Loan Assessment Process Description

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This document provides a detailed description of the loan assessment process presented in Chapter 9 of the textbook "Fundamentals of Business Process Management", by Marlon Dumas, Marcello La Rosa, Jan Mendling and Hajo A. Reijers, published by Springer in 2013. This description can be used to complete Exercise 9.14 of the textbook.

The BPMN example of this process is provided in the .bpmn and .xpdl formats with this document.

1 Process

The loan assessment process takes place between an applicant and a loan provider, with the purpose of approving home loan applications. We would like you to implement this process from the perspective of the loan provider. A BPMN representation of this process is provided in Figure 1.
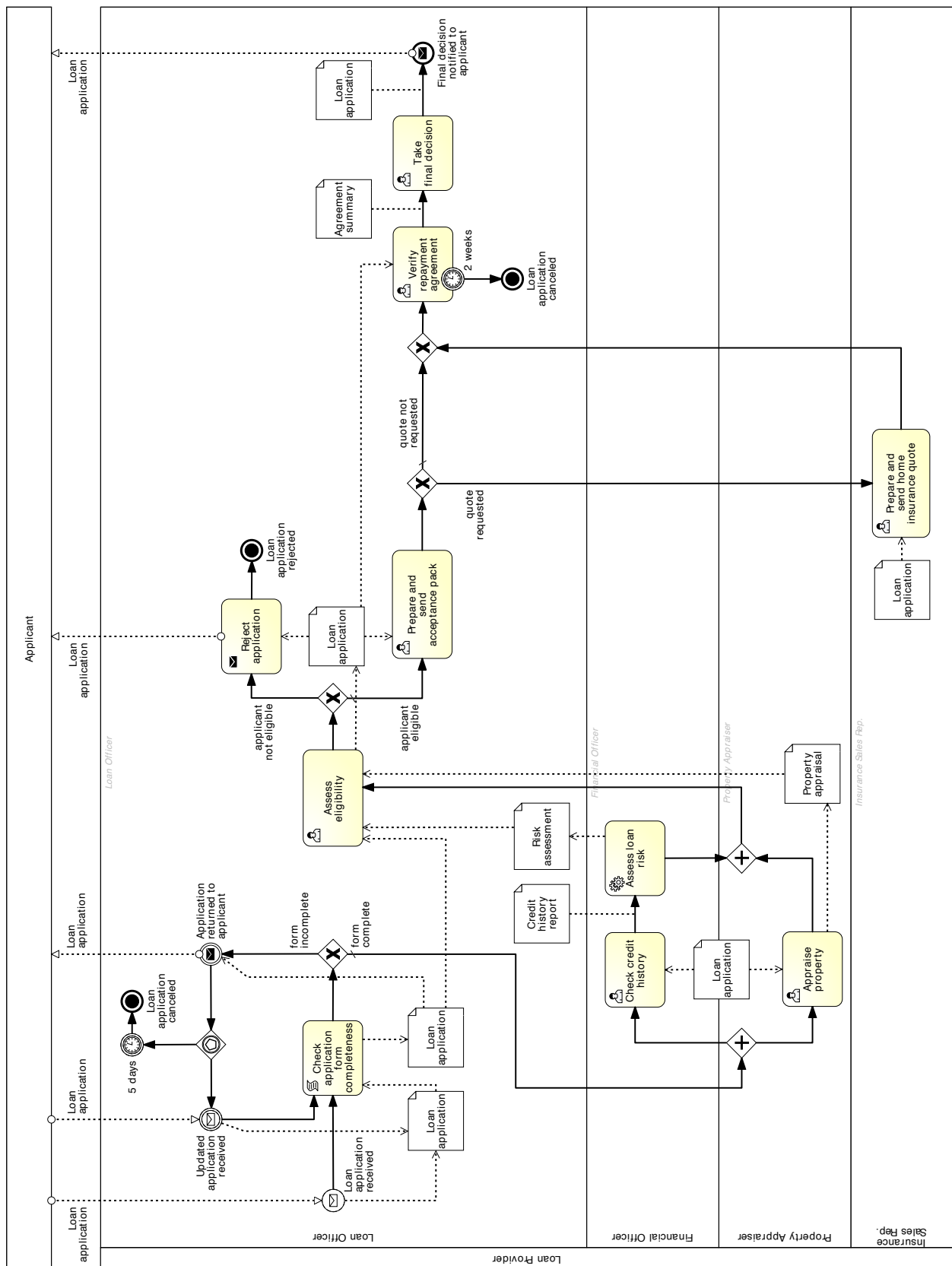
This process is executed by four roles within the loan provider: a financial officer takes care of checking the applicant's credit history; a property appraiser is responsible for appraising the property; an insurance sales representative sends the home insurance quote to the applicant if this is required. All other activities are performed by the loan officer who is the main point of contact with the applicant.

