

# **Lifestyle Sustainability and Credit Assessment for Loans**



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**Bachelor of Engineering in  
Financial Engineering  
School of Engineering  
King Mongkut's Institute of Technology Ladkrabang  
Academic Year 2023**

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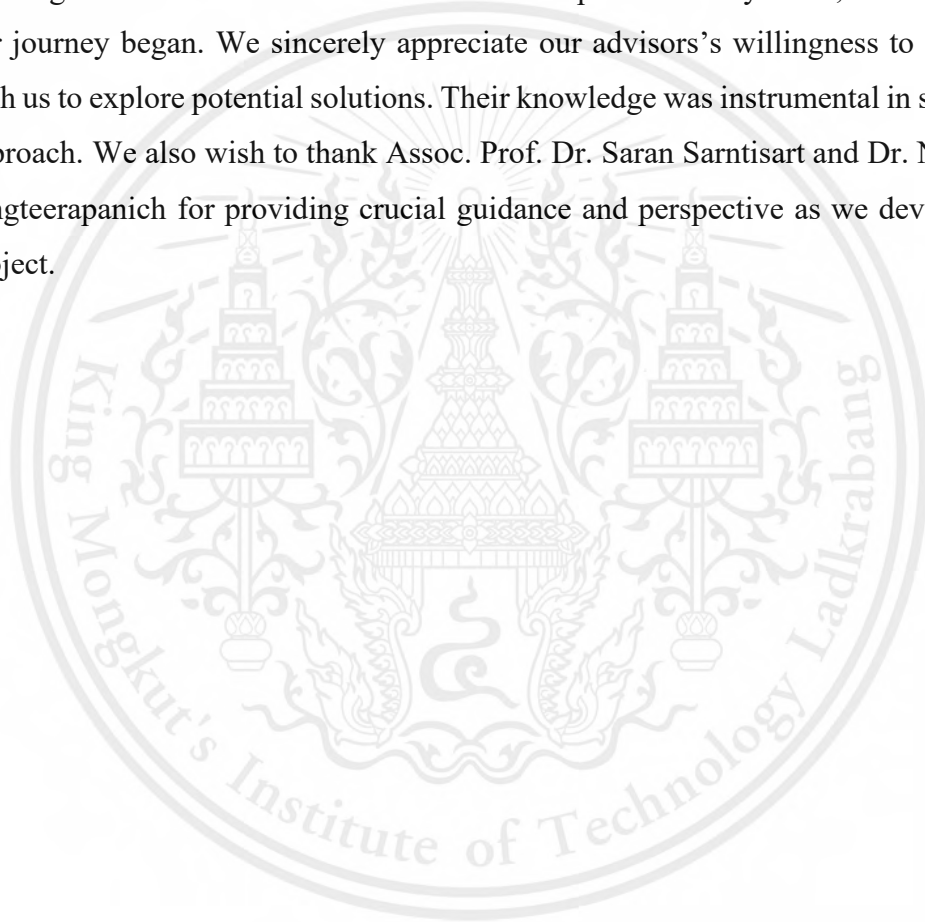
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# Abstract

This senior project explores a novel approach to lifestyle sustainability and credit assessment for microfinance loans in Thailand. The goal is to develop a framework that can more effectively evaluate creditworthiness for underserved populations that lack traditional financial histories.

The project begins with a review of microfinance models, such as the Grameen Bank and Kakao Bank, and the challenges associated with credit assessments in microfinance settings. It then proposes a multi-faceted model that incorporates metrics beyond just income and collateral, including lifestyle sustainability, reward points, and credit point systems.

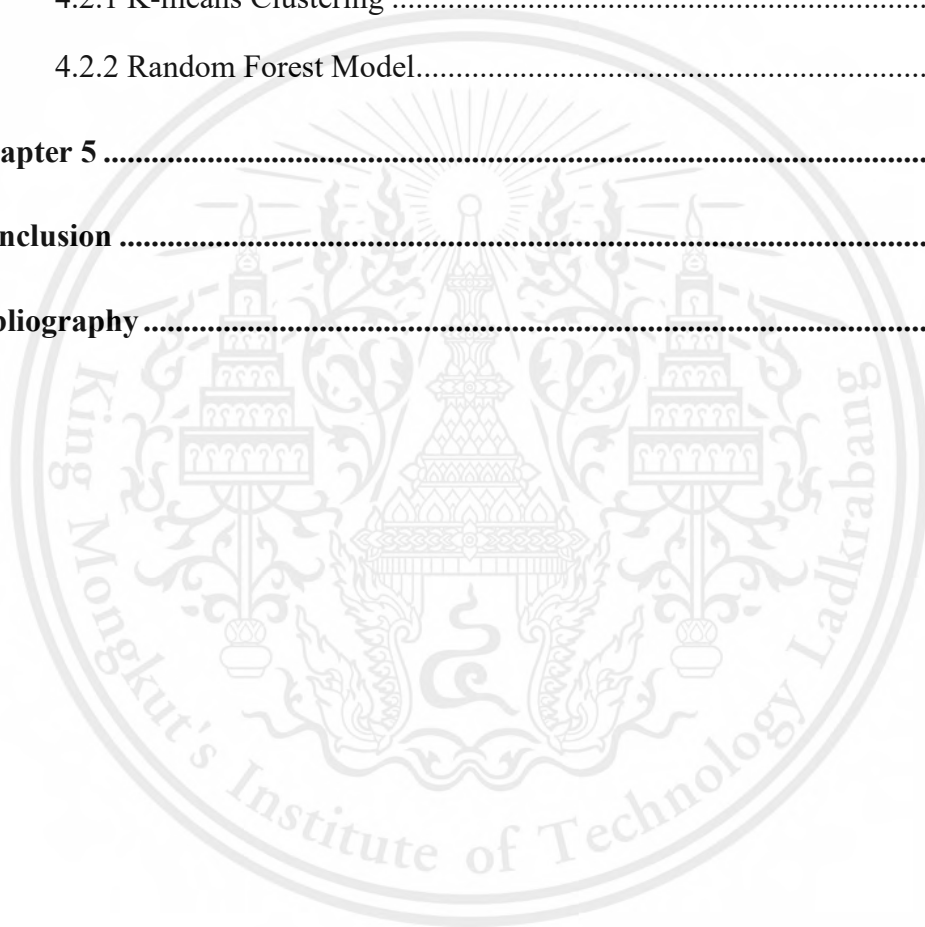
The researchers gathered data through social media analysis, questionnaires, customer activities, and partnerships to profile applicants' financial behavior and environmental consciousness. This data was then analyzed using K-means clustering and random forest models to identify correlations between "green" lifestyles and creditworthiness.

