# Develop a Customized Deposit Insurance Recommendation System

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**Abstract.** Deposit insurance is one of the guarantee for the public. Its purpose is to accumulate capital and encourage saving. Generally, people don't understand deposit insurance completely, and they make a decision subjected to what the insurance agent say. Different individual is in keeping with different deposit insurance policy. Under this circumstance, it is equivocal for individual buyer to determine the suitable deposit insurance, or even to evaluate the return on investment. The main idea of this study is to design a customized recommendation system for individual buyer to decide a suitable deposit insurance including the NTD and foreign currency. The system is meant to calculate the net present value (NPV) and actual Internal Return of Rate (IRR) of deposit insurance, and provide the useful decision making reference for individual buyer.

**Keywords.** Deposit insurance, Net Present Value (NPV), Internal Return of Rate (IRR), Insurtech, Customized

## Introduction

Establish a deposit insurance system in a country can view as a protection for small unsophisticated depositors, and it also can encourage public confidence in the financial system, and stabilize the economic development. Deposit insurance system was established in America first because of the Great Depression. The idea is based on that if depositors realize that the government will reimburse their deposits even in the failure of bank, then they will not attempt to withdraw their deposits.

In general, the insurance buyer expect the relative values to their payment is reasonable, and get the higher IRR and amount of insurance. However, for individual buyer, the knowledge of insurance is scarcity, and will affected by the image of insurance company brand and insurance agent. In this situation, information asymmetry will make the buyer into a certain degree of risk.

Insurance is based on an economic concept which calls mutual assistance, it will gather several economic units which may encounter the same risk, and built a group that has the same interest and harm. As a result, in this study, we use the Net Present Value and Internal Rate of Return to actually evaluate the insurance policy for the buyer. NPV shows the single payment deposit and annual premium deposit in the present value, and Internal Rate of Return calculate the actual interest rate about

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different type of deposit insurance. Through the proposed system, the individual buyer can easily grasp these information, and make decision more effectively.

The paper is organized as follows. In chapter 1, we discuss the deposit insurance, Insurtech and the mathematical formula. Chapter 2 illustrates the methodology and the framework of this system. Implementation of the recommendation system are discussed in chapter 3. Conclusions and further research are given in chapter 4.

## 1. Literature Review

### *1.1 History of Insurance Industry*

Since the year of Republic, the earliest established proprietary insurance industry was established in Shanghai. Since then, the new life insurance companies have set up, capital has gradually increased in 1949. There were a total of 10 domestic life insurance companies have built before government move to Taiwan.

After Taiwan's reestablishment, the Taiwan Provincial Chief Executive's Office set up the Taiwan Provincial Insurance Commission Supervision Committee to take over Japan's 14 life insurance companies and 12 product insurance companies. In 1947, by the provincial banks and other public investment in Taiwan Life Insurance Company and the Taiwan Product Insurance Company officially opened as Taiwan's first self-run by the insurance companies. In 1961, since the government need to promote national economic construction plan, in view of social and economic development, there’s an urgent need for insurance. As a result, more and more insurance company open private to strengthen the social security system. In 1986, the Ministry of Finance has been opening up Taiwan's insurance market to American businessmen. In 2002, the Ministry of Finance adopted the revised provisions of the Insurance Law and the Establishment Standard of the Insurance Industry to accept and apply for the property and casualty insurance business.

In past years, the common sales channel about insurances is insurance agent. We have to contact a professional agent no matter what kind of information we would like to know. However, in these years, more and more people use internet to get these information because of booming of the Internet. Moreover, some insurance company create an online channel for customers to buy insurances through it.

Wu, Ho and Lin (2006) shows an advantage through developing electronic commerce for an insurance company. They employed a value chain analysis to explore the impact of Internet on the life insurance industry and they applied Delphi method to obtain the consensus of experts. Through the research, they suggest the life insurance company can promote and purchase online and set Internet as an information-based channel for customers. As above, they indicate that the life insurance company should do the redesign about their process to cooperate with insurance purchase online.

Fintech is an innovative term in recent. It combines finance and technique and it means use some technique method to solve finance problem or create an innovative business model through Internet to become an e-commerce. One of the application is Insurance. From one point of view, insurance develops the slowest in Fintech in the past. However, when some online aggregators appear, it would cause disruptive innovation because it destroyed the traditional insurance sales channels which usually focus between customers and insurance agent. Moreover, the rapid development of

science and technology also cause the innovation in insurance product and business model.

