetic cards, chip cards, tokens, digital signatures;
- iii. Your characteristics (what you are) include biometrics such as fingerprints, voice, and iris.

Looking for the OJK policies above, the government has been proactive in dealing with technological developments. OJK has included voice as one of the biometric characteristics that can be used to verify financial transactions. However, the regulations do not specify in detail how transactions using voice commands can be truly safe.

To comply with the government regulation, we propose two authentications used in voice assistant services for mobile banking financial transactions, namely:

- i. The first authentication is performed when the customer gives a command to the voice assistant application. Users will be asked random questions. A list of questions and answers is entered when customers register for voice assistant services. For example, what is your favorite music group? What is your favorite color? and what is your favorite movie?
- ii. As final authentication, the voice assistant will ask the customer to say the One Time Password (OTP) when the voice assistant application will execute the transaction order. The system will send this OTP to the customer via voice call to the customer's telephone number registered in the bank's database.

Integrating with voice assistants like Google Assistant, Siri, or Alexa means they are ready to integrate with their cloud-based services. Basically, OJK has allowed the banking industry in Indonesia to use cloud computing technology since March 2020. This regulation is stated in the Financial Services Authority Regulation of the Republic of Indonesia Number 13/POJK.03/2020

concerning Amendments to Financial Services Authority Regulation Number 38/POJK.03/2016 concerning the application of risk management in the use of information technology by commercial banks. The POJK states that banks must cooperate with providers based in Indonesia in using the cloud. The Bank must consider several things [29]:

- Take control measures to produce systems and data that are confidential and integrated and support the Bank's objectives.
- Ensuring continuity and stability of IT operations and mitigating risks that could potentially disrupt bank operations.
- Provide a communication network that meets the aspects of confidentiality, integrity, and availability.
- Have a disaster recovery plan
- Reviewing disaster recovery plans at least once a year, placing electronic systems in data centers and disaster recovery centers in Indonesia.

b. Economic

Indonesia is a huge share of the technology market. Indonesia has one of the youngest demographic profiles in the world, namely, 60 percent of the population is under 30 years old, and the population is growing at a rate of 2.5 million per year [30]. It is estimated that the population could reach 280 million by 2030, with about 70 percent of the total population in that year being of working age or productive age. This age group is very responsive to the development and use of technology.

Based on Munish Kumar's (2016) research, e-banking is one factor that affects banking customer satisfaction [31]. Research by Eko K. Budiardjo and Dewi Aprillovi (2009) also states that mobile banking is a CRM channel. Mobile banking can increase and maintain customer loyalty [32]. The convenience of transacting on mobile banking is one of the keys to the bank's success in realizing customer loyalty. Therefore, it is hoped that the development of transaction services using voice assistants will provide more convenience and comfort in transactions to increase customer loyalty and the number of transactions. The increase in the number of transactions will undoubtedly increase the bank's fee-based income.

Innovating by applying the latest technology to a product/service will also

increase the bank's branding and marketing. It can attract the public's curiosity to try these products/services, thus opening up the potential to expand the product range and increase the number of new customers.

Looking at the total commercial bank accounts in Indonesia, as released by the Deposit Insurance Corporation (LPS), there were 350,324,950 accounts as of December 2020 [33]. It is a substantial market share for developing banking services.

Behind some of the benefits that can be obtained from voice assistant services, of course, some investments must be spent by the Bank, including:

- Developer fees (using third-party vendors or internal employees).
- Cloud-based infrastructure costs.
- System maintenance costs.
- Training costs for frontline employees (customer services, call center officers, marketing) who will educate customers.
- Marketing costs

As an illustration of the costs required for a one-time money transfer transaction through a voice assistant, it can be explained as follows. Given an example, the bank builds a voice assistant using Dialogflow. Each request is charged \$0.001 per second of audio, with a minimum of one minute [34]. The customer takes about 3 minutes for one transfer transaction, so the required fee is \$0.18. For authentication using OTP, an OTP delivery fee of \$0.013 per minute is required for OTP delivery via voice calls and \$0.0075 for one-time OTP sending via SMS [35]. So, the total cost is up to \$0.193 per transfer transaction. Banks may charge a monthly fee to customers who subscribe to voice assistant services.

c. Social

Voice assistant is one of the most advanced and widely used artificial intelligence applications, such as voice assistants on smartphones, smart homes and smart cars. Many Western media and academic studies have investigated the acceptance and use of voice assistants. However, we still need to study the Indonesian public's acceptance of voice assistant technology, especially for banking transactions. This service is not yet available in various banks in Indonesia.