The findings suggest there is indeed a link between sustainable consumer behaviors and better loan repayment rates in the Thai context. The proposed framework aims to enable more inclusive and data-driven microfinance practices that can better serve the needs of rural and underbanked communities in Thailand. The project provides a promising model for integrating social and environmental factors into credit assessment methodologies.

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# Chapter 1

## Introduction

### 1.1 Motivation

While the Thai economy is rapidly expanding, a substantial portion of the Thai population remains rooted in rural areas, where access to mainstream financial resources is limited. Traditional bank credit systems often fail to address the unique needs of these communities. There is a need to explore alternative ways of measuring credit that can better serve the underbanked.

### 1.2 Objectives

1. Find a new way to measure credit that incorporates lifestyle sustainability and other alternative parameters.
2. Gather supporting data to validate the applicability of the proposed concept in the Thai context.
3. Incorporate the sustainability-focused credit assessment framework with microfinance principles to efficiently mitigate risk.
4. Formulate innovative methods to accurately assess credit based on creative alternative metrics beyond just income and collateral.

## 1.3 Scope of Work

The scope of this project can be listed as follows:

1. Review existing microfinance models and credit assessment challenges faced in underserved communities.
2. Develop a multidimensional framework that incorporates lifestyle sustainability, reward systems, and credit point mechanisms.
3. Gather data from various sources, including social media, questionnaires, customer activities, and partnerships.
4. Analyze the data using clustering and predictive modelling techniques to identify correlations between "green" lifestyles and creditworthiness.
5. Refine the proposed credit assessment framework and integrate it with microfinance principles to address the unique needs of rural and underbanked populations in Thailand.

## 1.4 Thesis Structure

This thesis consists of five chapters which are arranged as follows:

- Chapter 1 Introduction - refers to the motivation, objectives, scope of work, and thesis structure of this thesis.
- Chapter 2 Literature Review – proposes the Literature survey that is relevant to this project.
- Chapter 3 Research Methodology – explains the methods that we use to conduct our research.
- Chapter 4 Results and Discussion – shows the results obtained from our research and discusses those results.

- Chapter 5 Conclusion and Recommendations – concludes what we have done and what we have found.



# Chapter 2

## Literature Review

### 2.1 Microfinance

Microfinance refers to the provision of financial services, such as loans, savings, and insurance, to low-income individuals or communities who typically lack access to traditional banking services. The goal of microfinance is to empower these individuals economically, allowing them to start or expand small businesses and improve their overall financial well-being.

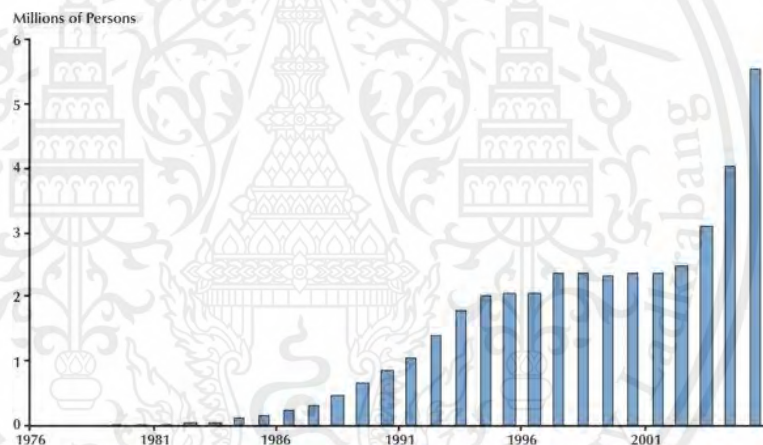
The roots of microfinance can be traced back to various informal savings and credit systems that have existed in communities for centuries. However, the modern concept of microfinance gained prominence in the late 20th century. Here are some case studies related to microfinance:

#### 2.1.1 Grameen Bank

The Grameen Bank pioneered microfinance by providing small collateral-free loans or “microcredit” to impoverished people in Bangladesh to help them establish credit and start small businesses. It was founded in 1976 by Professor Muhammad Yunus, who began experimentally lending small sums to women in rural villages. This was successful in showing the poor could be creditworthy borrowers.



