

Original Article

Web Application Design for Credit Evaluation: Proposal in a Financial Institution

Flor de Maria Milagros Ramirez Yovera¹, Anahí Adriana Mondalgo Castillo², Miguel Angel Cano Lengua³

^{1,2,3}Facultad de Ingeniería de Sistemas e Informática, Universidad Tecnológica del Perú, Lima, Perú.

³Facultad de Ciencias Matemáticas, Universidad Nacional Mayor de San Marcos, Lima, Perú,

³Corresponding Author : mcanol@unmsm.edu.pe

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Abstract - This article highlights the importance of implementing technological solutions in financial institutions to adequately manage credit risk since the main problem of financial organizations currently lies in the credit process. The objective of this research work is to design a web application to control the granting of credits in order to reduce the high-risk portfolio of the financial institution. The project was carried out by applying the scrum methodology, starting with the analysis for which information was collected through meetings and the use of tools such as questionnaires to identify then the necessary variables that will allow the selection of the ideal neural network algorithm that will allow us to improve the control of credit granting. Finally, the application prototypes are presented, so the respective measurement is carried out, for which the survey is divided into 4 dimensions.

Keywords - Credit risk, Neural network, Credit granting, Scrum methodology, Financial institution.

1. Introduction

The use of new technological tools and the constant changes that are applied in the financial sector has generated an increase in the flow of international capital, leading to an increase in supervision and security in financial institutions, which makes it necessary to find an adequate tool for risk management within the institution. For this reason, risk management has been considered a priority in recent years for financial institutions and regulators in countries worldwide [1]. Credit risk is inferred in the probability of not complying with the obligation to repay the debt or the agreed agreement [2].

In commercial banking, if there is an efficient system, it contributes to the development of the company and the country [3]. Likewise, savings and credit cooperatives contribute value to the country's economic development and financial inclusion, being one of the oldest means in Peru [4]. It is also important to know that the SBS is the entity that regulates and supervises the financial, insurance and AFP system in conjunction with Coopac [5]. In this sense, a web system will be designed to meet the needs and constant changes of the financial entity since it provides improvements compared to desktop software obtaining optimal results [6]. In addition, in software development, the methodology used is scrum, creating value with respect to the functionalities since they are adjusted to the client's needs and are delivered in a short time [7].

On the other hand, the prediction model helps us to select the most convenient decision by means of repeated behavior patterns [8]. Similarly, these models are key pieces to be able to understand the behavior and create strategies that can cause greater impact [9]. Therefore, in the "Predictive model of delinquency rank for bank loans using simulated data", the behavior of customers was determined by means of a statistical model in order to simulate data and predict the delinquency of a bank loan [10].

Considering the above, the use of neural networks is easily adjusted to financial drawbacks. One of the real cases is to apply it in calculating the probability of default in the portfolio of the financial company [11]. Moreover, to define the best method to evaluate credit risk, Binary Regression has been proposed in conjunction with Artificial Neural Networks using the mathematical learning algorithm Multilayer Perceptron [12]. Likewise, [13] comments that improving the neural network by GA algorithm avoids the limitation of the evaluation process, making the alert result more reliable and objective. [14] reports that it is necessary to improve credit risk models for the sector to progress.

The objective of this research work is the design of a web application for the control of credit granting, where the system will have the necessary characteristics, following an object-oriented programming structure and the application of the



SCRUM methodology to comply with mitigate and control the credit risk in CrediExpress Financial. Allowing the financial diversification of customers for a better control process in the granting of credit and thus reducing the high-risk portfolio of the financial institution.

Unlike other credit evaluation platforms, this work provides a web platform that presents an automation model for decision-making, being flexible and agile, and responding in a personalized way. An evaluation report is delivered that reveals the client's credit status to be eligible or not to grant credit.

2. Literary Review

In the review of the object of study in credit granting control, research indicates that the bank lending sector is determined by the demand for credit resources that increases as the share of overdue debt in the bank's loan portfolio increases. Thus, [15] tells us that the main problem is the correct formulation of the purpose of risk management; due to having several risk characteristics, the optimization of risk management is recurred to solve the problem of multi-criteria optimization. Something similar occurs with [16] indicates that although technology helps to improve the user's life, it can also generate a negative impact on the economy due to the misuse of credit cards that negatively impacts inflation. Also, [17] comments that credit quality problems could cause the financial entity's capital to decrease considerably and even become insolvent.

Also, [18] indicates that the essential financial information required to perform a credit risk analysis, such as contracts, agreements, and verification results of the prospective borrower, is in the form of unstructured texture, in large volumes and which is continuously updated. The analysis is a costly and time-consuming task.

Risk is necessary for any economic exchange, according to [19], which aims to provide a simple view of the risk management process and highlight how integrating digitization can eliminate deficiencies and improve the efficiency of the process. So, [20] states that neural networks and their involvement with respect to microcredit credit risk prediction are typified as a system that is easy to use and interpret, robust, and is embraced solely from the format and quality of the information presented.

Thus, [21] describes that companies offering loans to their clients often have problems recovering the money within the agreed time because there is no tool to identify the risks associated with loans and collections. Something similar is presented by [22], as he indicates credit management is a frequent problem in financial entities since as the company grows, the financial risk increases and this is generated by not having the necessary tools to control this risk.

The entities are more likely to increase their overdue portfolio, generating unfavorable effects on the finances of the companies; Similarly, [23] comments that for organizations, the loan portfolio is a very important asset, which is governed by regulations or policies of each entity and is currently exposed to many risks that must be evaluated. Likewise, [24] points out that in recent years the microfinance sector in Peru has been growing exponentially. It is up to the organizations to transform themselves by adapting to the client's demands.

On the other hand, [25] indicates a limitation that small companies currently have problems in the competitive environment due to the lack of current technology, which causes dissatisfaction among users. As a consequence, there is no increase in client growth.

[15] Used credit portfolio diversification and credit rating methods. This methodological model proposed in the quality management of the bank's credit portfolio is characterized by mixing quantitative and qualitative criteria to assess portfolio risk and monitor the credit portfolio, deciding whether or not to approve a credit application and risk factor variables. Similarly, [16] proposes a methodology where historical customer data are grouped using a fuzzy clustering algorithm.

With the objective of this stage is to find customer profiles, followed by a classification algorithm that allows discovering the likely group that has operations such as credit default. Thus, data mining techniques proved their efficiency in improving the accuracy and efficiency of credit risk analysis because large-scale data sets can be processed in a shorter time; as [18] indicates, his study is given by applying a data mining method based on domain adaptation for credit risk analysis. Such a method can be trained with a small training data set and learn underlying rules by extracting information from the target data set.

On the other hand, [17] bases his methodology on survival analysis, which symbolizes a collection of statistical procedures useful for analyzing data where the variable of interest is the time elapsed between the start of an event and its end.

Regarding the web development environment, [19], in his study, records back-end automation in this time of digitization of finance, particularly in FinTech. Highlighting that digitization of financial transactions has been helpful; financial institutions must be protected against cyber, outsourcing, financial exclusion and macrofinance risks that may formulate with this automation. As well as, [20] proposes to group the sociodemographic characteristics of borrowers registered in the database of financial intermediaries, annexed with the benefits and predictive particularities of neural networks, for their classification according to whether they are at risk.

According to the methodology [21] developed, qualitative and quantitative descriptive research for the collection of information techniques such as surveys or observation were applied. This methodology allows for identifying the critical points, that is to say, to give a sample where changes can be evaluated and made until the final result, improving the efficiency of the processes in credit risk management. In the same way, [25] used the same techniques in their research to know the processes managed by the institution and thus manage to automate the credit processes.

