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DESIGN OF BRANCHLESS BANKING INFORMATION SYSTEM USING USSD TECHNOLOGY: CASE STUDY IN PT BANK RAKYAT INDONESIA (BRI PERSERO) TBK

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Abstract

BRI (Bank Rakyat Indonesia) introduced a branchless banking service, called BRILink, to BRI's custome . BRILink provides real-time online banking services using Electronic Data Capture (EDC through internet connections. The shortcoming of the EDC technology is that a customer must carry a special device provided by BRI to do banking trasactions anywhere. This paper discusses the devlopment of BRI's branchless banking information system based on mobile applications using USSD technologies that utilizes GSM connections via mobile phones, and thus improving connection access to customers from wider range of areas. The conceptual design and the prototype of the USSD-based branchless banking have been developed and tested to confirm and validate its applicability in BRI. Some implementation issues and future improvement of the proposed system are discussed.

Introduction

The Financial Services Authority of Indonesia (OJK) issued the Non-Office Financial Services program for Financial Inclusion (LakuPandai), which is a delivery of banking services at an affordable cost to the vast sections of the underserved and low income groups(Nagendra & Shenoy, 2011). One of commercial banks that provide lakupandai service is BRI which is one of the largest state-owned banks in Indonesia. BRI is an active company in developing its information system. For example, BRI has implemented the DSS for internet banking technology which comprised of three models consist internal and external environmental analysis of service development,customer acquisition strategy priority analysis and area priority analysis of service development(Gautama, 2014).

In order to support the LakuPandai program, in March 2015 BRI introduced a branchless banking service called BRILink. BRILink is an agency service where BRI collaborates with customers as agents to provide real-time online banking services using Electronic Data Capture (EDC) or BRILink Web Application with business model of fee sharing(Bank Rakyat Indonesia, 2017).Branchless banking is a part of financial inclusion where a bank appoints a third party (bank agent) to undertake the basic banking activities in the unbanked area where they can reach its customers where there is no facility of a bank branch situated in that area(Nagendra & Shenoy, 2011). Branchless banking has positive impact on financial inclusion. Branchless banking alternatively helped the customers to increase their level of savings, consumption and also increased their standard of living(Mangaluru, 2016).Migap, Okwanya, &Ojeka (2015) have conducted a study related to financial inclusion for inclusive growth. The results revealed that the depth of financial inclusive is shallow even among African economies and more-so with emerging economies. It therefore recommends amongst others, the deployment of enhanced mobile banking and internet services by financial institutes to improve access to bank accounts and other services. Furthermore, In 2013, Indonesia's financial inclusion index was 59.74%, and it grew to 67.82% in 2016 (Otoritas Jasa Keuangan, 2017). This data indicates that there is still considerable room for the banking industry to contribute, especially to 32.18% or almost one-third of the people in Indonesia who have not gained integrated financial access.

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In 2016 there are some provinces that still have financial inclusion index below the national average such as West Sumatra province at 66.91%, Jambi at 66,91%, Central Borneoat 60,36%, North Borneoat 61,45% andSouth Borneo at 59,27%. Based on data obtained through the Central Bureau of Statistics (BPS), these provinces have percentage of the population who own or proficient to control the mobile phones above the national average and always increase each year in a varied number. In 2012 the national percentage is 47.99% and in 2015 increased to 56.92%. In 2015 percentage of West Sumatera Province is 57.04%, Jambi is 58.68%, Central Kalimantan is 63.29%, North Kalimantan is 67.48%, and South Kalimantan is 62.74%.These provinces have an index above the national average in the percentage of people who own or proficient to control the mobile phone but its financial inclusion index is still below the national average. In these provinces there is still considerable potential space for the banking industry to provide banking inclusion services. Performance expectation, business expectation and social factor have a significant positive effect on interest of information system utilization(Handayani, 2005).