Anisa Aini Arifin (2020) has conducted research using a semi-structured qualitative interview method regarding the motivation of

Indonesians to adopt voice assistant technology [36]. Interviews were conducted with 18 respondents ranging in age from 26 to 40 years. From this research, it was obtained three factors that influenced them to adopt and use voice assistant technology, namely:

- Peer influence
- Appreciation for service providers who have developed voice assistant features
- Rationalizing behavior

We conducted an extensive survey to understand better people's interests and factors of public concern in choosing voice assistant services for financial transactions. The survey was conducted by distributing questionnaires randomly to Bank customers in Indonesia. The questionnaire was distributed to customers aged 17–55 years, and the number of respondents who answered was 70 people. The selection of this age group is based on the consideration that this group is the most productive compared to other age groups. Therefore, this age group is the main target of the voice assistant service so that they can do several jobs at the same time.

As shown in Figure 2, the survey results state that 100% of the respondents are users of mobile banking services. We can assume these results to represent all Bank customers in Indonesia. It can also mean that almost all Bank customers in Indonesia use mobile banking services. It shows that the mobile banking service is in great demand by customers. The subsequent survey results stated that 52.9% of respondents always use mobile banking services in making financial transactions.

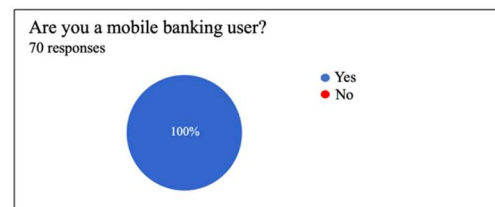


Figure 2: Number of respondents using mobile banking

Meanwhile, 44.3% of respondents stated that they used mobile banking frequently, and only 2.8% stated that they rarely used mobile banking even though they had a mobile banking application on their smartphone. It is shown in Figure 3. These results illustrate that most customers believe in the existing mobile banking services. We can mean that most of

these customers feel that mobile banking helps make it easier to make financial transactions.

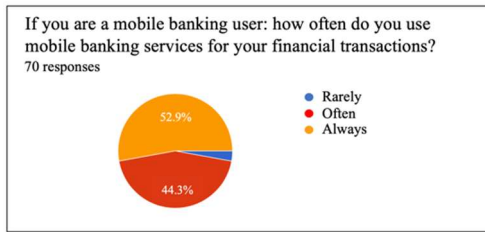


Figure 3: Frequency of use of mobile banking

Figure 4 shows the respondent's interest if the mobile banking service is equipped with a voice assistant. From the survey results, we know 27.2% of respondents stated that they were very interested in this new service offered. They hope that with the voice assistant service, financial transactions can be done more easily and quickly. In addition, the voice assistant system for financial transactions allows them to transact while doing other work at the same time, such as shopping, driving a car or writing. The factors that make customers interested in voice assistant services are shown in Figure 5.