Likewise, [23] used standards on methodologies to develop a flexible model consisting of parameters and future scalability. That is, he took a sample of the population study to be able to implement controls on the use of credit since it is necessary to know how the sector is evaluated and according to the amounts of the portfolio; to know the number of users of the entities.

Consequently,[22] shows that empirical evidence was obtained for his research since a risk classification table was established by applying algorithms according to the data collected from the finance company's processes and manual processes performed by the employees. Data were also collected by means of a survey to investigate and probe the changes in the process.

On the other hand, [24] conducted a study applying theoretical knowledge to change the processes and build adequate software. Therefore, he developed an experimental design to achieve practical results, improving the credit area's efficiency.

Finally, regarding the authors' conclusions regarding the credit risk study [15] demonstrate that when there is a growing demand for credit resources in the Russian economy, the value of the credit risk management system increases considerably.

[16], on the other hand, identified types of profiles. Arguing good performance for fraudulent credit operations and identification of customer profiles. The reason for this is that it is worse to rate a customer as a good risk when in fact, it is considered a bad risk than to rate a customer as a bad risk when in fact, it is considered a good risk.

However,[18] used several classical classification methods, achieving that the domain adaptation approach outperforms the other two methods, showing a relevant improvement in classification accuracy. Similarly, [17] concludes that the production of probabilities calculated based on the conventional estimation of transition matrices can be completed by means of survival analysis, improving the analysis for financial supervision purposes.

On the other hand,[19] tells us that adapting automation and innovation delivers a competitive advantage but also entails new risks. Hence,[20] concludes that, with the recommended improvement in the quality of information, predictions by classifying borrowers into "risk" and "no risk" will definitely improve the efficiency of lending terms and the presentation of the past-due portfolio.

Likewise, when an analysis of the results regarding the research on the web system is made, [21] shows that the use of a web tool is favorable for organizations since the algorithms are adjusted to the specifications and requirements of the company by performing an accurate, fast and concise search. Something similar is presented by [22], indicating that a web system has a favorable impact on the organization since it manages to generate good communication through the areas that perform the credit evaluation, reducing costs and generating greater utility.

Also [24], as a result, managed to include the good practices presented by the XP methodology allowing the development of appropriate processes and requirements. On the other hand, [23] shows the successful application of this object-oriented software methodology for small projects being scalable in the future. Similarly, [25] concluded that this analysis of the implementation of the web system serves as an example for small financial institutions, which lack technological tools, thus emerging new proposals and alternatives that allow customer satisfaction.

In summary, analyzing the research works where they used different methods for a possible solution to the problem posed by their research with reference to ours; we can say that the rapid growth of technologies generates financial institutions produce new profitability strategies, as well as provides a continuous customer rating, managing to classify customers by the homogeneity of their credit history being of great support in making decisions on approval and rejection of a loan application.

3. Methodology

It has been established to apply the scrum framework since the basic scrum idea consists of creating short development cycles, generally called iterations, which in scrum are called "Sprints" Figure 1. This framework is normally used for software development projects with the purpose of achieving customer satisfaction by achieving the objectives defined in the business. Scrum applies an incremental and iterative approach that improves predictability and risk monitoring.

Figure 1 shows the entire process of the scrum framework together with the users involved.

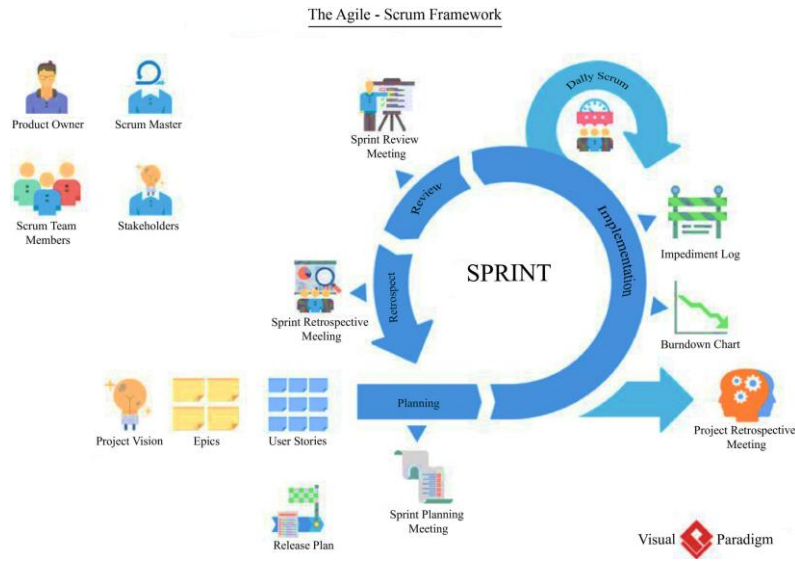


Fig. 1 The agile scrum framework

Source: [26]

3.1. Phases

According to [26], it indicates that the scrum methodology is very friendly and stands out for teamwork seeking to find the objectives quickly.

Figure 2 shows the project phases, managing each of them, from planning to delivering the final result.

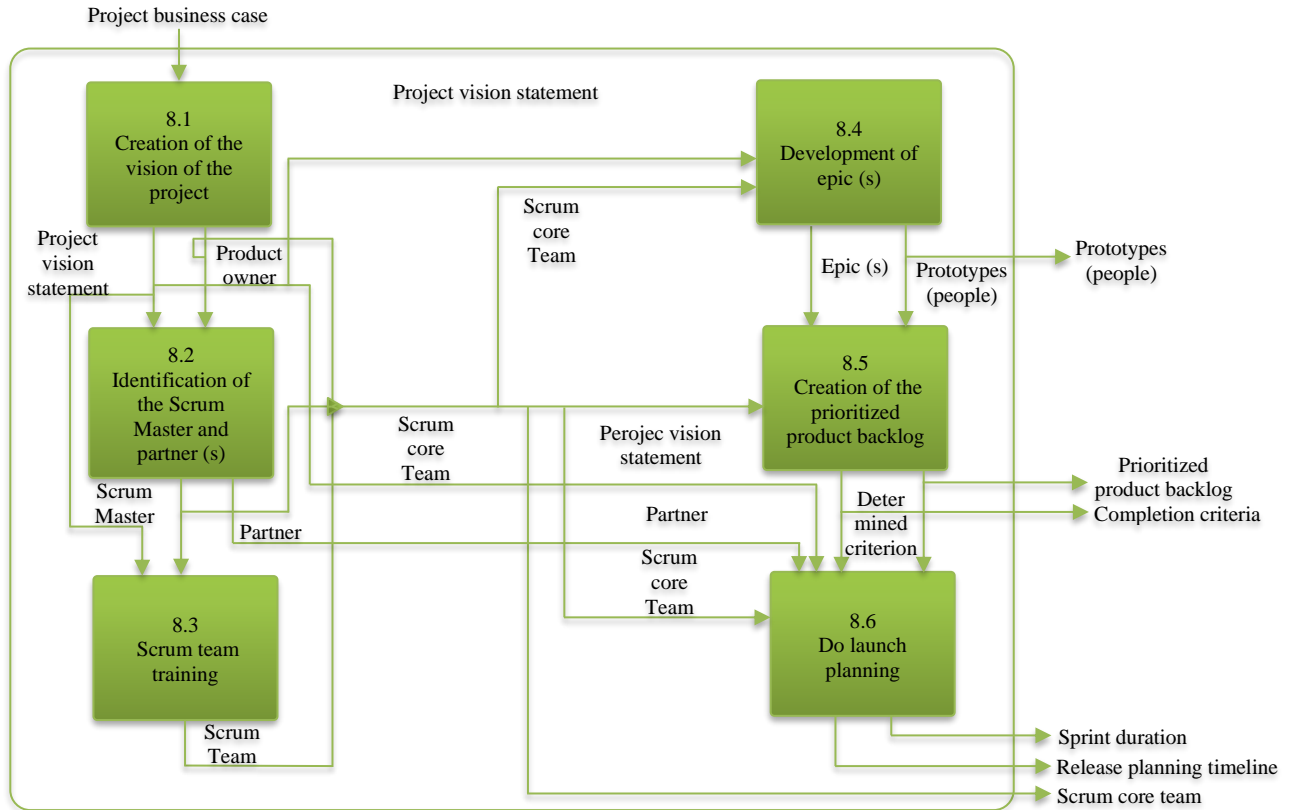


Fig. 2 Data flow diagram

Source: [27]

3.1.1. Product Backlog

List of functionalities of the product with the details indicated in Table 1, to be carried out by the Product Owner, which is ordered according to the system's priorities to be developed.