*Figure 1.1 Grameen Bank*



*Figure 2.2 Grameen Bank customers growth chart*

The Grameen model featured loans mainly to women in groups with peer support to facilitate repayment and focused on frequent small repayments. By improving lives through microcredit, Grameen Bank rapidly expanded, and its model was replicated worldwide. In 2006, Yunus and Grameen Bank were awarded the Nobel Peace Prize for contributions to economic and social development through pioneering microfinance.

## 2.1.2 Kakao Bank

Kakao Bank is an internet-only bank in South Korea that launched in 2017. It is an affiliate of Kakao Corp, the company behind the popular KakaoTalk messaging app. Kakao Bank was the first purely digital bank to be licensed in Korea, operating without any physical branches.

The bank leverages KakaoTalk's large user base and integrates with the app for easy access to banking services. Services offered include deposits, loans, remittances and payment services. Customers can open accounts and manage finances through the KakaoTalk app.

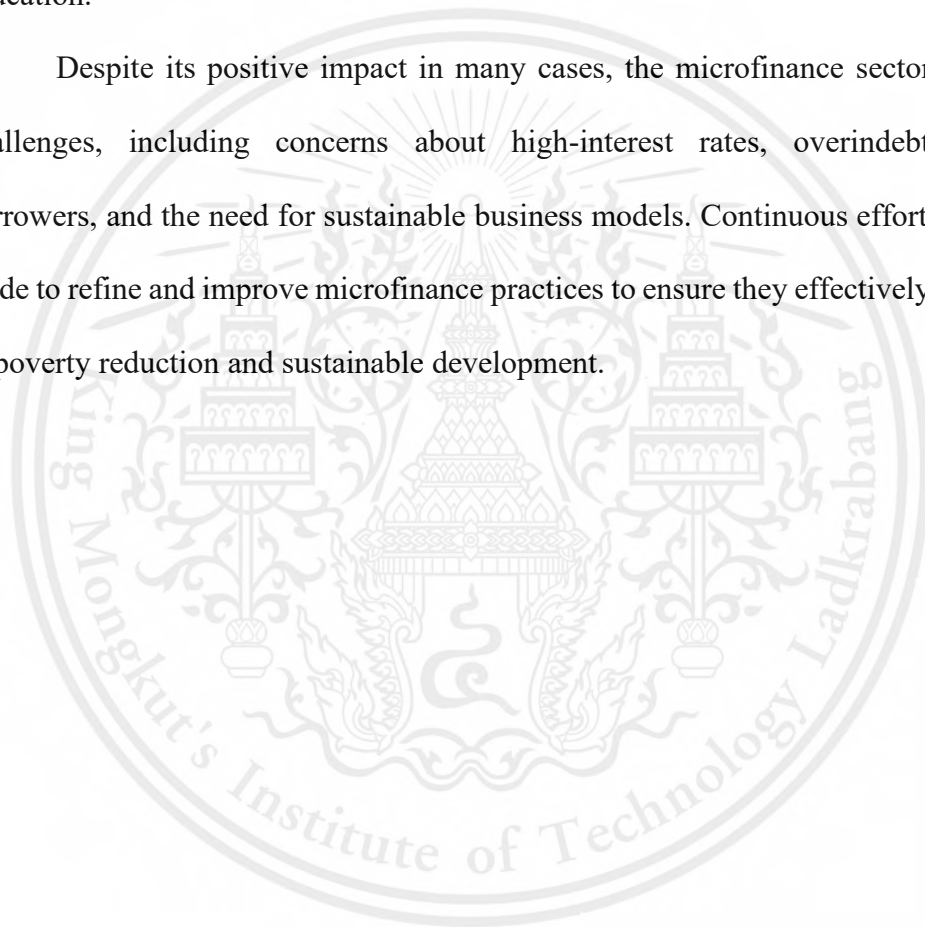
Kakao Bank reached over 10 million users within the first year of launch. As of 2022 it has over 20 million users. The bank has achieved rapid growth by utilizing advanced technology and capitalizing on KakaoTalk's familiarity and convenience for users.

Key factors in its success include simplicity, ease of use, integration with an everyday messaging platform, and innovative features like facial recognition for account opening.

In summary, Kakao Bank exemplifies a purely digital bank that has leveraged mobile platform integration and technology to acquire users and provide convenient, accessible banking services. Its rapid growth demonstrates the potential of digital-first financial services models.

And from these examples, we know that microfinance has gradually expanded globally over time, with numerous institutions and organizations adopting similar models. Microfinance institutions (MFIs) can be nonprofit organizations, cooperatives, or for-profit entities that aim to provide financial services to the unbanked or underbanked populations. The sector has evolved, incorporating various financial products and services beyond just credit, including savings, insurance, and financial education.

Despite its positive impact in many cases, the microfinance sector has faced challenges, including concerns about high-interest rates, overindebtedness of borrowers, and the need for sustainable business models. Continuous efforts are being made to refine and improve microfinance practices to ensure they effectively contribute to poverty reduction and sustainable development.