Therefore, here comes another term calls Insurtech. It means use some technique to deal with insurance process. Sarah Kocianski (2016) point out some new concepts about Insurtech in this book. She first indicated that Insurtech products mostly target retail customers. These kind products or services include individual customer or small business instead of focusing only on big businesses because it could contact to customers directly through some technique and Internet. Besides, Insurtech offer products and services that help insurance company improve their processes and better serve customers. Also, Insurtech carry out some risk to insurance agents because it can easily replicate agents' services and solving historical industry problems faster. No matter what, Insurtech is a trend nowadays and lots of insurance companies are working on improving their own direct-to-consumer digital interfaces and expect offering a better service process to customers.

### *1.2 Deposit Insurance*

Life insurance is divided into two categories: regular life insurance and life insurance. A life insurance policy is a contract with an insurance company. In exchange for premium payments, the insurance company provides a lump-sum payment, known as a death benefit, to beneficiaries upon the insured's death. Typically, life insurance is chosen based on the needs and goals of the owner. Term life insurance generally provides protection for a set period of time, while permanent insurance, such as whole and universal life, provides lifetime coverage. Insurance does not have the deposit insurance this kind of insurance, it is actually a form of life insurance. However, this kind of insurance have the protection function as life insurance and in addition to have the savings and value-added functions. Therefore, we often call such life insurance as deposit insurance.

Deposit insurance can be divided into short-term and long-term. The short-term savings insurance means savings are guaranteed for a limited period. It may be at the time of payment or a certain period of time after the expiration of the payment. When it's the time, then the amount must be brought back. The long-term means after payment expires the savings offer is sustainable for whole life, and the offer will be different in accordance with the different ways of protection. Long-term deposit insurance can be divided into three categories: value-added, annuity and comprehensive. The value-added means that the protection will increase in the form of compound value added. The concept of annuity savings insurance is similar to the old-age pension, retired pension. It means that it gives regular and fixed amount of protection. That is, after the payment period expires, the annuity savings insurance will pay a fixed annual annuity to death. Comprehensive is a very special kind of deposit insurance. It combines the advantages of value-added and annuity, but can avoid the shortcomings of these two insurances.

Explicit deposit insurance is a measure implemented in many countries to protect bank depositors, in full or in part, from losses caused by a bank's inability to pay its debts when due. Deposit insurance systems are one component of a financial system safety net that promotes financial stability. Banks are allowed to lend or invest most of the money deposited with them instead of safe-keeping the full amounts (see fractional-reserve banking). If many of a bank's borrowers fail to repay their loans when due, the bank's creditors, including its depositors, risk loss. Because they rely on customer

deposits that can be withdrawn on little or no notice, banks in financial trouble are prone to bank runs, where depositors seek to withdraw funds quickly ahead of a possible bank insolvency. On the other hand, since banking institution failures have the potential to trigger a broad spectrum of harmful events, including economic recessions, policy makers maintain deposit insurance schemes to protect depositors and to give them comfort that their funds are not at risk.

## 2. Method

### *2.1 Different Types of Deposit Insurances*

For the customers who have some deposit and decide to invest by buying the insurance, they have some different types of deposit insurances to choose as the following introduction.

#### *2.1.1 Single Payment Deposit*

Single payment means that the customers have to pay the whole amount of the insurance at the beginning of the first year. After policy period, customers could get back the whole amount with some interest. We choose six years for example here, as the Figure 2.1, the customer pay the whole money at the beginning (year zero) and he/she could get back all the amount of the insurance at year six.

The amount of interest would be different in different company and different insurance policy. Customers could choose by themselves. As usual, the more period is, the more interest customers would get.

#### *2.1.2 Annual Premium Deposit*

For the customers who don't have lots of money now, annual premium deposit is a good choice. Annual premium means that the customers don't need to pay the whole amount of the insurance at the first. Otherwise, they just need to pay little but consist amount year. After the policy period, the customers could also get the money back with some interest.

As the Figure 2.2, customers should pay the same amount in early six years and then they could get the money at the end of the sixth year. However, Annual premium deposit usually needs to pay the higher amount (total amount in six years) to get the same money back as single payment deposit.