Table 1. Prioritized table of pending product

INPUTS	TOOLS	OUTS
Scrum Core Team	User prioritization methods	Product Backlog
Epic(s)		Completion criteria
Scrum		

3.1.2. Product Backlog

Once the Product Backlog has been finalized, some points are selected from this list to be carried out, indicating the time in which the sprint will be carried out; for this purpose, we use the information mentioned in Table 2.

Table 2. Creation of sprint backlog

INPUTS	TOOLS	OUTS
Scrum Core Team	Sprint planning meetings	Sprint backlog
Estimated work task list		Sprint Work Pending Chart
Sprint Duration		

3.1.3. Sprint Planning Meeting

Here a meeting is held to determine the deadlines and processes of the project defined in the Product Backlog. This process is done before starting a Sprint, and the latter is composed of several features that must be performed; in Table 3, we visualize the inputs, tools and outputs.

Table 3. Launching the launch plan

INPUTS	TOOLS	OUTS
Scrum Core Team	Launch planning sessions	Launch planning schedule
Stakeholder(s)		
Project vision statement		
Product Backlog	Launch prioritization methods	Sprint duration
Completion criteria		

3.1.4. Daily Scrum o Stand-up Meeting

In this process, daily meetings are held Table 4, when a sprint is carried out to answer questions such as: What was done yesterday? What will I do today?, and here the scrum master enters to provide solutions to the problems that arise.

Table 4. Task creation

INPUTS	TOOLS	OUTS
Scrum Team	Daily meeting standing	Sprint pending work graph
Scrum Master		
Sprint Pending Work Chart	Three daily questions	

3.1.5. Sprint Review

It is a report of the finished sprint to provide information to the customer regarding the progress that can be analyzed; as we can see in Table 5 as output, we have the functional deliverables.

Table 5. Shipment of deliverables

INPUTS	TOOLS	OUTS
Product owner	Methods of organizational displacement	Functional deliverables agreement
Stakeholder(s)		
Accepted deliverables		
Launch planning timeline		

3.1.6. Sprint Planning Meeting

Table 6 we can say that the objectives achieved and the errors where improvements are applied are analyzed so as not to visualize the same problem.

Table 6. Project retrospective

INPUTS	TOOLS	OUTS
Scrum Core Team	Project retrospective meeting	Accepted actionable improvements
		Assigned action items and deadlines

3.2. Scrum Team

According to [28] points out that in this scrum methodology, the roles are important to achieve success, and one of them is the Product Owner since he is the one who leads and is responsible for prioritizing the backlog of requirements to achieve the project's expectations.

Likewise, [29] indicates that there is another important role called scrum Master who is the leader of the meetings that take place in the project, as well as responsible for monitoring that the agile principles are met in conjunction with the Product Owner in order to solve any incidents that arise in the development of each interaction.

And for this [26] indicates that we have the Scrum team since it is the team in charge of the development of the software with the purpose of meeting the goals of the project

It can be mentioned that the choice of this Scrum methodology was made because it has important results in various web and mobile applications related to the cost of the basic family basket [30], web platform for specialized consultations in practices [31], in the design of the web platform to boost sales in a company in Lima, Peru among others [32].

3.3. Case Study

3.3.1. Startup Phase

Delimitation of Positions and Activities

According to the methodology used, such as scrum, the positions and tasks of the team are defined, so there are no doubts and responsibilities are defined for each member.

Creation of Questionnaires

According to the business need, the Multiresponse questionnaire was developed to know the requirements and documentation requested by CrediExpress for the client's evaluation.

The following points were then taken into account when developing the questionnaire:

- ✓ Client Type
- ✓ Age Range
- ✓ Documentation for Natural Person
- ✓ Documentation for Legal Entity
- ✓ Client's Income Range

The form was elaborated in the Google Docs platform and sent via email to the areas involved for their participation.

3.3.2. Analysis Phase

Evaluation of the information obtained from the questionnaire

The questionnaire was developed with the purpose of obtaining information to help us identify the input variables for the algorithm to be applied.

Table 7. Variables of analysis

VARIABLES	TIPO	NOMENCLATURA	CODIFICACIÓN	CATEGORIZACIÓN
SBS Rating	Categorical	CALIF_SBS	0	Normal
			1	CPP
			2	Poor
			3	Doubtful
			4	Lost
N° of Entities Siste. Finan	Numeric	NUME_ENTFINAN	Not applicable	Not applicable
Age	Numeric	EDAD	Not applicable	Not applicable
Marital Status	Categorical	EST_CIVIL	0	Single
			1	Married
			3	Widowed
			4	Divorced
			5	Cohabitant
Housing Type	Categorical	TIP_VIVIE	0	Own
			1	Family
			2	Rented
Type of Income	Categorical	TIPO_INGRE	0	Self-employed
			1	Dependent
Line of Business	Categorical	GIRO_NEGO	0	Trade
			1	Production
			2	Service
Revenues	Numeric	INGRESOS	Not applicable	Not applicable
Expenses	Numeric	EGRESOS	Not applicable	Not applicable
Financial Expenses	Numeric	GAST_FINANC	Not applicable	Not applicable
Last Loan Amount	Numeric	MONT_ULT_PREST	Not applicable	Not applicable
Loan Currency	Categorical	TIPO_MONE	0	Soles
			1	Dollars
Destination of the Loan	Categorical	DEST_PREST	0	Consumption
			1	Working Capital
			2	Fixed Assets
			3	Vehicle
			4	Housing
Credit experience	Numeric	EXPER_CREDIT	Not applicable	Not applicable
Warranty	Categorical	GARANTIA	0	Yes
			1	No
Warranty Type	Categorical	TIPO_GARANT	0	Promissory Note
			1	Collateral
			2	Self-liquidating
			3	Not applicable

According to the data obtained in the questionnaire, we affirm that CrediExpress Finance works with both natural and legal clients. At the same time, the required documentation depends on the type of client. On the other hand, CrediExpress mainly has clients aged 40 - 50 years old, with a monthly income between 2000 - 3000 soles.

With this information obtained, the variables for the algorithm were defined, as shown in Table 7.

Choice of Analysis Tool

According to the analysis carried out, neural network models currently predominate as a favorite model to choose from. The neural network is part of Artificial Intelligence, precisely Machine Learning, which uses innovative algorithms that allow the processing of high volumes of information and, through learning, give results closer to the desired result. There are many tools on the market that allow the use of these algorithms, such as:

- ✓ Microsoft (Power BI)
- ✓ IBM SPSS Modeler
- ✓ Tableau

3.3.3. The Tool Selected for Analysis is IBM SPSS Modeler

Designed to provide predictive intelligence. The main advantage of this tool is its user-friendly graphical interface, allowing it to quickly and intuitively build predictive models without programming and visualize the data mining process easily.