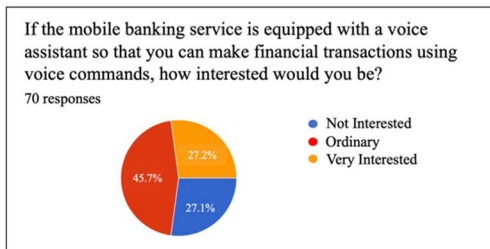


Figure 4: Respondent interest in voice assistants for financial transactions

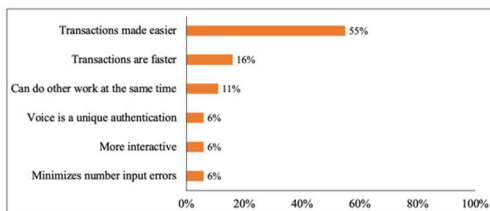


Figure 5: Reasons for Interested in Voice Assistant Services

Meanwhile, 45.7% of respondents said they felt ordinary about developing a voice assistant system for financial transactions. The reason is that they do not know the features and workings of the system offered by the voice assistant service. They are also not used to using voice assistant services on their smartphones, such as Google Assistant, Siri or

Bixby. Among them said that if they already know how it works, the capabilities of the features offered, and the security of the voice assistant system in transactions, they will be interested in trying it. An overview of the factors that influence customers in this group can be seen in Figure 6.

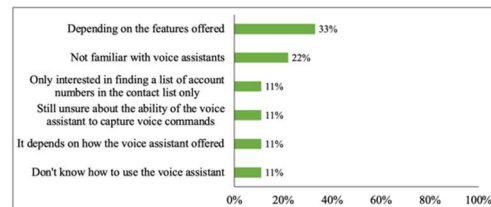


Figure 6: "Ordinary" Reasons for Voice Assistant Services

The remaining 27.1% of respondents stated that they were not interested in voice assistant services for financial transactions. Doubts about the ability of the voice assistant to capture voice commands conveyed by users are the most significant factor that concerns them. Transactions that should be easier and faster with voice commands will take longer if the user has to repeat commands because the voice assistant system cannot accurately capture commands. Another factor is privacy in transactions and data confidentiality. By transacting using voice commands, transaction and financial information will be heard and known by others around them. The reasons why customers are not interested in voice assistant services are shown in Figure 7.

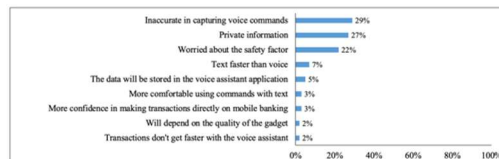


Figure 7: Reasons for Not Interested in Voice Assistant Services

With various factors that concern respondents to use or not use voice assistant mobile banking services, they expect voice assistant services for financial transactions that can capture user orders accurately, safely, smartly and easily to use. Some of the voice assistant system capabilities expected by customers are shown in Figure 8.

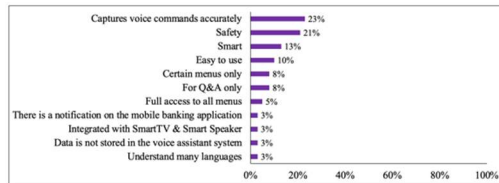


Figure 8: Voice Assistant Capabilities Customers Expect Technology

d. Technology

Technology is fast disrupting business models across various industries. Some of the technological trends impacting the macro environment include artificial intelligence, machine learning, and big data analytics. Many companies in Indonesia are already taking advantage of the opportunities presented by this disruptive or game-changing technology. The Internet is also becoming mainstream. We Are Social in January 2020 reported on internet penetration in Indonesia. Out of 272.1 million people in Indonesia, there are 175.4 million internet users. Among internet users aged 16 to 64 years, 96% own a mobile phone, 94% have a smartphone, 66% have laptops or desktop computers, and 23% own a tablet device [37].

Voice assistant is an application that utilizes artificial intelligence and machine learning technology, supported by a conversational user interface and natural language processing (NLP). According to Gartner, virtual assistants will continue to evolve into advanced virtual assistants targeting multiple jobs and functions and driving the expansion of AI chat agents to every area of consumer life and business interactions [38]. Virtual assistants change how consumers interact with devices and IoT (Internet of Things) while improving customer experience and engagement. Gartner ranks advanced virtual assistants as the four most impactful technologies for 2021 [38]. The famous virtual assistants in Indonesia are Google Assistant, Siri and Alexa [36].