Based on this background the authors are interested in analyzing and building the conceptual design of BRILink information systems based on mobile application utilizing Unstructured Supplementary Service Data (USSD)technology. USSD is an ability in standard GSM to support the transmission of information through the GSM network signal channel(Annam, Winarno, & Ferdiana, 2016). By the development of existing technology such as USSD and electronic data capture, bank sinergize with Telco Company and private sector, so they can create reliable technology to reach unbanked society(Shabirah & Aldianto, 2014).

Through the proper design, the system is expected to be easy to use and function as needed. Lim(2013) has conducted a study related to what the commercial banks should learn to be competitive. The results of the study showed that perceived usefulness and perceived easy to use positively affected the intent to use online banking.

Methodology
The method used in this research is descriptive research method, while SDLC with prototype is used as system information development method. Development of information systems is the activity of creating a new information system, including developing or modifying existing information systems(Sidharta, 1996). Stages of research are as follows:
1. SDLC, this approach is used in order to illustrate the current system, the existing procedures, the documentation of steps in the system to be developed and explain the linkages of the parties involved in the system. The stages of SDLC used in this study are investigation, analysis and design.
2. Prototyping, is a simple model developed to be proposed and discussed with the user or product owner about the basic aspects of system input, processes that occur, and output generated by the system. It is repeatedly refined until it is accepted by the end user (O'Brien & Marakas, 2011). Another purpose of prototyping is to make it easier to visualize the needs and expectations of the created system.

Research Results

System Investigation
Based on the results of this stage is known that BRI's branchless banking product named BRILink. Submissions may be submitted by individual agents or business entities. Submission of candidate agents and its approvals is managed by a system called BRI agency system. BRILink transactions can be made through an Electronic Data Capture (EDC) device or via the BRILink web application, the selection of a transactional media tool is selected when the agent candidate enrolls as an agent. BRI's agency system has terms such as agent, merchant and outlet, when a registration agent is approved for the first time, the agent will have a merchant and an outlet. In the future an agent may have more than one merchant and a merchant may have more than one outlet by applying for additional merchants or outlets. The hierarchy of BRI's agent can be seen in Figure 3. The current system flow consists of four main processes: agent registration, agent approval, product and service operations and agent complaints.
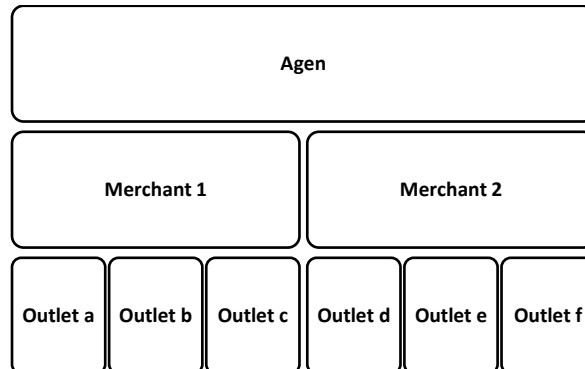
Figure 3 Hierarchy of BRI's Agent

Based on the results of the investigation of the system can be identified several things as follows:
1. BRI's branchless banking system processes are structured, but there are processes that are still through manual processes and still untouched by the system.
2. There is an inefficient flow at the agent's submission when the candidate agent has to meet BRI's marketers or come to the branch office before the bank officer makes a visit to the candidate agent's place.
3. Complaints are conveyed through BRI's contact center by phone or come to BRI's branch office.
4. USSD technology has not been used in branchless banking BRI.

Feasibility can be seen from various perspectives or point of view, such as technical feasibility, operational, cultural, legal, schedule and economic(Whitten & Bentley, 2007).

1. **Technical and Operational Feasibility**
   The use of USSD as a medium of financial transactions has been used and mentioned in previous research, for example is a mobile money application named M-PESA which has been implemented in Kenya (Ukpere, Ayo, Oni, Omote, & Akinsiku, 2012)and FNB Cellphone Banking which has been implemented in South Africa(Ismail & Masinge, 2011). This service has also been widely adopted by various domestic banks, for example by using a provider Telkomsel, bank services through USSD can be accessed through the code *141#. The security characteristics of USSD are the same as those in the SMS service because they both use GSM services. The most important security features in GSM systems are user authentication, communication encryption and temporary identity usage(Sarajlic & Omerasevic, 2007).