- ✓ Supports multiple data sources
- ✓ Automatic data configuration
- ✓ Automated modeling
- ✓ Machine learning algorithms and regression models
- ✓ A variety of algorithmic methods

Selection of appropriate AI Algorithm for risk assessment

Figure 3 shows the chosen Perceptron algorithm, which will be applied for the development of the application.

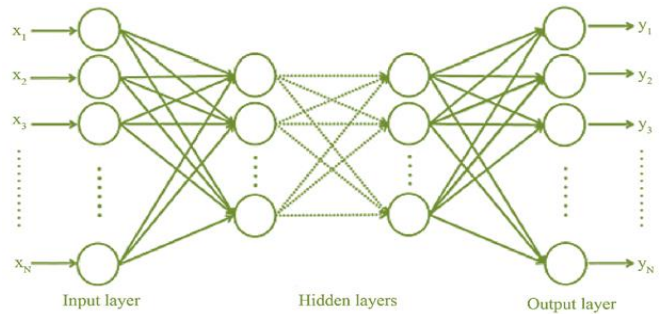


Fig. 3 Red Neuronal Perceptrón
source: [20]

3.4. Constitute Data Obtained to the SPSS System

The obtained data is integrated into the statistical system in order to test the model and obtain the results. Two models were established for comparison.

Figure 4 shows the simulation of tests in the SPSS program comparing linear regression and the neural network.

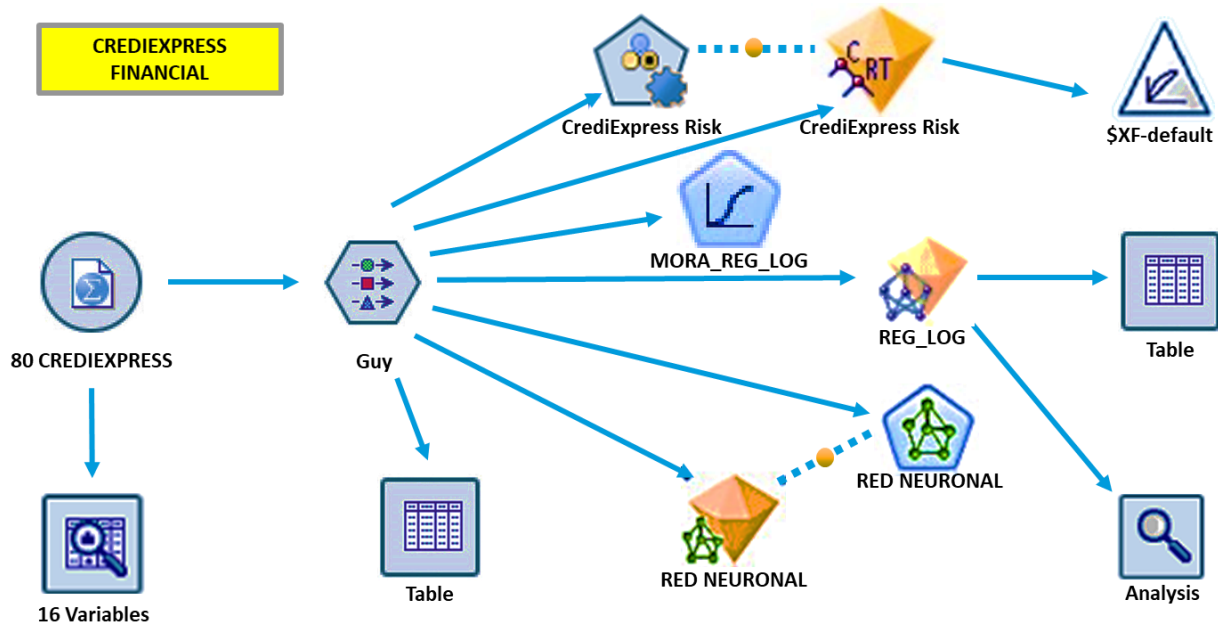


Fig. 4 Test simulation with input data

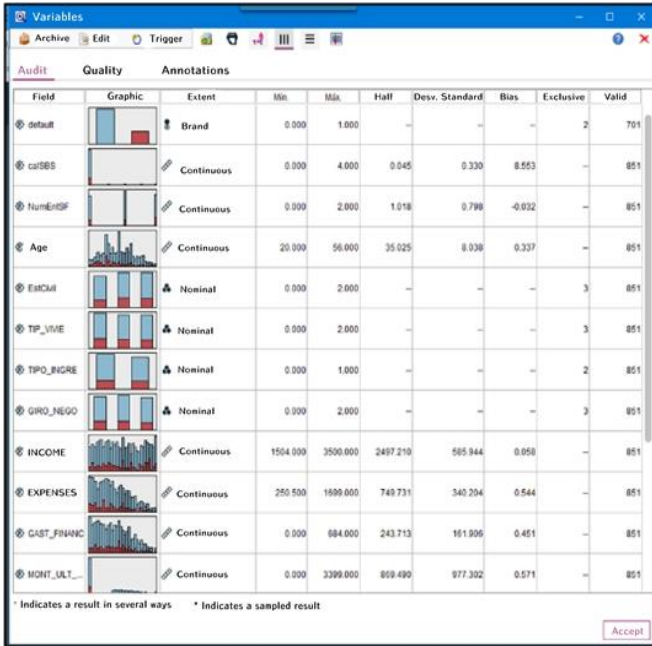


Fig. 5 Definition of variables

Figure 5 shows the variables defined and entered in the simulation of tests in the SPSS program. Among the comparisons made between the linear regression and the neural network with the input variables, it was determined that the neural networks were more effective with 0.6346.

Figure 6 shows the most effective algorithm, this being the neural network algorithm.