In some developed countries, the use of voice assistants to complete financial transactions is gaining popularity. Several banks in developed countries have implemented voice assistants for financial transactions, including the U.S Bank, ING Australia, Barclays UK, KEB Hana Bank Korea, and OCBC Singapore [9]. Meanwhile, no banks provide voice assistant services/applications for banking financial transactions such as transfers and bill payments in Indonesia. Implementing a voice assistant

application in financial transactions will be a breakthrough in Indonesia that offers users a natural voice experience and a zero-touch experience when making transactions.

Integration of voice assistant application with database banks using a private API to maintain customer transactions and data security. Other than that, the history of transactions on the voice assistant application is still stored in the bank's database to ensure confidentiality and authorization control in the system, database and application.

e. Legal

Implementing voice assistants for banking transactions can create opportunities but also increase risks. Several legal issues must be considered in developing voice assurance for financial transactions, such as data protection, integrity principles, data accuracy, non-repudiation, segregation of duties, and maintenance of audit trails. Therefore, to protect data and ensure customer security, several things must be of concern from both the bank and the customer.

The Bank should carry out the following security procedures to create a secure communication network between the Bank's server and the voice assistant server.

- i. Use private API with a specific endpoint to integrate with the voice assistant application.
- ii. Use network encryption to encrypt data transmitted between Bank's server and client/voice assistant's server.
- iii. Use firewall network security to protect Bank's network by acting as an intermediary between Bank's internal network and outside traffic.
- iv. Use a dedicated server outside the primary database server. This dedicated server only contains data needed for voice assistant transaction services, does not contain all customer data. In addition to data protection, this server is also to maintain server and application performance.
- v. The history of conversations and transactions on the voice assistant application is still stored in the bank's server to ensure confidentiality and authorization control in the system, database and application. It is so that the bank can maintain records/logs of all customer transactions to provide clear forensic

evidence and assist settlement if there is a dispute with the customer.

Banks must also implement the following rules for transaction security:

- i. Customers who will use voice assistant services for banking transactions must register with the respective bank.
- ii. The email used by the customer in the voice assistant application must be registered with the Bank.
- iii. There are features to set up:
 - Maximum transfer nominal in one transaction.
 - A maximum number of transactions per day.
- iv. There are notification messages to customers for every transaction, either via SMS, email or notifications on mobile banking.
- v. The transfer feature can only be done for the destination account number registered in the Bank application's contact list.
- vi. Customers are required to sign in on the voice assistant application when making transactions. The application will not detect anonymous users.
- vii. When a customer makes a transaction using a voice assistant, the customer incorrectly mentions the authentication code twice, the customer's voice assistant service will be blocked by the bank.

Meanwhile, from the customer side, before using the voice assistant service for financial transactions, customers must take the following steps:

- i. Register the transaction destination account number into the contact list of the mobile banking application.
- ii. Set up a maximum transfer nominal in one transaction on the mobile banking application.
- iii. Set up the maximum number of transactions per day in the mobile banking application.
- iv. Sign in on the voice assistant application when making transactions.
- v. It is recommended to activate the voice match feature in the voice assistant application.

f. Environment

Virtual/voice assistants, in general, have also been widely used to build and market environmentally friendly innovations. The

Google Assistant has Climate Change Trivia, while Alexa has skills like Environmental and Climate Change News which provides information on the latest scientific findings and current events. Google Assistant and Alexa can help save energy use by controlling your lights and other electronic devices and sprinklers to help curb overuse [39].

Voice assistants have done very well in many fields, including in the world of education, by helping children with learning disabilities and equipping medical personnel with life-saving information in an emergency [39]. Likewise, the implementation of voice assistants in the banking sector is expected to help persons with disabilities carry out financial transactions independently anywhere, anytime, quickly, comfortably and safely.