2. **Economic Feasibility**
   To build a USSD-based transaction system at BRI does not require additional server machines or other infrastructure, as BRI now has an SMS banking system.USSD technology has similarities with SMS system, therefore the USSD implementation server uses SMS banking server that has been used.Currently BRI already has partners (third parties) in operating SMS banking facilities, for the implementation of USSD system no additional network infrastructure is required.

3. **Cultural Feasibility**
   Data on the percentage of people who own or control cellular phones by province and the regional classification obtained from BPS provides the basis that the agents are expected to be capable of operating cellular telephones and can use the USSD service so that the direction of BRILink products can be more in line with the main target of laku pandai and help Indonesia on improving their financial inclusion.

4. **Legal Feasibility**
   Government regulation Number 19/POJK.03/2014 stated that banks that provide laku pandai must meet the requirements of having infrastructure to provide electronic services for customers in the form of SMS banking or mobile banking and internet banking or host to host.

5. **Security Feasibility**
   The USSD service has a higher security level than SMS, because USSD does not leave a copy in the user's device, which is the potential security hole that can arise from the use of SMS as a banking transaction tool (Nyamtiga et al. 2013). Other USSD security features is referring to the GSM security system as the basic

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platform of USSD. The most important security features in GSM systems are user authentication, communication encryption and the use of temporary identities (Sarajlic and Omerasevic 2007).

System Analysis

In the design of a system, the stage of analysis is a stage that aims to produce a technical design system and system functional requirements that can meet the needs of users.

1. *Functional Requirements*

   Based on the analysis can be seen that the functions required by the user to support the process of brancless banking system USSD as follows

   a) **Input**

   The system input data consists of submission data on the candidate agent, transaction data, approval data of candidate agent, agent complaint data, agent complaint solution data and report request data.

   b) **Process**

   The required USSD BRILink processes are as follows:
   - Processing direct application of candidate agent,
   - Provide notification of submission process,
   - Receive response from agency system regarding approval of candidate agent of BRILink,
   - Provide agent approval notification,
   - Processing BRILink transactions through USSD both financial transactions and non financial transactions,
   - Provide transaction notification to agents and customers,
   - Processing summary report requests via USSD,
   - Giving summary reports that have been formed,
   - Processing customer complaints through USSD by issuing complaint tickets,
   - Notify complaint process, and
   - Receive response from contact center system in the form of ticket solution.

   c) **Output**

   The system output data consists of notification of submission process and approval notification of agent candidate, transaction notification done by agent, proof of transaction given to customer, transaction report requested by agent in the form per transaction, limit report, daily report, monthly report and ticket solution for complaints submitted.

2. *Non-Functional Requirements*

   a) **Audit Trail**

   BRILinkUSSD required the ability to record chronological transactions so that it can be tracked of any changes. This feature isimportant for investigation, and also a complianceto regulatory requirements. Additional attributes required include date changes and person changes. Details of the required transaction records are as follows:
   - Changes of agent data.
   - Changes agent approval status.
   - Transactions either succeed or fail.
   - Changes of complaint data.
   - Changes in complaint report status.

   b) **Availability**

   The USSD BRILink system is one of BRI's electronic channel systems where the service should be available for 24 hours in a day.

   c) **Data Retention**

   Agent data, transaction data, and complaint data in the USSD BRILink system need to be maintained and should be available for 10 years. The availability of online data on the USSD BRILink system must be accessible at least data in the last 6 months.

   d) **Capacity**

   In the first year of implementation, estimation number of BRILinkUSSD usersis 5000 users, and estimation number of transactions of 6,000,000 transactions.

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e)   Performance
The USSD BRILink system must be able to serve transactions with minimum performance of 200 tps (transaction per second). The success rate of the system in serving the demand should be above 99.95%.

f)   Hardware
The hardware used for the USSD BRILink system consists of 4 servers, 2 application servers and 2 database servers. These servers must be monitored and maintained so the load should be under 80%. Both application server and database servers must redundancy implemented. The database must be replicated in realtime to maintain system availability.

g)   Software
Software was developed using proswitching with openedge language of advanced business andopenedge database. The USSD BRILink system should also be included in the monitoring systems to monitor the level of availability and success of the system. The system operates by being accessed through all operating systems on the mobile phone.