No matter which kind of deposit insurance, both of them could separate in two types. The common one is that customers have to pay the money in New Taiwan Dollar as the other one is paying in foreign currency. Usually, the interest in Foreign Currency Insurance would higher because it also comes with higher risk of exchange rate. As a results, customers need to evaluate their own situation such that if they can endure higher risk and if they could pay in full. As most of customers would like to know how much difference in different type of deposit insurance, we use IRR as an index to evaluate it.

*2.2 Net Present Value*

In finance, the net present value (NPV) is a measurement of the profitability of an undertaking that is calculated by subtracting the present values (PV) of cash outflows (including initial cost) from the present values of cash inflows over a period of time. Incoming and outgoing cash flows can also be described as benefit and cost cash flows, respectively.

Net present value (NPV) is determined by calculating the costs (negative cash flows) and benefits (positive cash flows) for each period of an investment. The period is typically one year, but could be measured in quarter-years, half-years or months.

$$\mathrm{NPV} = -C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_T}{(1+r)^T}$$

$$-C_0 = \text{Initial Invenstment}$$

$$C = Cash\ Flow$$

$$r = Discount\ Rate$$

$$\mathrm{T} = \text{Time}$$

Net Present Value (NPV) is a formula used to determine the present value of an investment by the discounted sum of all cash flows received from the project. The formula for the discounted sum of all cash flows can be rewritten as

$$\mathrm{NPV} = -C_0 + \sum_{i=1}^{T} \frac{C_i}{(1+r)^i}$$

When a company or investor takes on a project or investment, it is important to calculate an estimate of how profitable the project or investment will be. In the formula, the $-C_0$ is the initial investment, which is a negative cash flow showing that money is going out as opposed to coming in. Considering that the money going out is subtracted from the discounted sum of cash flows coming in, the net present value would need to be positive in order to be considered a valuable investment. A positive net present value indicates that the projected earnings generated by a project or investment (in present dollars) exceeds the anticipated costs (also in present dollars). Generally, an investment with a positive NPV will be a profitable one and one with a negative NPV will result in a net loss. This concept is the basis for the Net Present Value Rule, which dictates that the only investments that should be made are those with positive NPV values.

*2.3 Internal Rate of Return*

In order to compare different kinds of insurance, we need to understand the calculation of internal rate of return (IRR). It is a tool that can use cash flow to reverse annualized returns. The IRR can be defined as the discount rate which, when applied to the cash flows of a project, produces a net present value (NPV) of nil ( $\mathrm{NPV} = 0$). This discount rate can then be thought of as the forecast return for the project. If the IRR is greater than a pre-set percentage target, the project is accepted. If the IRR is less than the target, the project is rejected. Considering the definition leads us to the calculation. The IRR uses cash flows (not profits) and more specifically, relevant cash flows for a project. To perform the calculation, we need to take the cash flows of a project and calculate the discount factor that would produce a NPV of zero.

$$\text{IRR} = r_a + \frac{NPV_a}{NPV_a - NPV_b}(r_b - r_a)$$

$$r_a = lower\ discount\ rate\ chosen$$

$$r_b = lower\ discount\ rate\ chosen$$

$$N_a = NPV\ at\ r_a$$

$$N_b = NPV\ at\ r_b$$

## 3. The Prototype of Recommendation System

### *3.1 System Function Analysis and Design*

The system architecture as show in Figure 2.3. Recommendation system purpose is to help the buyer to calculate the IRR of the deposit insurance, including the NTD, and foreign currency according to the different kinds of deposit insurance policy.

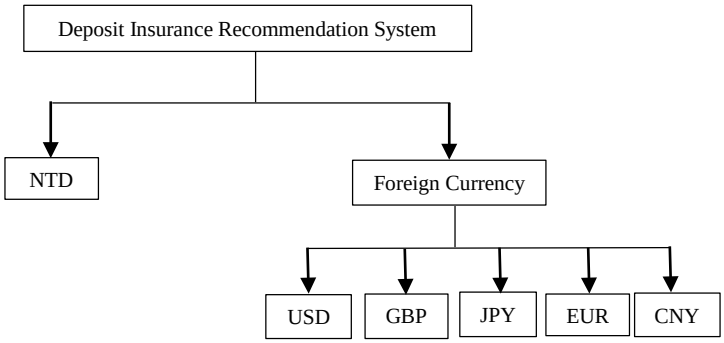


Figure 2.3

When the buyer use the system, they need to input the required information, including the type of deposit insurance as mentioned in chapter 2 and amount of the insurance, that is, the money they expect to get back which usually shows on the deposit insurance policy according to different insurance company. The operating procedure as the following Figure 2.4 and Figure 2.5. After calculating, if the buyer is satisfied about the IRR, then it can compare with other different type of deposit insurance which he or she is also interested in, and make a suitable choice.