4.2 Proposed System

In the proposed system, first, the customer calls the voice assistant application to perform the ordered transactions. This voice assistant application will then request a query via a private API to the bank's server to retrieve the required data. Furthermore, the voice assistant application will provide output to customers in the form of voice as well. The services provided by the proposed system are as shown in Figure 9:

- Check nominal balance.
Customers can find out their amount balance.
- Check the last transaction history.
Customers can find out the details of their account transactions, including the type of transaction, the amount of the transaction, the time of the transaction, the place of the transaction and the destination account for the transfer (for transfer transactions).
- Check the amount of credit card and electricity bills.
Customers can find out the amount of the last charge on their credit card. They can also see the amount of their electricity bill based on customer ID.
- Add bank contact.
Transfer via voice assistant can only be done for the destination account number that has been registered in the contact list of the mobile banking application. Therefore, adding a contact list is also facilitated using a voice assistant.
- Internal transfer
Customers can transfer to the same bank.
- Interbank transfer
Customers can transfer to other banks.

- Top-up e-wallet
Customers can top up electronic wallets such as OVO, Gopay, Dana, LinkAja, ShopeePay.
- Bill payment
Customers can pay credit card bills, mobile, electricity, cable TV, and muti-finance bills.

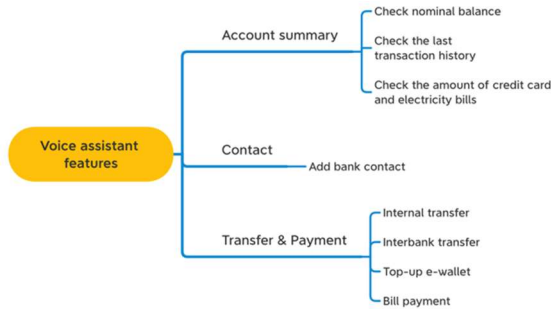


Figure 9: Features of Voice Assistant

This voice assistant is designed according to customer needs in financial transactions while still applying the HCI principles and the Indonesian government regulations regarding digital banking transactions. For a prototype view, we build the voice assistant using Dialogflow, and it can be demonstrated how this system works for transfer transactions. Given an example, we call this voice assistant “Jago Bot”. Figure 10 shows a balance check workflow using a voice assistant. While the workflow for the transfer transaction process is shown in Figure 11.

Figure 12 to Figure 16 are the display of the voice assistant prototype. This prototype demonstrated using Bahasa to describe the customer experience in Indonesia when using voice assistants. Figure 12 shows the first time the user calls the “Jago Bot” application. Figures 13 and 14 show a conversation between a user and “Jago Bot” voice assistant for balance check transactions.