## 2.2 Credit assessment

Credit assessments in microfinance present several challenges, often stemming from the unique characteristics of the target clientele—low-income individuals with limited or no credit history and irregular income streams. Here are some key challenges associated with credit assessments in microfinance:

- 1. Lack of Credit History:** Many microfinance clients do not have a formal credit history, as they may not have engaged with traditional financial institutions before. This makes it challenging for microfinance institutions (MFIs) to assess their creditworthiness based on past financial behavior.
- 2. Informal Income Sources:** Microfinance clients often derive income from informal and irregular sources, such as small businesses, agricultural activities, or daily wage labor. The unpredictable nature of these income streams makes it difficult to assess borrowers' ability to repay loans consistently.
- 3. Limited Collateral:** Traditional lending relies on collateral to mitigate risk. However, microfinance clients, especially in impoverished areas, may lack valuable assets to use as collateral. This absence of collateral makes it challenging for MFIs to secure loans and assess the risk associated with each borrower.
- 4. High Transaction Costs:** Microfinance institutions typically deal with small loan amounts, which can result in high transaction costs relative to the loan size. The cost of conducting thorough credit assessments for each borrower may be prohibitive, leading to a trade-off between comprehensive risk analysis and operational efficiency.

5. **Seasonal Variability:** Some microfinance clients, especially those engaged in agriculture, experience significant seasonal variability in their income. Traditional credit assessment models may struggle to account for these fluctuations, leading to challenges in predicting borrowers' repayment capacity accurately.
6. **Overindebtedness:** In some cases, borrowers may take loans from multiple microfinance institutions simultaneously, leading to overindebtedness. Without a centralized credit reporting system, it becomes challenging for MFIs to identify and manage the total debt burden of a borrower.
7. **Cultural and Social Factors:** Cultural and social factors can impact repayment behavior. For example, in tight-knit communities, social pressure to repay loans may be strong, positively influencing repayment rates. Conversely, in some cases, borrowers may prioritize community needs over individual loan repayment.
8. **Technological Barriers:** In regions where microfinance operates, there may be limited access to technology and financial infrastructure. This can hinder the adoption of digital tools for credit scoring and risk assessment, making it harder for MFIs to streamline their processes.

## 2.3 Green Customers

Green customers are statistically better debtors. But collecting a customer's personal data enough to calculate their "greenness" is financially and operationally infeasible. Instead of acquiring a customer's full data from each partner, we may ask for their "greenness" score assessed by them, to be further used instead. Instead of targeting the whole green customers, we may target only a specific sector of them, e.g., athletic customers.



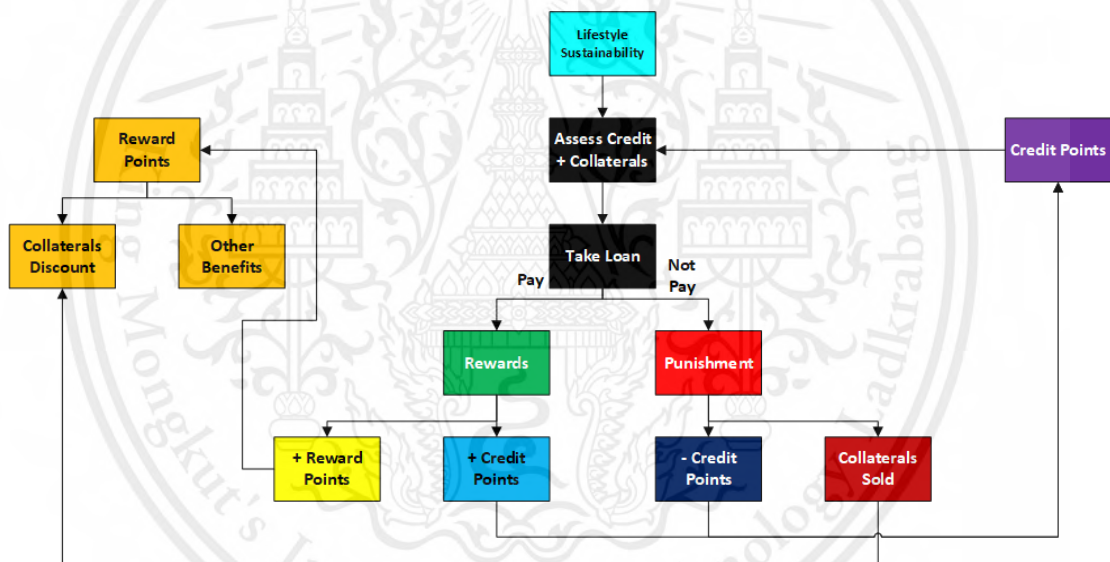
Figure 2. *Error! Bookmark not defined.* Eco and Health-motivated Consumers

# Chapter 3

## Research Methodology

We will focus on creating more metrics to assess customers' credit and use the following model as shown below:

### 3.1 Model



*Figure 3. Error! Bookmark not defined. Credit Model*

#### 3.1.1 Lifestyle Sustainability

The model starts with the so-called “Lifestyle Sustainability” which you can see at the top of the diagram. It measures how sustainable the customers’ lifestyle is. The details on how the measurement works will be explained in the next section.

### **3.1.2 Collaterals and Interest Rates**

Now we have the initial rough credit score of the customers. The value of the collaterals needed and the loan interest rates can now be calculated from that.

Now the debtors may either pay back the loans as agreed upon or not pay. If they do pay, they will get rewards, which are separated into two parts, reward points and credit points.

### **3.1.3 Reward Points**

Reward points are considered a pull factor incentivizing the debtors to pay back their loans on time. They can either be used as discounts to buy the collaterals other debtors lose (because they did not pay back on time to some limit), or they can be used to get other benefits, such as discounts in restaurants, cafes, etc.