The loan assessment process starts upon the receipt of a loan application from an applicant. Once a loan application is received by the loan provider, it is checked for completeness. If the application is incomplete, it is returned to the applicant, so that they can fill out the missing information and send it back to the loan provider. This process is repeated until the application is found complete or terminated if an updated application is not received in 5 days from the date the incomplete application was sent back to the applicant.

Once the application has been deemed complete, it is approved if it passes two checks: i) the applicant's loan risk assessment, done automatically by a service, and ii) the appraisal of the property for which the loan has been asked, carried out by a property appraiser. Before conducting the risk assessment, a credit history check is required on the applicant, which is performed by a financial officer. Once both the loan risk assessment and the property appraisal have been performed, a loan officer can assess the applicant's eligibility. If the applicant is not eligible, the application is rejected, otherwise the loan officer prepares an acceptance pack, prints it and sends the printed copy to the applicant by post.

The acceptance pack includes a repayment agreement which the applicant needs to sign on, and send it back to the loan officer by post within two weeks. If this agreement is received on time, the loan officer verifies its content to check if the applicant agreed with both the loan conditions and the repayment schedule. Based on this check, a loan officer different from the one who verified the agreement takes the final decision on the application (i.e. a four-eye principle is enforced). If the applicant disagreed, the loan officer cancels the application, otherwise, the officer approves the application. In either case, the process completes with the applicant being notified of the final result.

A loan application may be coupled with a home insurance plan, which is offered at a discounted price. The applicant may express their interest in a home insurance plan at the time of submitting

Fig. 1: BPMN model of the loan assessment process

their loan application. This information is checked after sending the acceptance pack. If the insurance plan is required, an insurance sales representative sends a home insurance quote to the applicant. The acceptance of the insurance quote by the applicant and the subsequent insurance contract fall outside the scope of the loan assessment process.

2 Data

The **loan application** contains these data fields:
- Applicant information:
  - Identify information (name, surname...)
  - Contact information (email, home phone, cell phone...)
  - Current address (street name and number, city, postal code...)
  - Previous address (if any, format as above plus duration of stay)
  - Financial information:
    * Job details (current employer, monthly net revenue...)
    * Bank accounts (bank name, type of account and account number for each account held)
- Property information:
  - Type of property
  - Address (street name and number, city, postal code...)
  - Purchasing price
- Loan information (amount, number of years, start date, interest rate, interest type: variable/fixed)
- Insurance quote required (a boolean to store whether or not a home insurance quote is sought)
- Administration information (a section to be completed by the loan provider):
  - Application identifier
  - Submission date & time
  - Revision date & time.
  - Status (a string to keep track of the status of the application, with pre-defined values: "incomplete", "complete", "assessed", "rejected", "canceled", "approved")
  - Comments on status (optional, e.g. used to explain the reasons for rejection)
  - Eligibility (a boolean used by the loan officer to store whether or not the applicant is eligible for a loan)
  - Loan officer identifier (the identifier of the loan officer assigned to this application).

All fields of the loan application except "Previous address" and "Administration information" are mandatory and should be submitted by the applicant when filing a loan application, meaning when a new instance of the process is started.

The **credit history report** contains these data fields:
- Financial officer identifier
- Reference to a loan application
- Applicant's credit information:
  - Loan applications made in the last five years (loan type: household/personal/domestic, amount, duration, interest rate)
  - Overdue credit accounts (credit type, default amount, duration, interest rate)
  - Current credit card information (provider: Visa, Mastercard..., start date, end date, interest rate)
  - Public record information (optional, if any):
    * Court judgements information

∗ Bankruptcy information
- Credit assessment (a string with predefined values: AAA, AA, A, BBB, BB, B, unrated).

The **risk assessment** contains the following data fields:
- Reference to a credit history report
- Risk weight (an integer from 0 to 100).

The **property appraisal** contains the following data fields:
- Reference to a loan application
- Property appraiser identifier
- Value of three surrounding properties with similar characteristics
- Estimated property market value
- Comments on property (optional, to note serious flaws the property may have).

The **repayment agreement** contains the following data fields:
- Reference to a loan application
- Repayment schedule:
  - Monthly repayment amount
  - Number of repayments.

The **home insurance quote** contains the following data fields:
- Reference to a loan application
- Home insurance total cost
- Additional cost on monthly loan repayment
- Insurance terms and conditions
- Insurance sales representative identifier.

The **agreement summary** contains the following data fields:
- Reference to a loan application
- Conditions agreed (a boolean indicating if the applicant agreed with the loan conditions)
- Repayment agreed (a boolean indicating if the applicant agreed with the repayment schedule)
- Link to digitized copy of the repayment agreement.