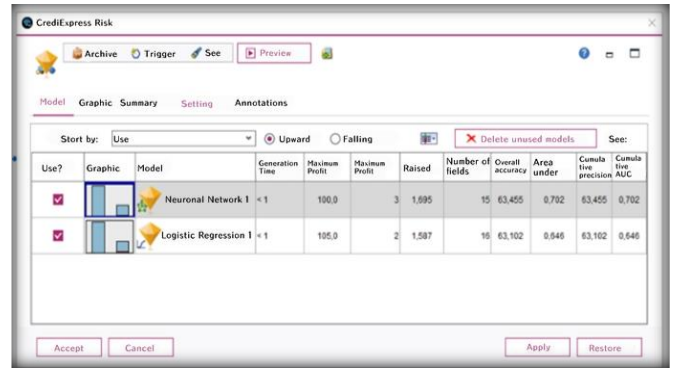


Fig. 6 Algorithm efficiency and accuracy chart

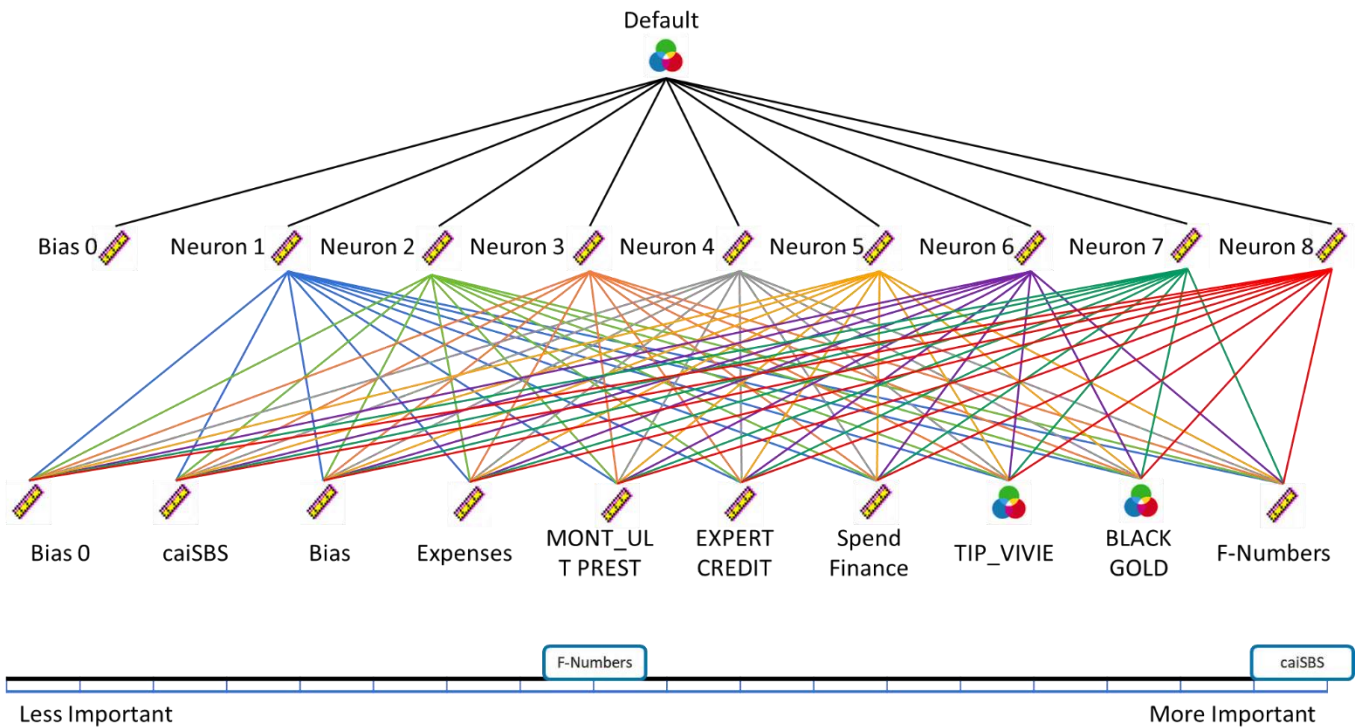


Fig. 7 Neuronal network

Figure 7 shows the result of the entire process generated in the test simulation.

Determine User Stories

The user stories will be elaborated according to the interviews conducted with the user since it is necessary to show what he/she expects from the application by expressing his/her point of view. First, the epics will be defined for the web application Table 8.

Table 8. Epics Chart

Nº	ID	DESCRIPCIÓN
1	Epica-01	Information Gathering
2	Epica-02	Web access control
3	Epica-03	Modules for evaluation
4	Epica-04	Reports

Determine Product Backlog

Table 9 shows the schedule to be developed for the project.

Table 9. Product backlog

IDENTIFIER (ID)	STATEMENT	USER
PB01	As a project manager, I want to know the process in CrediExpress risk management to choose the right risk model.	Teamwork
HU01	As a User, I wish to log in to access the application.	User
HU02	As an administrator, I want to have the option to manage employees.	User
HU03	As an administrator, I want to have the option to manage the application's users.	User
HU04	As a User, I want to have the option to manage user profiles.	User
PB02	As the project manager, I want to select the appropriate algorithm for the credit risk assessment of CrediExpress' customers.	Teamwork
HU05	As a User, I would like to recover my password to log in and access the application.	User
HU06	As a User with an existing account, I would like to see help links to inform me about the login options for the application.	User
HU07	As a User with an existing account, I wish to access the application and view the welcome message.	User
HU08	As a User with an existing account, I would like to access the application to view the list of available operations.	User
HU09	As a User with an existing account, I would like to access the application to view my loan portfolio balance.	User
HU10	As a User with an existing account, I would like to access the application to register Customer Login Source.	User
HU11	As a User with an existing account, I would like to access the application to register for Financial Evaluation.	User
HU12	As a User with an existing account, I would like to access the application to register the Business Ratios.	User
HU13	As a User with an existing account, I would like to access the application to process decisions.	User
HU14	As a user, I want a report of credit evaluations for measurement purposes.	User

Table 10. Product backlog prioritization chart

IDENTIFIER (ID)	STATEMENT	USER	PRIORITY	RISK
PB01	As the project manager, I want to know the processes in Credit Express risk management to choose the right risk model.	Teamwork	High	High
HU01	As a User, I wish to log in to access the application.	User	High	High
HU02	As an administrator, I want to have the option to manage employees.	User	High	High
HU03	As an administrator, I want to have the option to manage the use of the application.	User	High	High
HU04	As a User, I want to have the option to manage user profiles.	User	High	High
PB02	As a project manager, I want to select the appropriate algorithm for the credit risk assessment of CrediExpress' customers.	Teamwork	High	High
HU05	As a User, I would like to recover my password to log in and access the application.	User	Half	High
HU06	As a User with an existing account, I would like to see help links to inform me about the login options for the application.	User	Half	Medium
HU07	As a User with an existing account, I wish to access the application and view the welcome message.	User	Half	Bajo
HU08	As a User with an existing account, I would like to access the application to view the list of available operations.	User	Half	Medium
HU09	As a User with an existing account, I would like to access the application to view my loan portfolio balance.	User	Half	High
HU10	As a User with an existing account, I wish to access the application to register Customer Login Source.	User	High	High
HU11	As a User with an existing account, I wish to access the application to register for the Financial Evaluation.	User	High	High
HU12	As a User with an existing account, I wish to access the application to register the Business Ratios.	User	High	High
HU13	As a User with an existing account, I want to access the application to process decisions.	User	High	High
HU14	As a User, I want a report of credit evaluations for measurement purposes.	User	Half	Medium

Product Backlog Prioritization

Table 10 shows the product backlog prioritization information being proposed by the Product Owner together with the Scrum Master.

Determine Sprints

After the planning meeting, we proceed to create the sprint backlog where the total sprint for the project is determined, in this case, 4 Sprint Table 11.

Table 11. List of sprints

IDENTIFIER (ID)	STATEMENT	USER	PRIORITY	RISK	ITERATION (SPRINT)
PB01	As a project manager, I want to know the processes in Credit Express risk management in order to choose the right risk model.	Teamwork	High	High	1
HU01	As a User, I wish to log in to access the application.	User	High	High	1
HU02	As an administrator, I want to have the option to manage employees.	User	High	High	1
HU03	As an administrator, I want to have the option to manage the use of the application.	User	High	High	1
HU04	As a user, I want to have the option to manage user profiles.	User	High	High	1
PB02	As the project manager, I want to select the appropriate algorithm for the credit risk assessment of CrediExpress' customers.	Teamwork	High	High	2
HU05	As a User, I would like to recover my password to log in and access the application.	User	Half	High	1
HU06	As a User with an existing account, I would like to see help links to inform me about the login options for the application.	User	Half	Medium	2
HU07	As a User with an existing account, I wish to access the application and view the welcome message.	User	Half	Bajo	2
HU08	As a User with an existing account, I would like to access the application to view the list of available operations.	User	Half	Medium	2
HU09	As a User with an existing account, I would like to access the application to view my loan portfolio balance.	User	Half	High	2
HU10	As a User with an existing account, I wish to access the application to register Customer Login Source.	User	High	High	3
HU11	As a User with an existing account, I wish to access the application to register for the Financial Evaluation.	User	High	High	3
HU12	As a User with an existing account, I wish to access the application to register the Business Ratios.	User	High	High	3
HU13	As a User with an existing account, I want to access the application to process decisions.	User	High	High	4
HU14	As a User, I want a report of credit evaluations for measurement purposes	User	Half	Medium	4

3.4.1. Design Phase

Design of the Software Architecture

The software architecture is designed to demonstrate the application's communication with the user, services and database. The layered programming model will be implemented for the web application.

a) Presentation Layer

Composed by the application logic, it organizes the data sent to the client layer, where it processes the client's request and then sends it to the business logic.

b) Business Layer

Performs application functions such as data processing, administration of external resources, managing various users, and developing business tasks.

c) Data Layer

Composed of the services that provide the data to be used by the business logic.