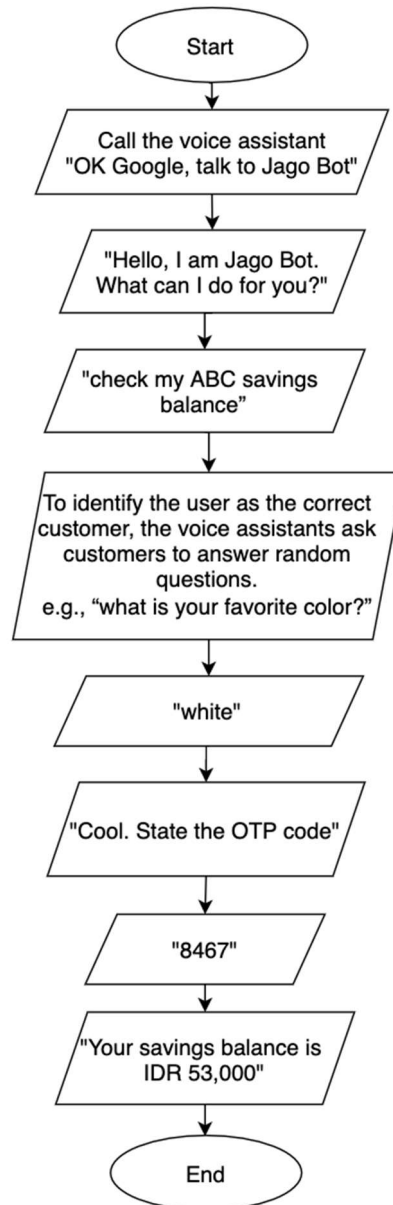


Figure 10: Flowchart for balance check

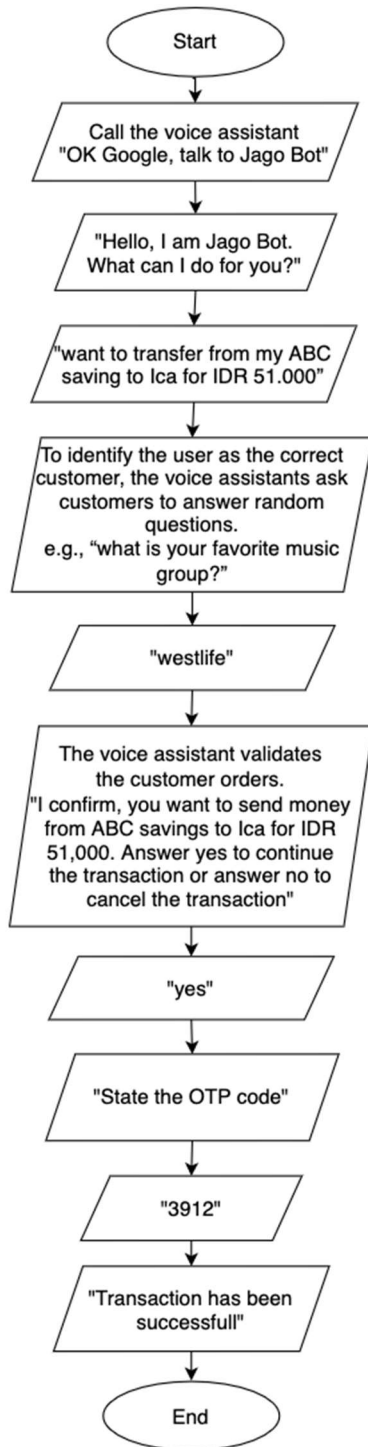


Figure 11: Flowchart for transfer transaction

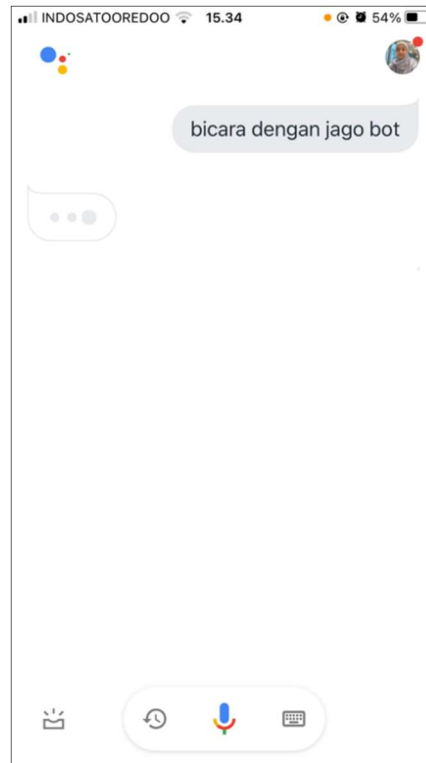


Figure 12: Voice assistant application view

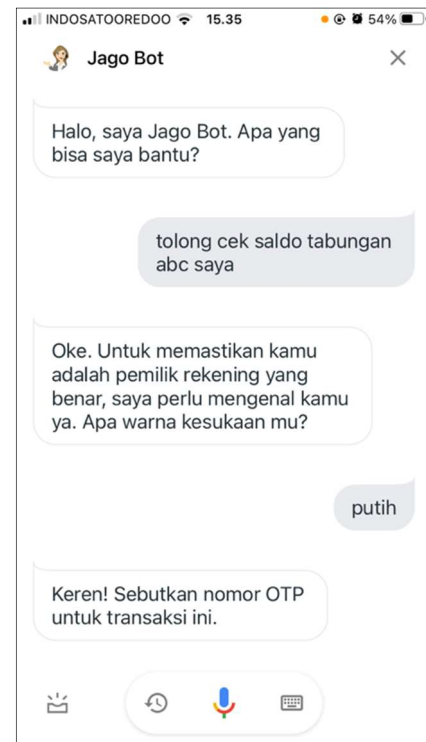


Figure 13: Voice assistant application view for balance check (1)