3.   *Context Diagram*
Context diagram is an analytical tool used to describe the relationship between BRILink USSD branchless with external entities that become sources and receive information. Context diagram of BRILink USSD can be seen in Figure 4.
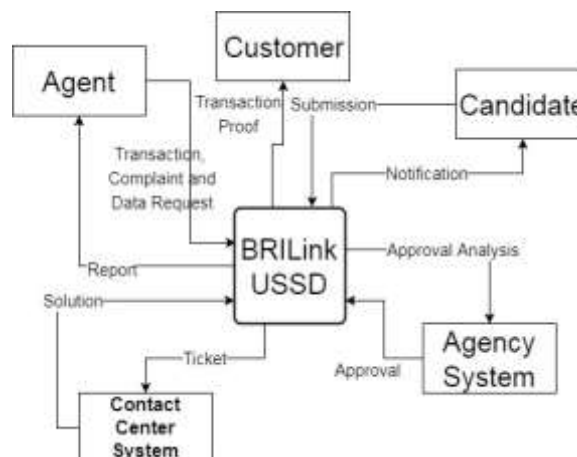

Figure 4 BRILink USSD Context Diagram

a)   The candidate agent is the source of the submission as a BRILink agent and is the goal of the notification which processed by the system,
b)   Agency system is an entity that plays a role in giving approval of agency submission
c)   Agent are the source of BRILink transactions, both financial transactions and non-financial transactions. Agent are also the source of complaints complaints and report requests from transactions that have been made,
d)   The Customer is an entity that receives the output from the USSD BRILink system in the form of transaction proof notification,
e)   The contact center system is the gateway of complaints and is the source of the solution for BRILink USSD complaints.

4.   *Data Flow Diagram (DFD)*
DFD describes in more detail entities associated with the USSD BRILink system on DFD level 1 BRILink USSD system. At this level DFD the data flow between subsystems is described in the more detailed USSD BRILink system, both incoming and outgoing data. The sub-systems present in the USSD BRILink system can be seen in Figure 5. The sub-systems consist of:

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a)   Registration Sub-System (1.0), step of submission of candidate agent which inputed into BRILink
     USSD system, then the submission is forwarded to the agency system for processing.
b)   Approval Process Sub-System (2.0), processes when BRILink USSD receives approval response
     from agency system and BRILink USSD passes the approval to approved candidates by notification.
c)   Transaction Input Sub-System (3.0), process when the client's transaction request is executed by the
     agent. Agent enters the transaction input into the USSD BRILink system and the transaction is
     recorded in the database.
d)   Transaction Output Sub-System (4.0), process when agent transaction has been passed where the
     system of BRILink USSD issued output in the form of notification received by agent and output in
     the form of proof of transaction received directly by customer.
e)   Reporting Activity Sub-System (5.0), stages when an agent performs a report request that can be
     presented in per transaction report or summary report. The USSD BRILink system provides the data
     in the form of a report in accordance with the request.
f)   Complaint Service Sub-System (6.0), process when a complaint is submitted by the agent into the
     USSD BRILink system, then the system makes a complaint ticket thataccessible to the Contact
     Center System. The Contact Center system creates a solution for the ticket and then informs the
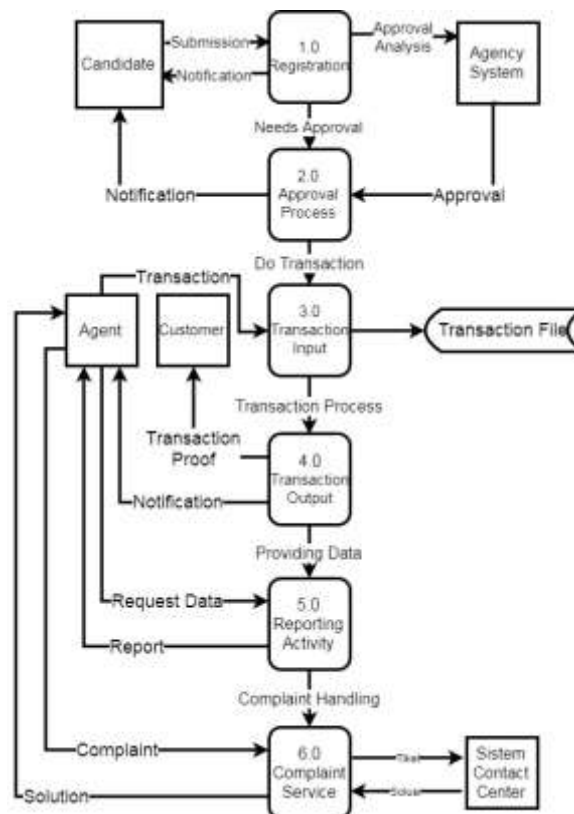   solution back to BRILink USSD system.