Figure 8 shows the layered diagram of the web application since a layered software architecture model will be applied.

The web application will have the following components:

a) User Interface

User Interface is the interface in which the user can enter the data to be consulted.

b) Administration Interface

The administrator will have an access and profile administration interface.

c) Validates Login Information

Proceeds to validate the access data.

d) Executes Query

Executes Query in the user interface, the analyst proceeds to search for the client and execute the respective evaluations

so that the system will process the analysis with the applied neural network algorithm.

e) Visualize Data

when searching for the client, the analyst can visualize the client's information.

f) View Result

click on the "View results" button to display the results of the evaluation performed by the algorithm.

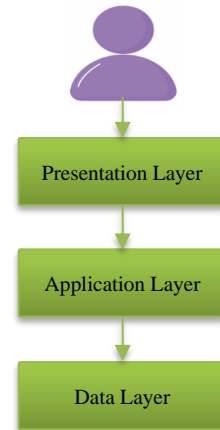


Fig. 8 Layer diagram

In Figure 9, the component diagram of the web application is displayed to provide an overview of the system.

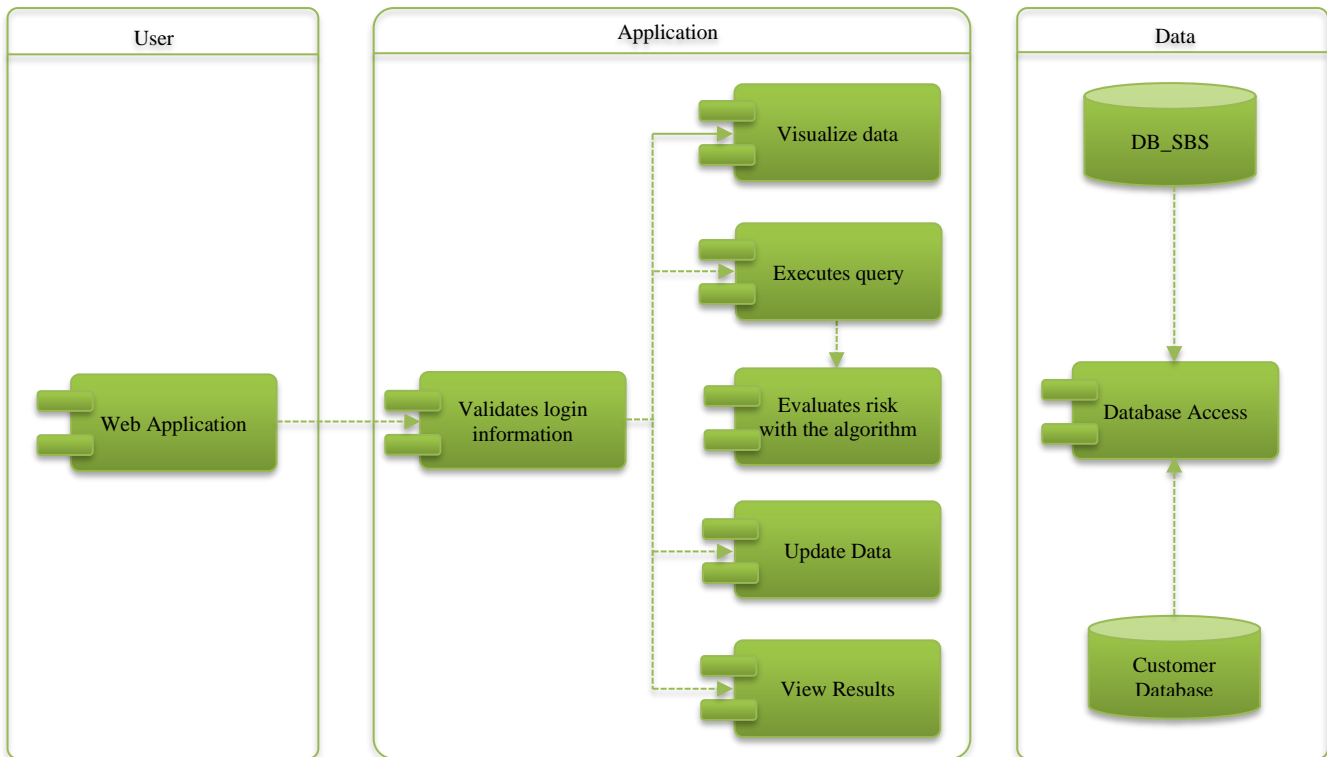


Fig. 9 Component diagram

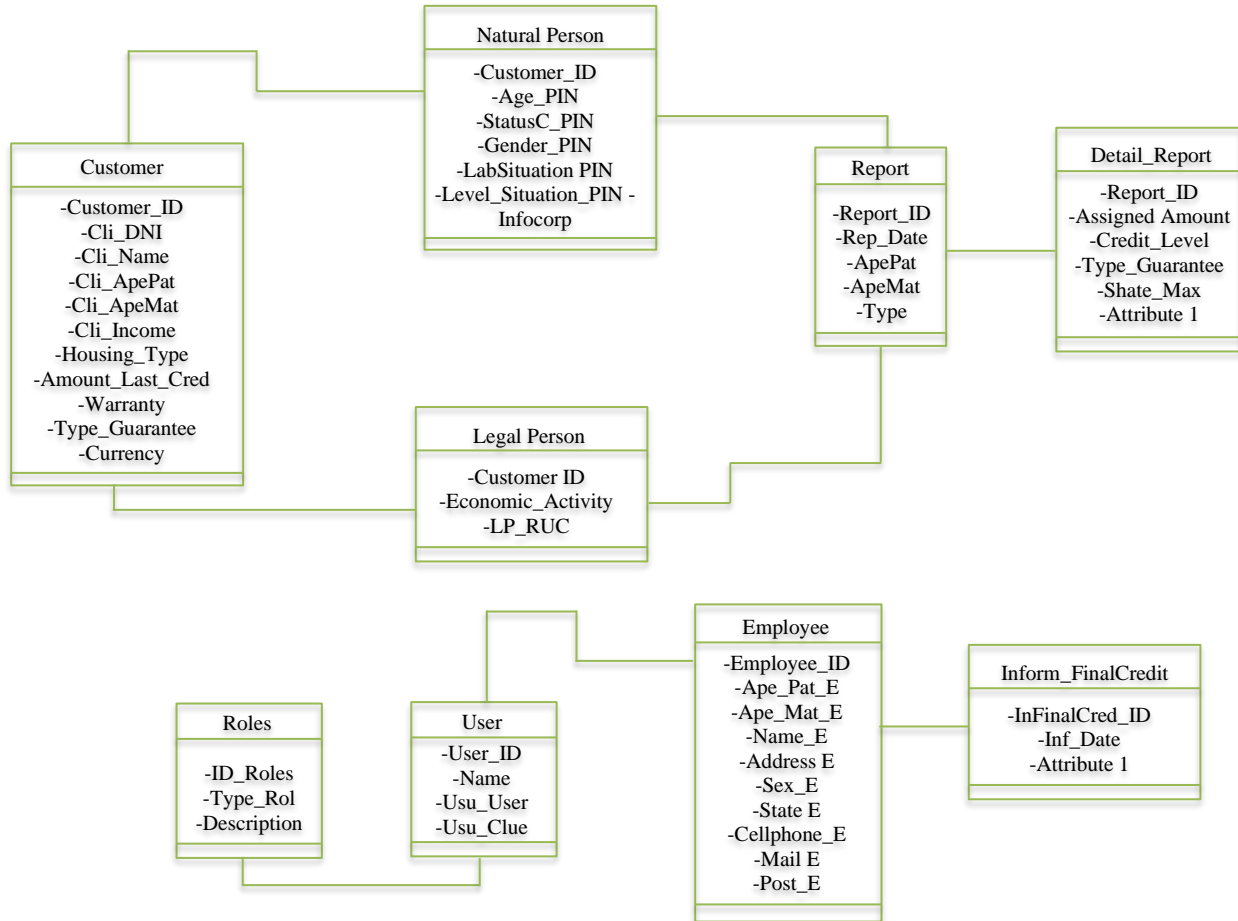


Fig. 10 Database model design

The database is organized according to the indispensable information required for credit risk analysis.