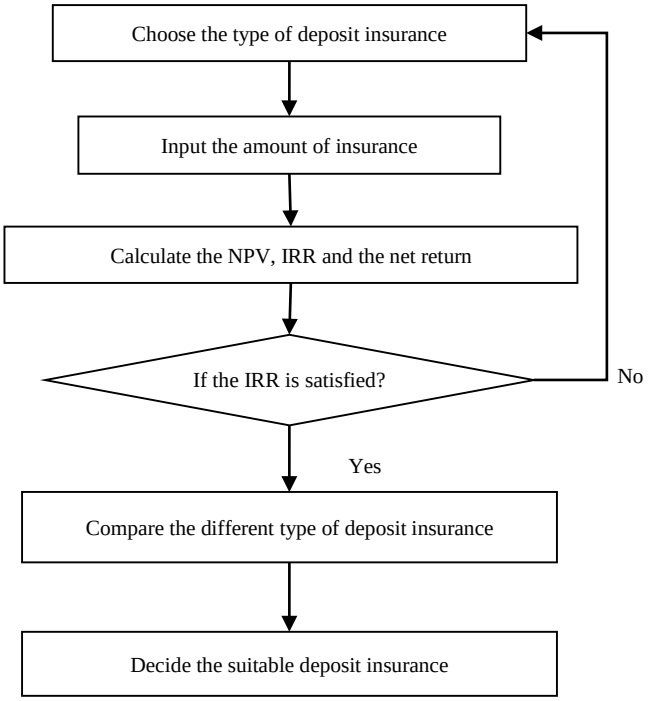


Figure 2.4 the buyer operating procedure based on NTD

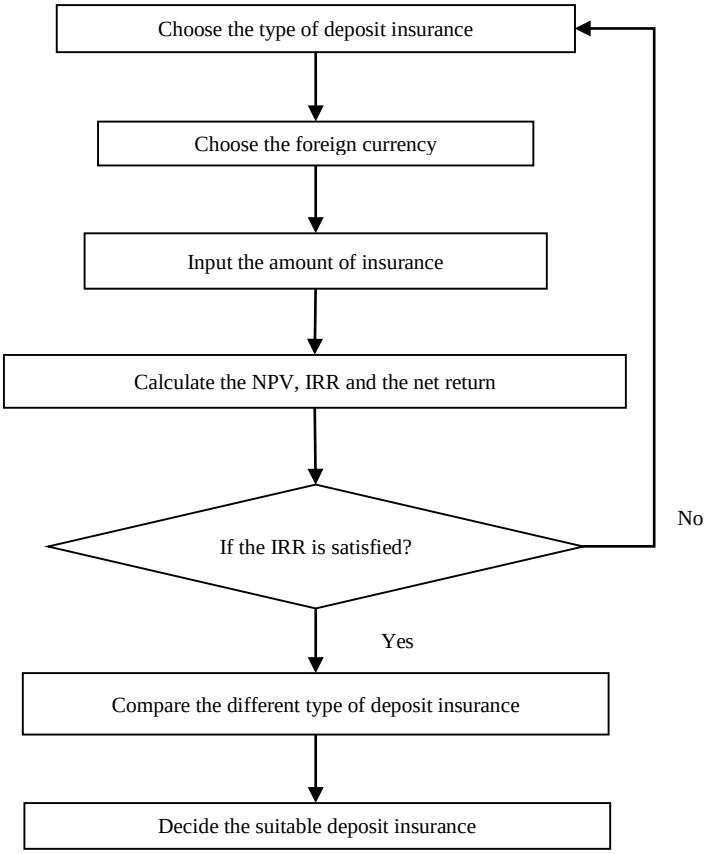


Figure 2.5 the buyer operating procedure based on foreign currency

*3.2 Implementation of the Recommendation System*

In our website, we have two different interface, one will help you to find the appropriate insurance type for you, the other will help you to calculate the insurance amount and help you to decide which type of insurance is best for you. Figure 2.6 will show the whole process in the website for you, and the prototype will be shown and illustrate furthermore.