Figure 4 DFD Level 1 of BRILink USSD

System Design
System design is described using entity relationship diagrams (ERD) and data structures. BRILink USSD ERD
describes the relationships that occur between entities. These relations form the processes occurring within the
system such as agent registration, the establishment of merchants and outlets, transactions, report requests and
complaints.The USSD BRILink ERD is presented in Figure 5. These interconnected entities are represented by a
straight line connecting two entities through a relation. The degree of relation used on the USSD BRILink ERD
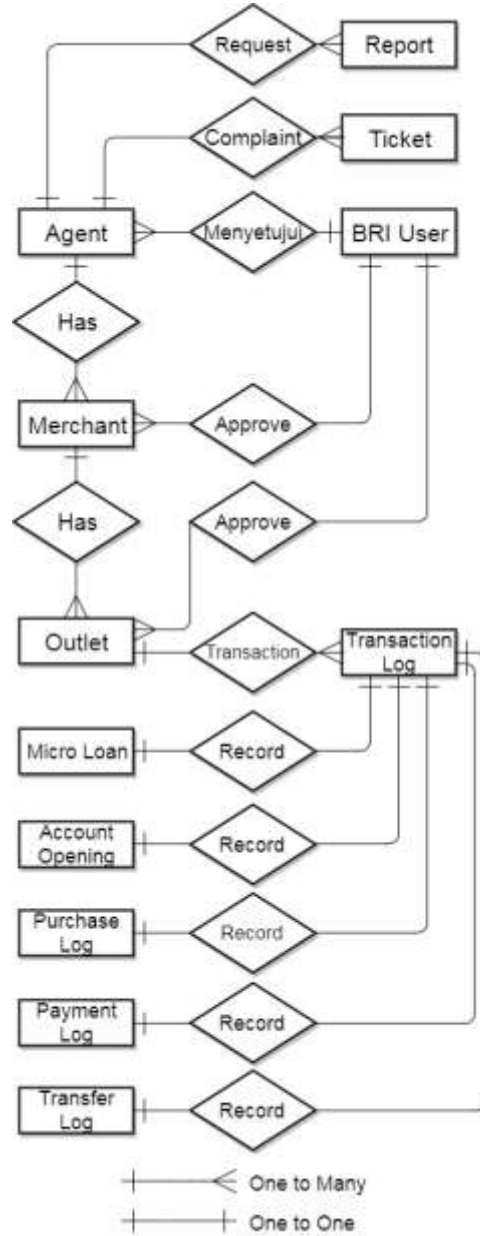is One to One and One to Many.

Figure 5 ERD of BRILink USSD

Prototype System

The USSD BRILink application system has three main menus: menu that appear when USSD access is performed by a customer who has not been registered as an agent, menu that appear when USSD access is performed by registered agents and menu that appear when USSD access is performed by registered outlets. The selected menu is identified through a phone number that accesses USSD. For those who have not registered will appear the option to register, for those listed as agents will appear the code and the name of the agent and the menus that can be selected are reports, complaints, add merchants and add outlets. For those listed as outlets will appear the code and name of the outlet along with the choice of transactions that can be done. The three main menus can be seen in Figure 6.