In Figure 10, the class diagram is displayed where the entities and their relationship between them are shown to provide a description of the system database.

3.4.2. Implementation Phase

Sprint N° 1

Figure 11 shows the Login form, which allows users to access the application through their credentials.

Figure 12 displays the form to administer the employees with the management of registering, updating and deleting.

Figure 13 shows the form to manage users with the management of registering, updating and deleting. It should be noted that the user is assigned a profile with certain access to system functions.

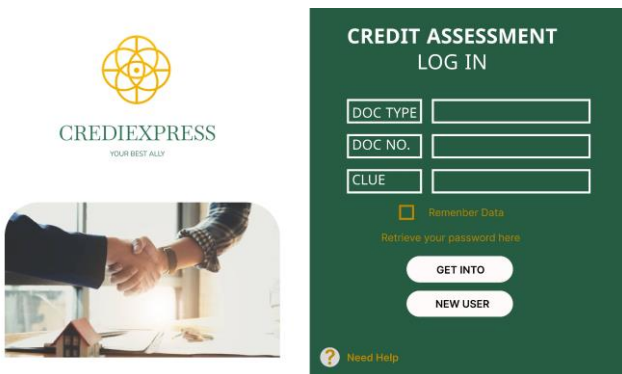


Fig. 11 Login window HU01

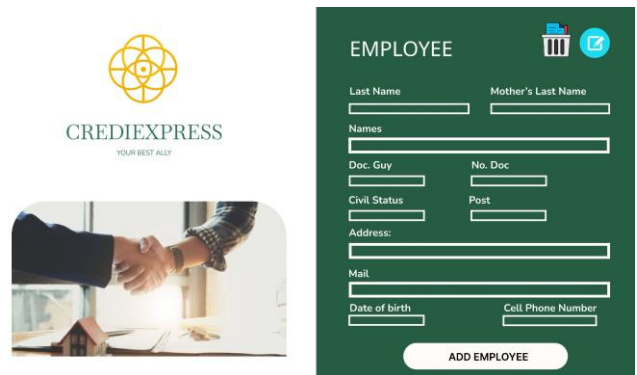


Fig. 12 Employee administration window HU03

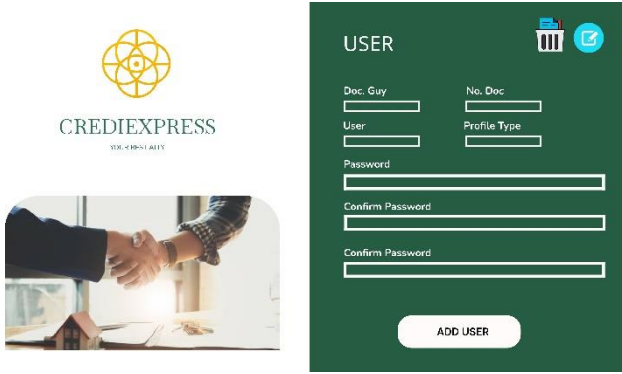


Fig. 13 User administration window HU02

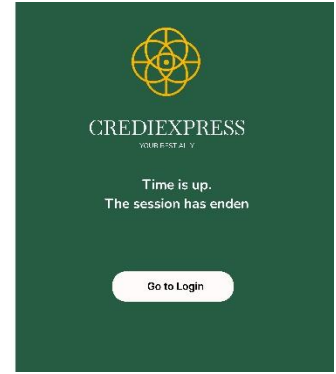


Fig. 17 Timeout ended

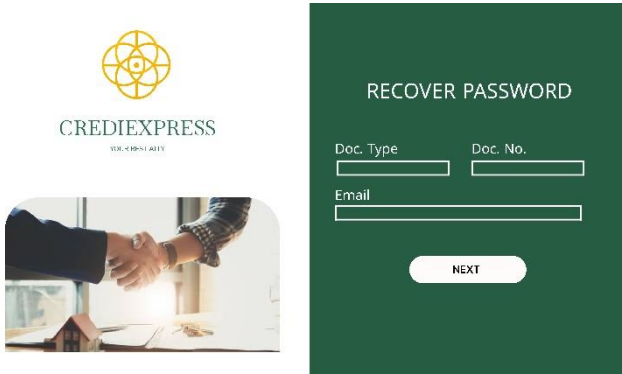


Fig. 14 Password recovery window HU05

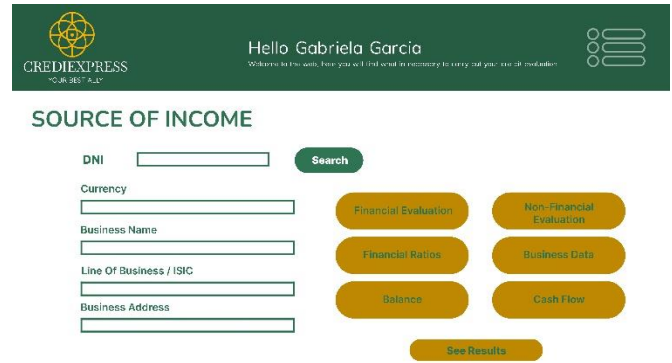


Fig. 18 Sprint 4 and 5 evaluation screen

Figure 14 shows the form for recovering the user's password so they can access the application.

Sprint N° 2

In Figure 15, a respective space with help information options for the user is shown on the screen.

Figure 16 shows the screen with a welcome message to the user after having logged in for the first time.

Sprint N° 3

Figure 17 shows the screen with the message that the session has ended due to exceeding 2 minutes of inactivity in the web application.

Sprint N° 4

Figure 18 is the Source of the Income registration form for each client. Likewise, the other options available to manage the credit evaluation process are verified.

4. Results and Discussion

4.1. Results

A user survey was conducted, and 4 dimensions were proposed for measuring the results. We also used IBM SPSS Statistics software for the statistics of the results.

Figure 19 shows the defined questions of the survey embodied in the SPSS program to proceed with the corresponding analysis.