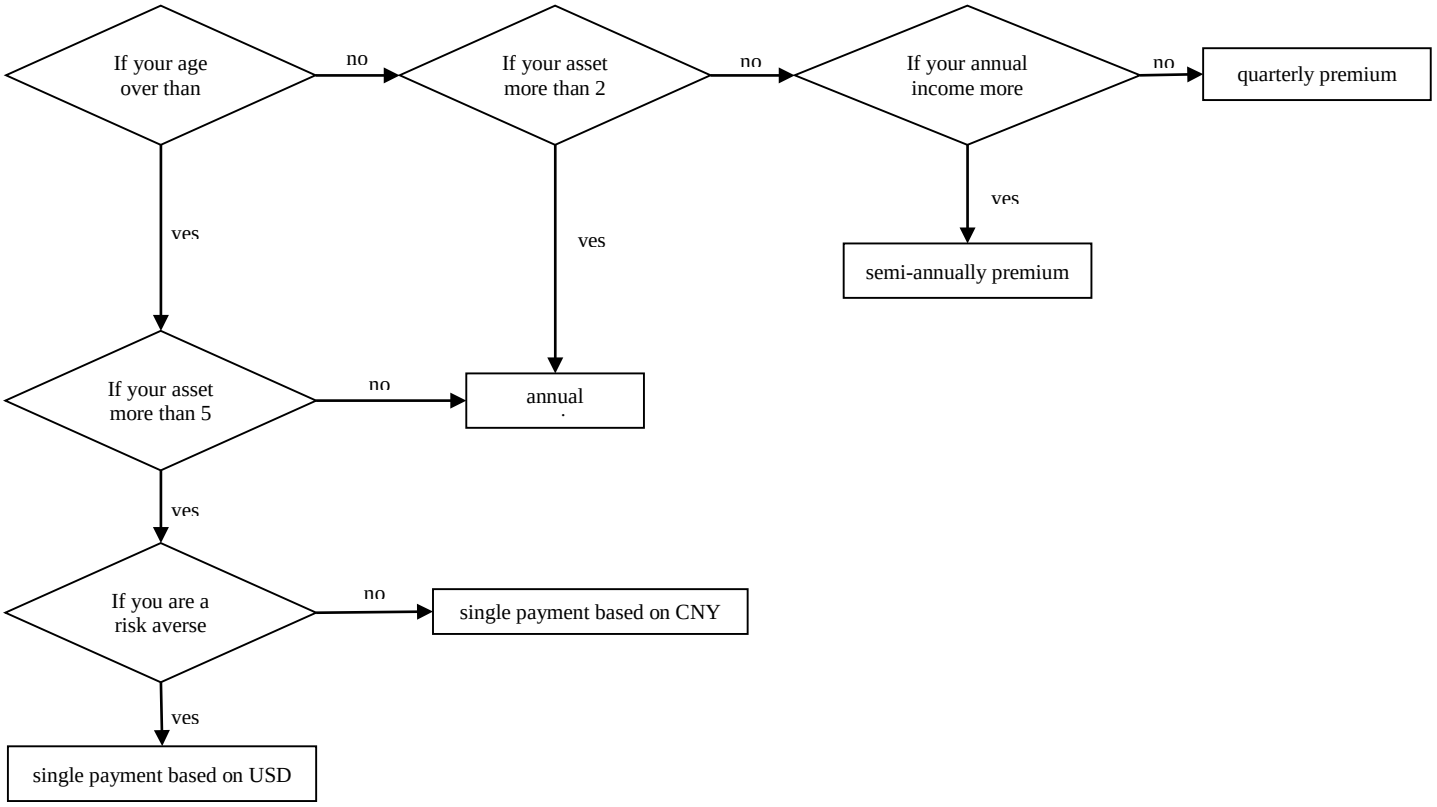


Figure 2.6 The operation process of the website

The first function provided by our website is that it can help you to choose the appropriate types of insurance for you, the interface is shown in figure 2.7. Based on you age, accumulated personal assets and annual income. In addition, it also have some reminder for you, so that you would not buy the insurance impulsively and without known enough information. For example, if your accumulate assets is a lot, and your also earn a lots of annual income, then single payment will be best for you, and it usually gets more internal rate of return too. But if your annual income are not so much, the recommendation system will suggest you to take annual payment or semi-annually premium, though it may have lower internal rate of return, it's more appropriate for you.