### **3.1.4 Credit Points (+)**

Credit points are considered a push factor incentivizing the debtors to pay back their loans on time. They can be used as their track record to measure how disciplined they are on paying back the loans.

Now, if they do not pay back their loans on time, there will be penalties, which are separated into two parts.

### **3.1.5 Credit Points (-)**

Their credit points will be deducted. Lifestyle Sustainability and Credit Points affect interest rate and the value of the collaterals needed.

### **3.1.6 Collateral Seizure**

Once the limit has been reached, their collaterals will be seized and sold to the internal market, which other members can buy (as mentioned with reward points).

## **3.2 Data Gathering**

These are the ways we planned for gathering data:

### **3.2.1 Social Media**

With the current trend, we see many websites and apps giving customers a choice to register or link the account with their social media accounts such as: Facebook, Instagram, Twitter, Etc.

We will then use AI designed to evaluate their credit score based on their social media activities.

### **3.2.2 Questionnaire**

Upon registration or during an event, we will give them a questionnaire with the questions being generated by AI to make the questions random and customized for different customers.

The questions will be random enough to mitigate lying to certain extent, some of the questions will appear unrelated, or we can add some trick questions. Additionally, we will track their speed if they are spending reasonable time to complete the questionnaire, and their movement during the process to further assess the credit.

### **3.2.3 Activities**

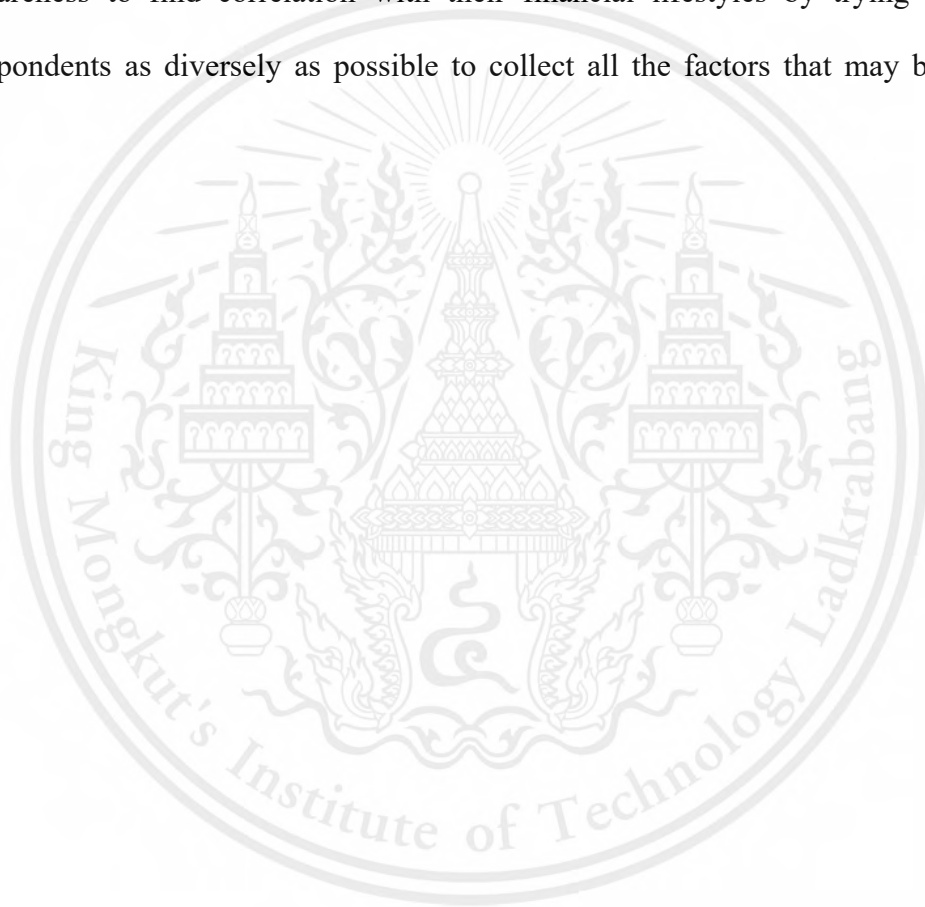
We can include simple games or events for our customers and gather more information from how they play, how they manage their time, and when they are able to participate.

### **3.2.4 Partnerships**

We can potentially cooperate with other companies with pre existing behavioral data such as health tracking apps with information about their activity, sleep routine, or daily exercise.

### **3.3 Survey**

We conducted a survey to probe the respondents' demographics, lifestyle, or awareness to find correlation with their financial lifestyles by trying to ask the respondents as diversely as possible to collect all the factors that may be relevant.



# Chapter 4

## Results and Discussion

### 4.1 Results

We have received 101 responses so far, the majority being 55-64 years old. This is a chart representing respondents' gender.