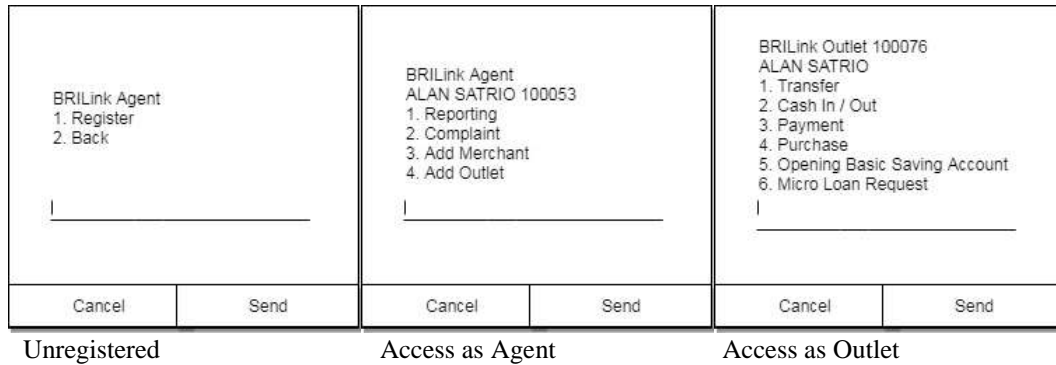INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Figure 6 Three Main Menus in BRILink USSD

Candidateswho wish to register as agents may access the USSD BRILink service and the unregistered main menu appear on the phone screen.After selecting the registration option the candidateneed to fill the form of personal data to pass the submission. Candidates who fill the form correctly will be recorded in the system andSMS notification will be sent to the candidate's phone number. The candidates will be visited by the BRI to be reviewed and they must provide the documents required by the regulator.

Registered outlets can serve BRILink transactions to customers. The outlet will be prompted to enter the customer's ATM card number along with the expiry date if the outlet wishes to conduct a financial transaction that debits the customer's account.The system will send a One Time Password (OTP) that sent to the customer's phone number as registered at the account opening. This is to verify that the customer of the card and account owner is the right party to make the transaction. Thereafter, to proceed the outlet transaction is required to enter the outlet Personal Identifier Number (PIN) to verify that the transaction is performed by the correct outlet or agent officer. The user inferface of OTP verifaction can be seen in figure 7.
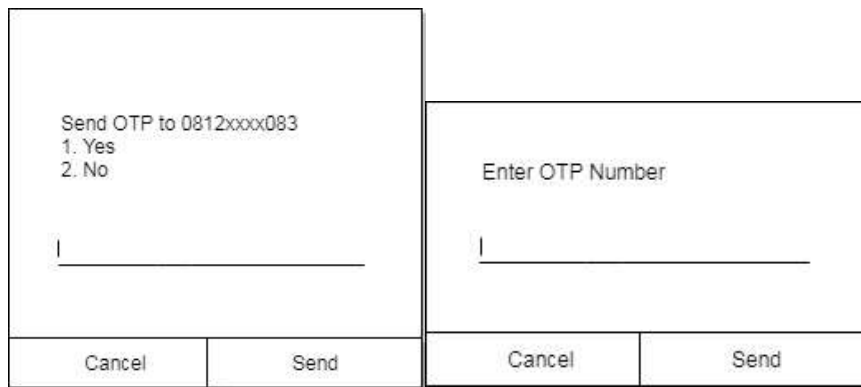