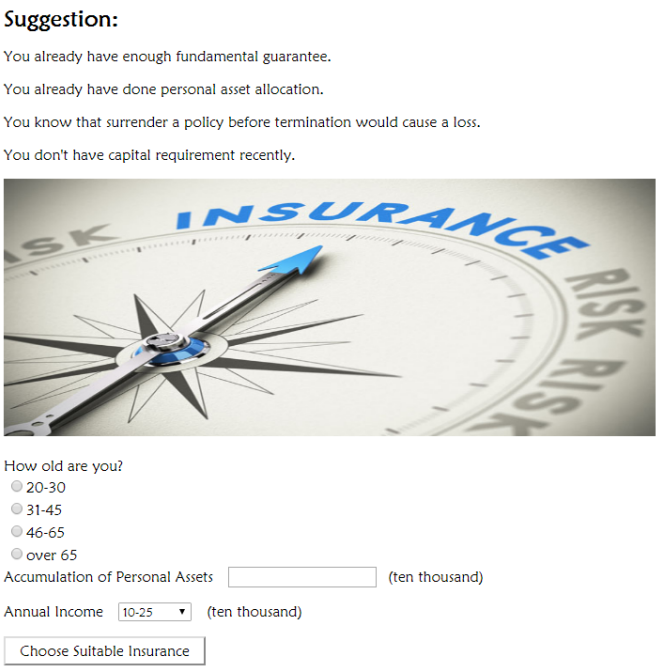


Figure 2.7 website page- recommend insurance based on your condition

In figure 2.8, it can help you to calculate the amount you need to pay each period as process we have mentioned in figure 2.6. Also, you can use the drop down list to choose the currency that you want to consider and click "Show Rate", then the exchange rate will show on the right side. The currency is updated at any times, the time will also be captured on our website.

Furthermore, you can click the "calculate" button, the website will help you to calculate the net return and internal rate of return (IRR), so that you can compare different types of insurances and choose the one that best fits your need.

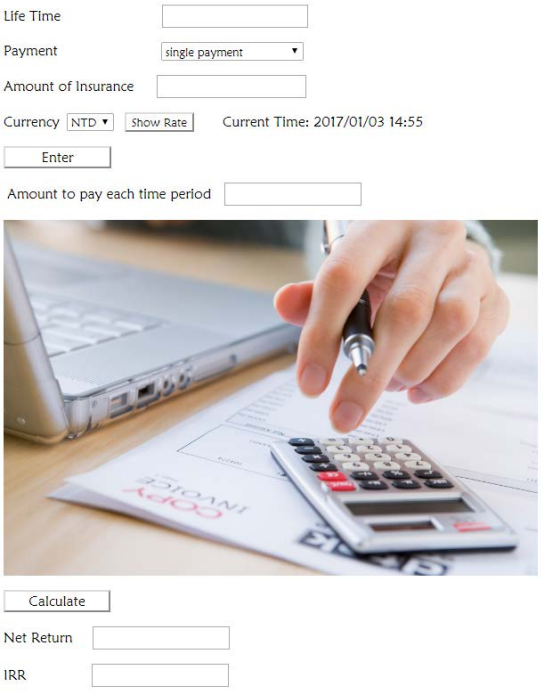


Figure 2.8 website page- calculate net return and IRR

## 4. Conclusion

Nowadays, more and more people choose deposit insurance to accumulate capital and encourage saving. However, for individual buyer, the knowledge of insurance is scarcity, and will affected by the image of insurance company brand and insurance agent.

For the individual buyer who have some deposit and decide to invest by buying the insurance, they have some different types of deposit insurances to choose. However, there isn't a system for the individual buyer to decide which type of deposit is suitable for them so they can just follow what agent say. As a result, we create a simple website to solve this problem.

We use IRR as an index that help us to measure the benefit of each deposit insurance. Also, for the individual buyer without lots of assets, we give them some suggests that help them to measure which type of deposit insurance is suitable for them. Furthermore, some customers would like to buy deposit insurance by foreign currency. The advantage of it is that the rate will be higher so that customers could get more money back after time period. However, it also carry out higher risk because the foreign exchange rate is unstable. So this website also provide this function for customers to decide which currency they prefer.

Though this website could solve the problem that individual buyer couldn't get enough information about insurance, there're still some parts that we can improve in

the future. First of all, for the insurance company, they could expand it to other types of insurances. For example, life insurance, health care insurance and so on. Moreover, they can also combine more insurance that provide customers more specific portfolio insurance. In addition, as Insurtech is flourish in these days, maybe we can create a full service system about insurance so that the individual buyer could buy any insurance they need through it.

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