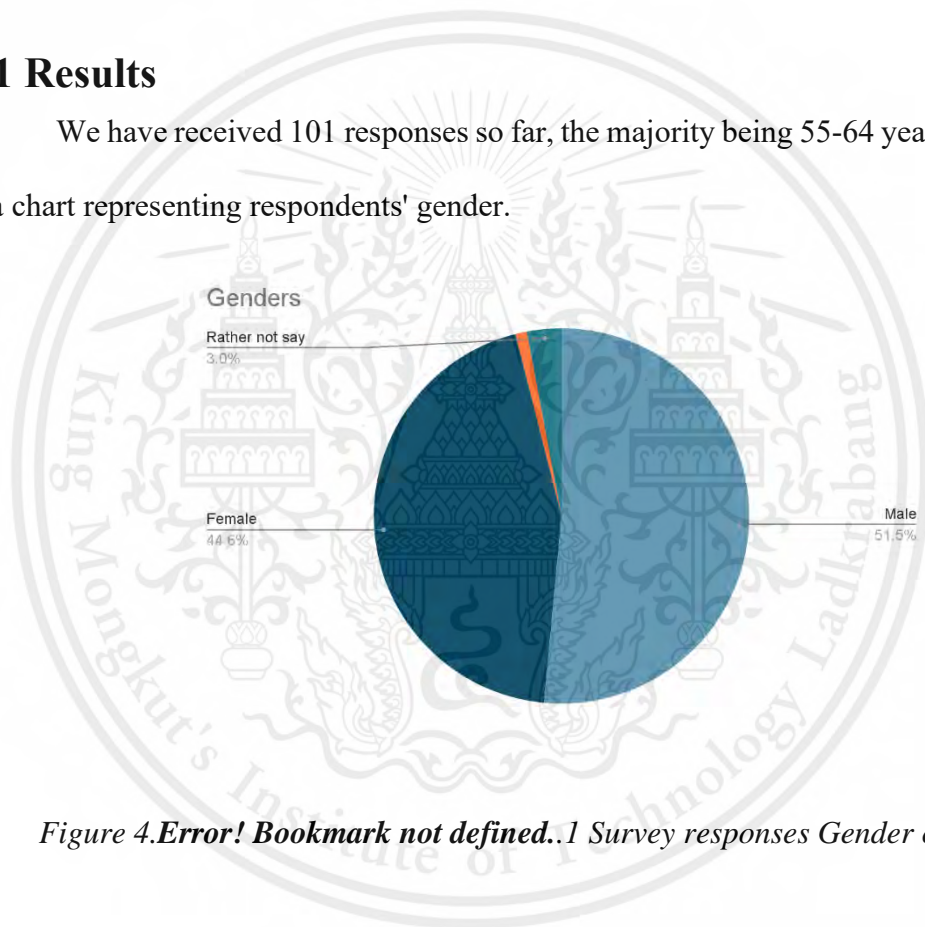


Figure 4. Error! Bookmark not defined..1 Survey responses Gender chart

### 4.1.1 Sample Questions

- Have you ever considered using or have you used electric or hybrid vehicles for reasons related to the environment?

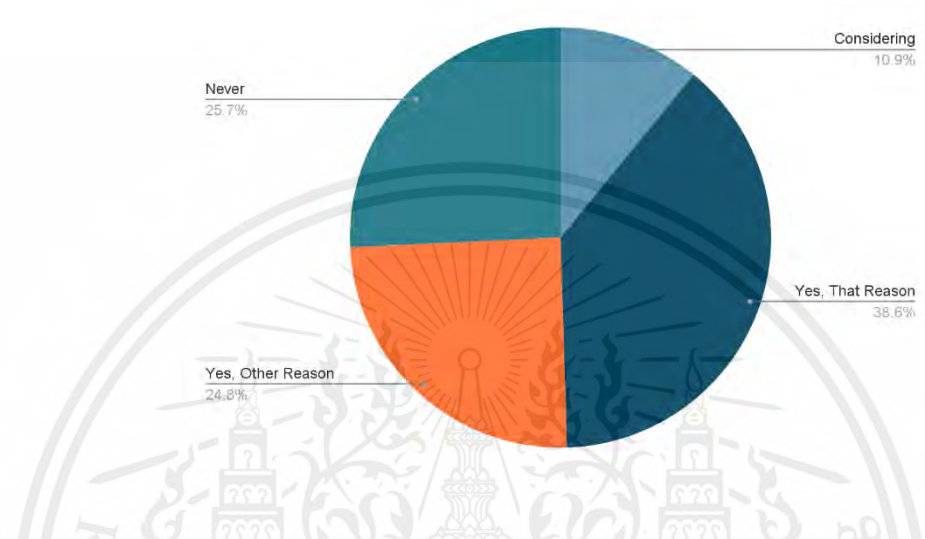


Figure 4. Error! Bookmark not defined..2 Survey responses Sample Q1

- Do you always budget and plan your finances?