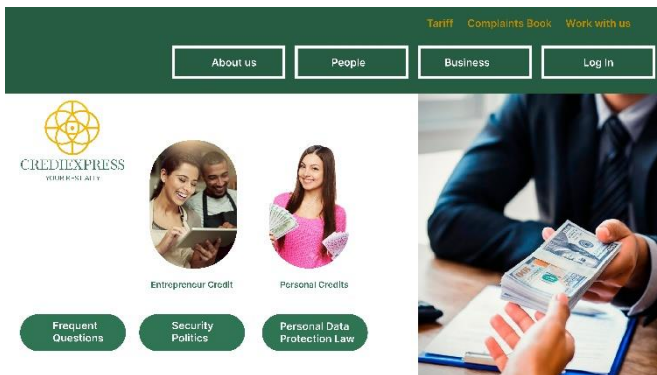


Fig. 15 Help links window HU06

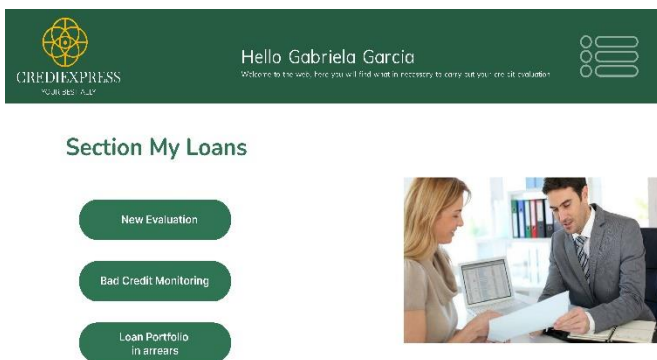


Fig. 16 Welcome and operations list HU07 - HU08

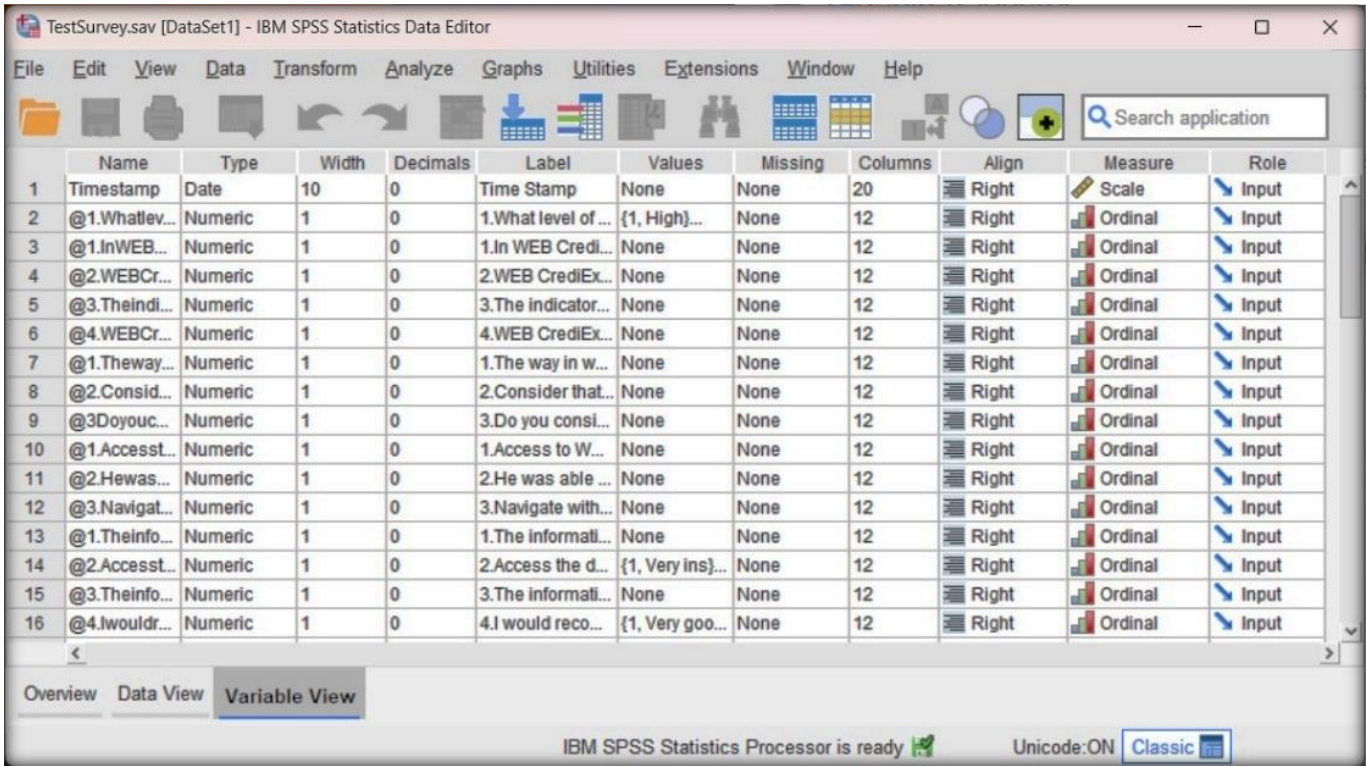


Fig. 19 Model parameters

Table 12. Valid case

		N	%
Cases	Valid	50	100,0
	Excluded	0	,0
	Total	50	100,0

In Table 12, after uploading the database obtained from the Google forms to the SPSS software, it validates 100% of valid cases.

Table 13. Reliability statistics

Cronbach's Alpha	N of elements
,841	15

In Table 13, the result is 8% in the reliability statistic.

Tables 14 show the questions posed to the users, and accordingly, we proceeded with calculating the mean and variance.

Table 14. Element statistics

	Mean	Variance	N
1 What level of importance do you consider a credit risk?	1,12	,328	50
1. In WEB-CreditExpress, did you find all the information you needed for the client's evaluation?	4,72	,454	50
2. WEB-CreditExpress, did it allow you to obtain clients with low credit risks?	4,68	,551	50
3. Did the indicators of your monetary portfolio decrease with the use of WEB-CreditExpress?	4,62	,567	50
4. WEB-CreditExpress, did you connect correctly with the SBS Risk Center (RCC)?	4,58	,609	50
1. Was the way in which the information was organized within WEB-CreditExpress adequate and easy to search?	4,76	,431	50
2. Do you think that WEB-CreditExpress was correctly integrated with the CORE of the Financial Company?	4,60	,535	50
3. Do you think the credit evaluation used by WEB-CreditExpress is adaptable for all types of credits?	4,62	,490	50
1. Access to WEB-CreditExpress was easy and simple?	4,86	,351	50
2. Were you able to enter WEB-CreditExpress on the first try without having to insist?	4,74	,443	50
3. Was browsing within WEB-CreditExpress an easy experience?	4,82	,388	50
1. Is the information published on WEB-CreditExpress reliable?	4,68	,471	50
2. Do you think accessing the WEB-CreditExpress data through a web browser is safe?	4,52	,614	50
3. Was the information registered in WEB-CreditExpress stored successfully?	4,70	,463	50
4. Would you recommend the use of WEB-CreditExpress for credit evaluations?	1,38	,567	50

4.2. Discussion

Regarding the analysis developed by [19], we can say that customer information must be validated through detailed analysis in order not to make mistakes and thus obtain valid information for decision-making.

According to what was mentioned [20], neural networks are a good technique to predict credit risk because the training process and the layers are organized sequentially, so their result has a good percentage of validity.

With respect to what was stated by [21], the statement given about the liquidity problem that customers have to make their payments on time according to the dates established by financial entities turns out to be a constantly identified problem. Therefore, the web platform must be designed to make an exhaustive evaluation of potential customers and thus avoid risks in the collection process.

5. Conclusion

Therefore, through the application of new technologies and having a good administration in the use of roles so that each user has access to the information that corresponds to him to avoid inconveniences in the interactions of the web system, we can safeguard and have an application with good functionality. Likewise, it was determined that the web application is helpful in the process of granting credit, allowing greater measurement through variables and neural network algorithms in order to grant loans with low credit risk, which contributes to maintaining a good portfolio of loans in the institution.

In future work, it is suggested that several experts from different disciplines be integrated, such as an expert in computer science, to see it from a multidisciplinary approach.

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