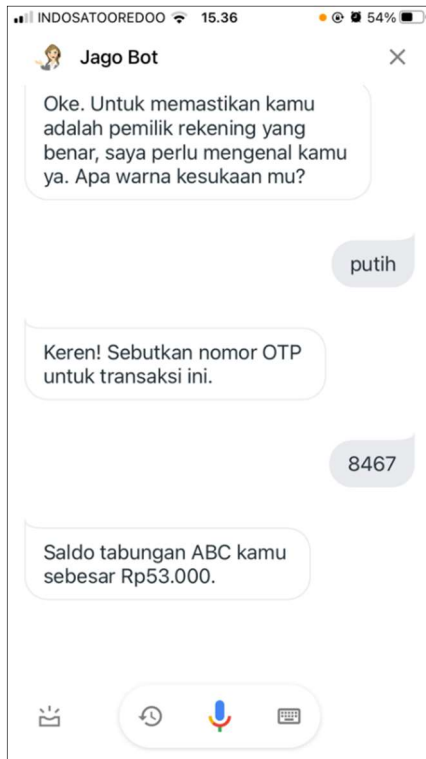


Figure 14: Voice assistant application view for balance check (2)

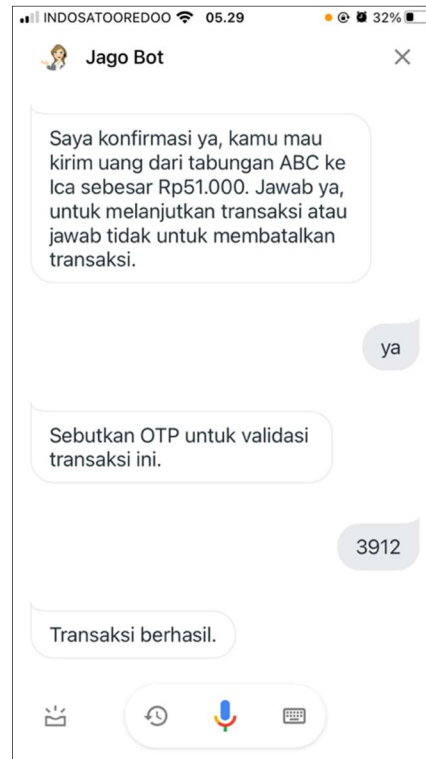


Figure 16: Voice assistant application view for transfer (2)



Figure 15: Voice assistant application view for transfer (1)

4.3 System Design Evaluation

The proposed service and application model must ultimately be evaluated and validated, whether acceptable and useful for stakeholders. The evaluation pattern refers to the general evaluation of the DSR recommended by Sonnenberg, C., & vom Brocke, J [40]. The researcher presented the service model and the features offered and demonstrated the application prototype to five stakeholder representatives, namely IT Risk, IT Planning and Architecture, Technical Lead, Product Owner and IT Operation. Discussions are carried out separately from each stakeholder. They were asked to assess according to the point of view of their respective roles. Table 1 summarizes the final evaluation results from stakeholders on the proposed voice assistant service and application model for banking transactions.

Table 1: Evaluation Result

Element	IT Risk			IT Planning & Architecture			Technical Lead			Product Owner			IT Operation		
	Good	Avg	Bad	Good	Avg	Bad	Good	Avg	Bad	Good	Avg	Bad	Good	Avg	Bad
Easy to use	✓			✓			✓			✓			✓		
Features	✓			✓			✓			✓				✓	
Authentication	✓			✓			✓				✓			✓	
Security	✓			✓			✓				✓			✓	

The evaluation results from stakeholders stated that the development of voice assistants for banking transactions is good because it adapts to technological advances. The transaction features offered are also good with easy-to-use workflows. However, IT Operations still have concerns that tend to use voice assistant services only for queries such as checking balances and checking recent transaction history. The Product Owner and IT Operation said that if this application is equipped with a voice recognition system to identify whether the voice is the voice of the correct customer, then this application will be even better. This service is safe enough to implement with the offered layered authentication, namely by using an OTP sent to the customer's mobile number.