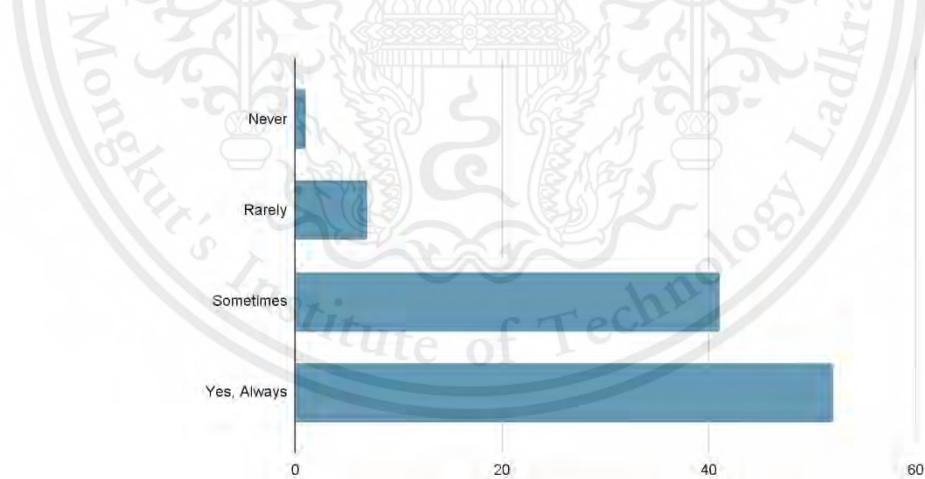


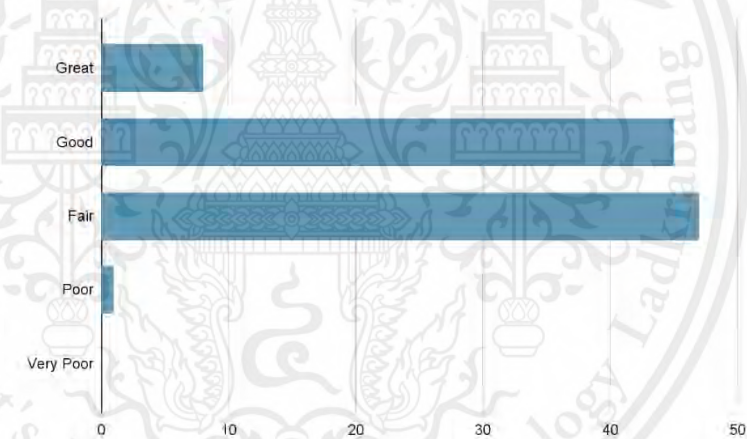
Figure 4. Error! Bookmark not defined..3 Survey responses Sample Q2

- What do you usually spend with?



*Figure 4. Error! Bookmark not defined..4 Survey responses Sample Q3*

- How would you describe your current financial situation?



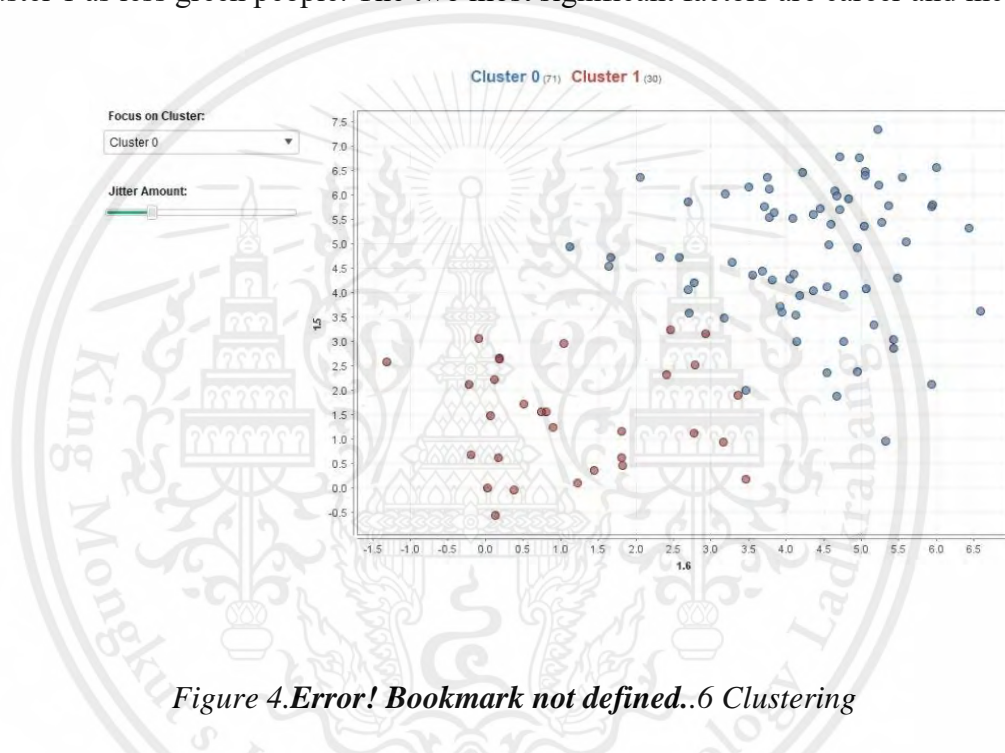
*Figure 4. Error! Bookmark not defined..5 Survey responses Sample Q4*

## 4.2 Data Analysis

From the responses we received, we use RapidMiner to cluster with the K-means model and predict with a random forest model.

### 4.2.1 K-means Clustering

We use the Random Forest Model to try to group people into two clusters, namely Cluster 0 and Cluster 1. The result being Cluster 0 as greener people, and Cluster 1 as less green people. The two most significant factors are career and income.



### 4.2.2 Random Forest Model

We use the Random Forest Model to try to predict what we want to know of a particular person from the data that we have. For instance, in this example, we try to predict how often a person takes loans. We then train the model to produce 100 trees using different sets of variables and training data subsets to try to answer the question one by one, and then all trees vote on the final answer. Here are some of the trees.