3 Websites and Services

The loan provider offers a one-stop website where applicants can submit and revise loan applications online, and track the progress of their applications. You may use any communication protocol to connect the website to the loan assessment process. For example, you may want to handle this communication directly using HTTP. Another option is to use SOAP or REST over WSDL. In this case, you may implement two WSDL interfaces, one where the loan assessment process acts as the service provider and the other where the website acts as the service provider. The former interface may contain one *in-only* WSDL operation for the loan assessment process to receive the initial loan application (via event "Loan application received"). The latter interface may contain one *in-out* operation for the applicant to receive the incomplete application (via event "Application returned to applicant") and reply with the updated loan application (via event "Updated application received"), one *in-only* operation to receive the rejected loan application (via task "Reject application"), and one *in-only* operation to receive the approved or canceled loan application (via event "Final decision notified to applicant").

Further, the loan assessment process interacts with an internal service at the loan provider for assessing loan risks (via task "Assess loan risk"). This service determines a risk weight that is proportional to the credit assessment contained in the credit history report, on the basis of a business rule. You may implement this service by exposing a business rule from your rules engine as a Web service, or by connecting the business rule directly to the loan assessment process, without the need for a Web service interface.

4 Tasks and Gateways Implementation

- "Check application form completeness": this is a simple check, which can either be implemented by a script run directly by the process engine, or by an external service. This task takes a loan application as input and checks that all required information is present and in the right format. Depending on the outcome of the check this task changes the application status to either "complete" or "incomplete", assigns a fresh application identifier to the application if empty, writes the submission or revision date and time and, if applicable, fills out the status comments section with pointers to data fields requiring revision from the applicant.

- XOR-split ("form complete"/"form incomplete"): the routing of this gateway is based on the "status" field of the loan application

- "Check credit history": the financial officer is shown a Web form of the credit history report (see Section 2), where the reference to the loan application (not editable) may be embedded into the same form, e.g. in a separate tab, or be available as a PDF attachment. The officer fills in their identifier, the applicant's credit information and the credit assessment. Then the officer submits the form back to the BPMS engine.

- "Assess loan risk": this task takes the credit assessment as input and returns a risk assessment containing a reference to the credit history report and the risk weight. The business rule for computing the risk weight is very simple (though applicants don't know about it): the risk weight is 0 if the credit assessment is B, 20 if BB, 40 if BBB, 60 if A, 80 if AA and 100 if AAA.

- "Appraise property": the property appraiser is shown a Web form of the property appraisal (see Section 2). The appraiser completes the appraisal by adding their identifier, the value of three surrounding properties with similar characteristics, the estimated property market value and optionally comments on the property, before submitting the appraisal.

- "Assess eligibility": the loan officer is shown a Web form containing the loan application and a reference to the risk assessment and the property appraisal (the latter two documents are not editable: they may be embedded in the form or provided as PDF attachments). The officer checks the available documents and edits the loan application by entering their identifier, specifying whether or not the applicant is eligible for the loan and adding status comments in case of ineligibility, after which the officer submits the form to the engine. Upon form submission, the status of the loan application is changed into "assessed".

- "Reject application": this task modifies the status of the loan application to "rejected" before sending the loan application to the applicant.

- "Prepare and send acceptance pack": the loan officer who completed task "Assess eligibility" is shown a Web form of the repayment agreement (see Section 2). The officer completes the repayment schedule section by providing the amount of the monthly repayment and the number of

repayments. Then the officer manually prepares the acceptance pack by printing out the repayment agreement form, and attaching the loan terms and conditions to this. The officer then mails the acceptance pack to the applicant. [Optional] The Web form may provide a PDF export function so that a printout of the repayment agreement can be made from the PDF.

- "Prepare and send home insurance quote": the insurance sales representative is shown a Web form of the home insurance quote (see Section 2). The sales rep fills in their identifier, the home insurance total cost, the additional cost on the monthly loan repayment and attaches the insurance terms and conditions as PDF. Then the sales rep prints the form and mails the printout to the applicant. [Optional] The Web form may provide a PDF export function.

- XOR-split ("quote requested"/"quote not requested"): the routing of this gateway is based on the value of the loan application's field "Insurance quote required".

- "Verify repayment agreement": a work item of this task appears in the queue of the loan officer who completed task "Prepare and send acceptance pack", as soon as this task has been completed. The loan officer starts this work item once they have physically received the repayment agreement from the applicant, and within two weeks from the date this work item was created, otherwise the work item automatically disappears from the officer's queue, and the process terminates. The loan officer is shown a Web form of the agreement summary (see Section 2). The officer attaches a scanned copy of the repayment agreement in PDF to the agreement summary [Optional]. If the applicant accepted all loan conditions and agreed with the repayment schedule, the officer ticks the respective checkboxes in the agreement summary and submits the form.

- "Take final decision": a loan officer different from the one who verified the agreement is demanded to take the final decision on the application. This officer is shown a Web form of the agreement summary containing a reference to the loan application. Based on this, the officer presses the Approve or the Reject button to submit the form back to the engine. Upon form submission, the status of the loan application is changed into "approved" or "rejected" based on the officer's decision.