Figure 7 User Interface of OTP Verification

Customer receives transaction proof in the form of SMS that contains transaction information. The proof of transactions is sent to a specific phone number as desired by the customer. The outlet officer inputs the number into system. The transaction proof can be seen in figure 8.
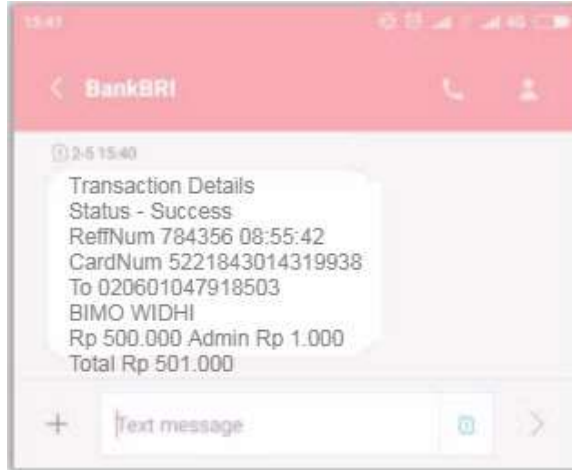
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Figure 8 Transaction Proof

The example of daily summary report can be seen in figure 9, the example of monthly summary report can be seen in figure 10, and the example of transaction limit report can be seen in figure 11.

Figure 9 Daily Summary Report

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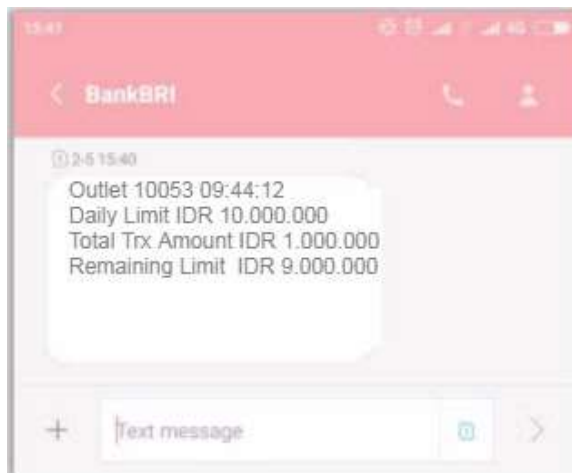

Figure 10 Monthly Summary Report

Figure 11 Transaction Limit Report

Complaints can be submitted by agents through BRILink USSD system. The complaints submitted are recorded in the system and BRI will contact the agent and deliver the solutions. The user interface of complaint service can be seen in figure 12.

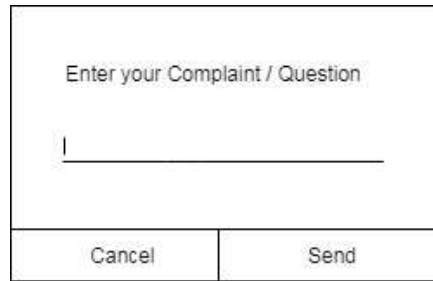INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Figure 12 Complaint Services in BRILink USSD

Conclusion

BRI's Branchless Banking Information System based on mobile applications using USSD technology allows to be implemented in order to adapt the application to the target market conditions of laku pandai. The results of system analysis and design indicate that the conclusion of this research is as follows:

1. Conceptual design of information system built based on functional requirement which identified at analysis step and adapted to existing information systems, so it does not change the core but improves the existing process. The improvement is in candidate agent's submission process that can be done directly by candidate by accessing USSD without have to meet directly to BRI marketers or come to the BRI branch office, so the registration process is easier, faster and directly recorded in the system.

2. BRI's branchless banking design using USSD technology built as a first step of implementing the new delivery channel of the USSD BRILink application which adjusted to the laku pandai target market conditions. BRILink transactions that have been using the internet path on the EDC and web applications to be used also in the GSM line via mobile phones. This is important because through this design BRILink products can widen its reach to areas that are still difficult to get internet connection or people who are still not proficient using the internet.

Future Work

BRI's branchless banking system using USSD technology prototype is still a basic design and needs to be developed and refined. An analysis of the feasibility of the financial aspects of this development needs be done to convince stakeholders or shareholders.

From the point of view of system development, it is necessary to cooperate with third parties that acts as intermediaries connecting banks to providers of telecommunication service provider. After the system development is completed, penetration test should be implementedas a step to increase security, which is an activity to simulate the attacks that could be done to the system.

In order to succeed the implementation of this system, it is required the commitment and full support from the managements of the company in establishing branchless banking USSD, so that all parties feel interested and system development can be realized smoothly.

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