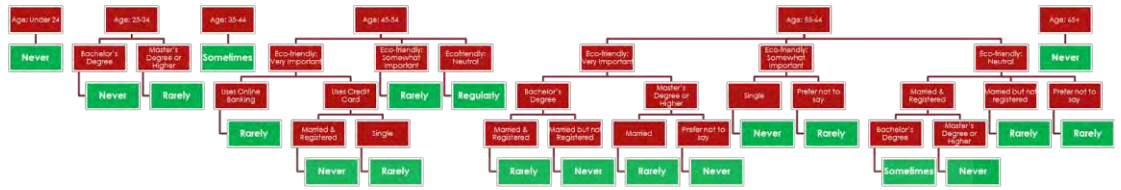


Figure 4. Error! Bookmark not defined..7 Random forest model Tree 1

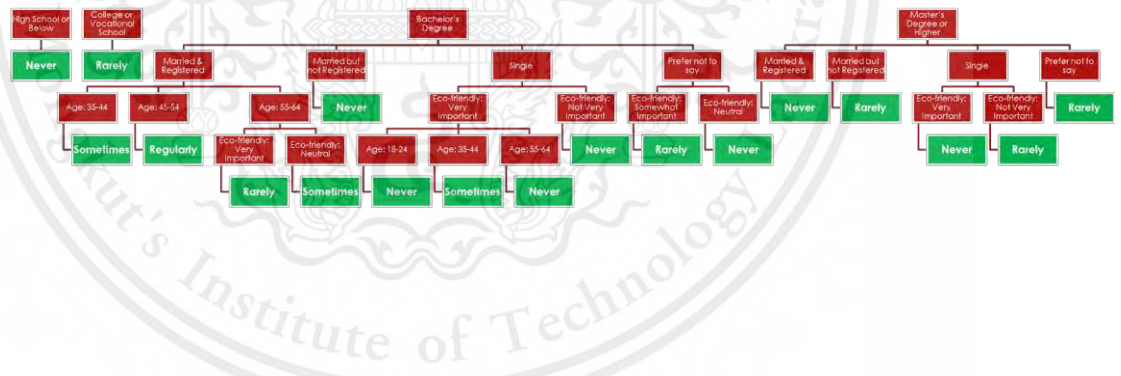


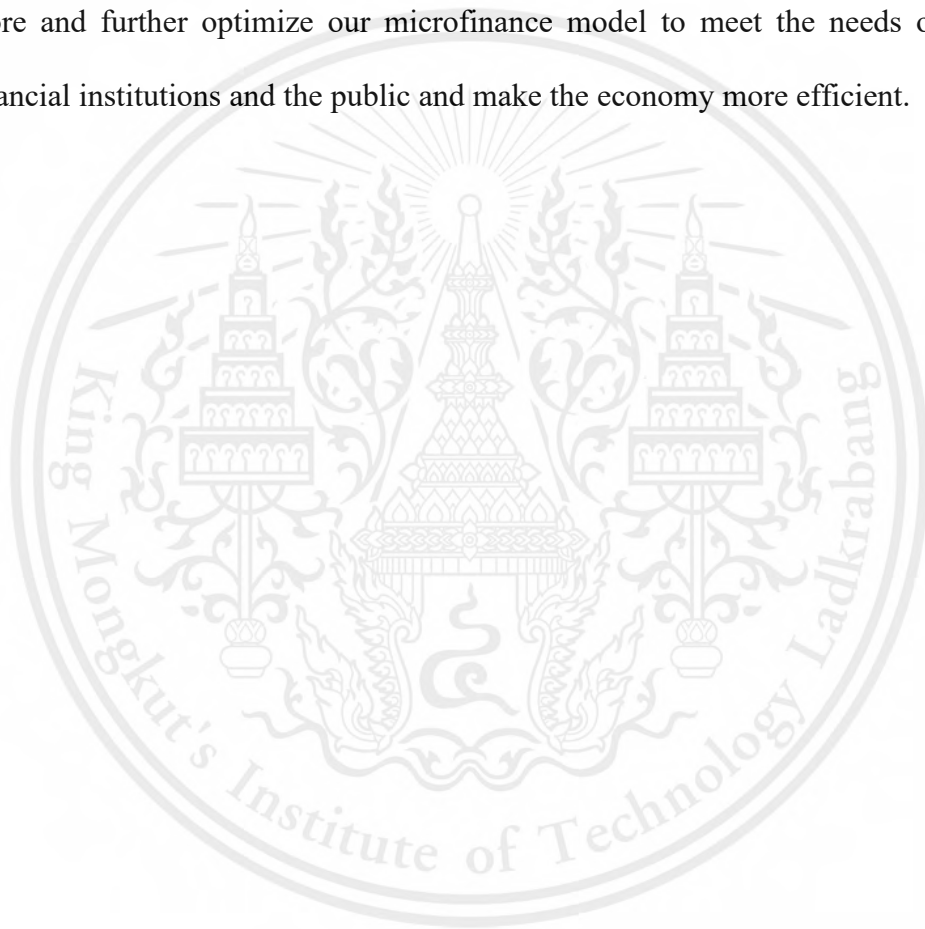
Figure 4. Error! Bookmark not defined..8 Random forest model Tree 69

As mentioned above, we use each of these trees to answer the question by its own first, and then all cast their votes to yield the final result. Note that we can build this type of model for any question that we want to know, given that we have the data for it.

## Chapter 5

### Conclusion

We found that there is enough evidence to support that Thai people's data also reflects the study done globally. That is, greener Thai people are better debtors. We may use the clustering and predicting model that we find to assess the customers' credit score and further optimize our microfinance model to meet the needs of both the financial institutions and the public and make the economy more efficient.



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