4.4 Challenges

Developing products and services by following technological advances is one of the ways for the bank to grow and remain competitive in the market. However, banks must consider many things to provide voice assistant services as a channel for banking transactions. System and transaction security factors are of great concern to users. For example, the five stakeholders interviewed mentioned the security factor of the system and transactions as the first answer when asked their opinion about using voice assistants for banking transactions:

Adapting to technology is good, but banks must be able to minimize risks. How secure is the network, how secure is the data, and how accurately is the voice assistant able to capture voice commands from users. (S1)

Another factor of concern is the authentication system used in the voice assistant application:

How to make sure that the one giving the order to the voice assistant is the right customer? (S3)

OJK as the banking regulator in Indonesia continues to evaluate and develop banking regulations to adapt to technological advances. OJK has regulated the

implementation of digital banking services by commercial banks. However, the regulation does not explicitly mention the system network architecture, data network and workflow for voice assistant services.

From the results of this study, three challenges will be faced by the bank in implementing voice assistant services. The first challenge is to determine the most secure authentication system. The system design proposed in this study is to use a random question and an OTP number as an authentication system. The goal is that voice assistant services can be used in many devices, such as smart speakers, smart TVs and smart cars, not limited to smartphones. Authentication using fingerprint identification and face recognition may be more secure, but voice assistant services will be limited to smartphones. Another option, the bank can try to develop an application equipped with voice recognition as authentication. It, of course, has an impact on additional costs that banks must incur for application development, such as voice recognition platform and developer/vendor fees.

The second challenge faced by the bank in providing voice assistant services is regarding the accuracy of voice assistants in capturing user voice commands. If the voice assistant is not accurate in capturing the user's voice commands, instead of making transactions faster and easier, it can take longer, and even wrong transactions can occur.

The third challenge is related to providing education to customers about how to use the voice assistant, dos and don'ts, complete with information about the ease that can be obtained as well as the risks involved in using voice assistant services. It needs to be done to create transparency between the bank and customers regarding a bank product and increase customer awareness regarding transaction security.

5. CONCLUSION

From the results of the PESTLE analysis, the voice assistant has the potential to be developed as a channel for banking financial transactions. In developing this service innovation, the principles of confidentiality, integrity, availability, authenticity,

non-repudiation, authorization control in systems, databases and applications (authorization of control) and maintenance must be taken into account, and audit trails (maintenance of audit trails).

By adapting the DSR methodology, the research provides a service and application model design. That includes checking balances and recent transaction history, adding bank contact, checking the amount of credit card bills, internal transfer, transfer to other banks, e-wallet top-ups and bill payments. Two authentications are used to validate transactions, namely random questions and OTP numbers.

This study also found three challenges faced in implementing voice assistant services. The first is to determine the most secure authentication system so that this service is not only accessed using smartphones but can also be accessed using smart speakers, smart TVs and smart cars. Second, the accuracy of the voice assistant application in capturing voice commands needs to be tested. Moreover, third, education to customers must be provided in a clear, accurate and transparent manner.

Hence, further research needs to analyze the security level of higher authentication systems, such as voice recognition. The accuracy of the voice assistant in capturing orders for banking transactions has also not been tested in this study.

However, with the development of a voice assistant service for banking financial transactions, the bank has made it easier for customers to make transactions anytime and anywhere. The development of transaction services using voice assistants is also the latest innovation in Indonesian banking that can impact the bank's branding and marketing. This new service can attract public curiosity to try these products/services, thus opening up the potential to expand product reach and increase new customers. It is also a valuable product for seniors and visually impaired people in the banking sector. It will increase the number of transactions, which will impact increasing the bank's fee-based income.

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