

# Software Project and Process Management

“ICE”—Online Entity Game Store



Team Member

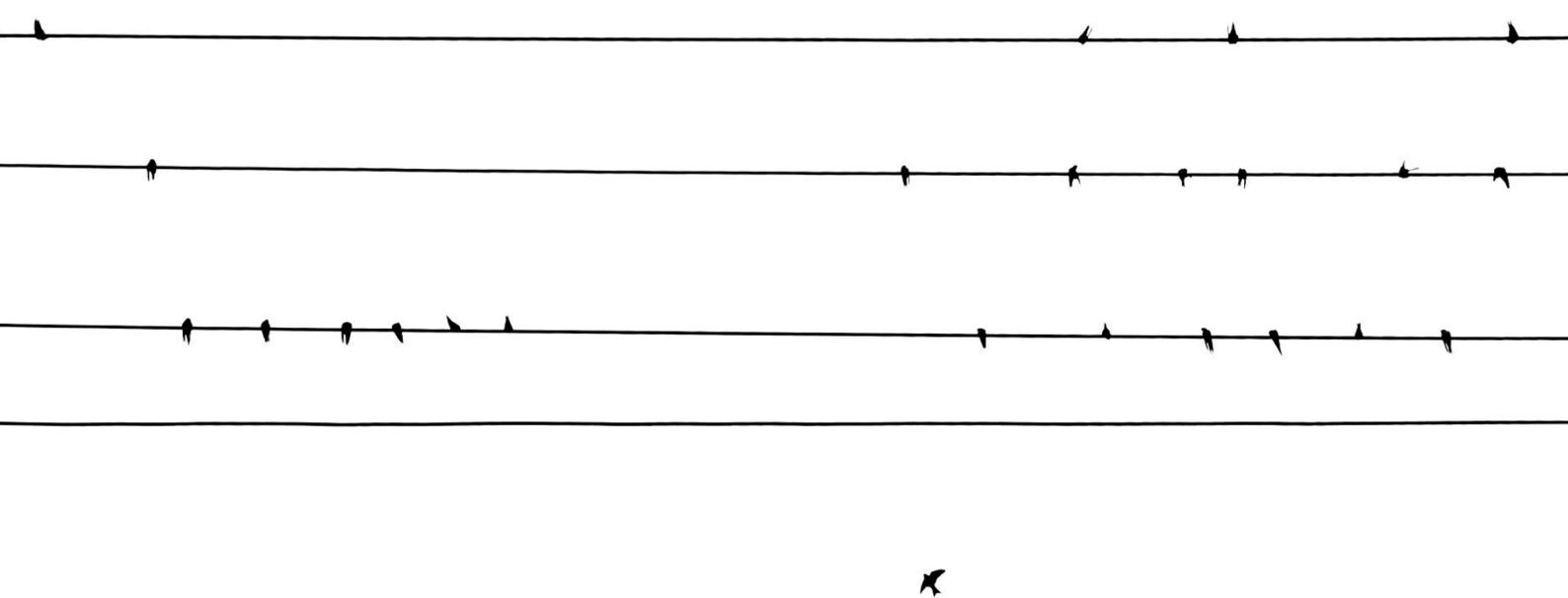
1754060 Zhe Zhang

1753414 Di Bu

1753188 Kaixin Chen

<b>Part II:</b>	<b>4</b>
<b>Software Engineering Economy</b>	<b>4</b>
<b>1. Company Overview</b>	<b>5</b>
<b>1.1 Company Profile</b>	5
<b>1.2 Market Analysis</b>	5
1.2.1 Feasibility Analysis .....	6
1.2.2 Ecosystem Analysis .....	7
1.2.3 Customer Analysis .....	7
<b>1.3 Competition Analysis</b>	<b>8</b>
1.3.1 Competitive Advantages .....	8
1.3.2 Competitive Disadvantage .....	9
1.3.3 Competition Analysis Form .....	9
<b>1.4 Assumption &amp; Prerequisites</b>	<b>10</b>
<b>1.5 Operation Plan</b>	<b>10</b>
1.5.1 Product .....	10
1.5.2 Office Environment.....	12
1.5.3 Personnel.....	13
<b>2. Budget</b>	<b>17</b>
<b>2.1 Statement</b>	17
<b>2.2 Effort Estimation</b>	17
2.2.1 Function Points Estimation .....	17
2.2.2 Development Effort Estimation .....	20
2.2.3 Operation and Maintenance Effort Estimation .....	21
<b>2.3 Development Cost Estimation</b>	<b>22</b>
2.3.1 Direct Labor Cost Estimation .....	22
2.3.2 Direct Non-labor Cost Estimates .....	23
2.3.3 Indirect Labor Cost Estimation .....	23
2.3.4 Indirect Non-labor Cost Estimates.....	24
2.3.5 Total Development Cost Estimate.....	24
<b>2.4 Operation and Maintenance Cost Estimation</b>	<b>24</b>
2.4.1 Labor Cost Estimation (direct + indirect) .....	24
2.4.2 Non-labor Cost Estimates (direct + indirect) .....	25

<b>2.5 Source of Budgets</b>	<b>25</b>
<b>2.6 Repayment Strategies</b>	<b>26</b>
2.6.1 Equivalent Principal:.....	26
2.6.2 Equal Repayment of Principal and Interest: (selected) .....	27
<b>3.Financial Evaluation</b>	<b>28</b>
<b>3.1 Pricing Strategy</b>	<b>28</b>
3.1.1 Factors Affecting Pricing .....	28
3.1.2 Six Steps For Pricing Decision .....	28
3.1.3 Determine the Final Price Strategy .....	29
<b>3.2 Cash Flow</b>	<b>30</b>
3.2.1 Statements of Cash Flow .....	30
3.2.2 12 Month Cash Flow of 2020 .....	32
3.2.3 12 Month Cash Flow of 2021 .....	33
3.2.4 12 Month Cash Flow of 2022 .....	34
3.2.5 Project Cash Flow in 3 years .....	35
<b>3.3 Depreciation &amp; Amortization</b>	<b>37</b>
3.3.1 Depreciation .....	37
3.3.2 Amortization .....	38
<b>3.4 Profit &amp; Loss Statement</b>	<b>39</b>
<b>3.5 Balance Sheet</b>	<b>40</b>
<b>4. Economic Evaluation</b>	<b>42</b>
<b>4.1 Break-Even Analysis</b>	<b>42</b>
<b>4.2 NPV, IRR and Paybackyear</b>	<b>42</b>
<b>4.3 Sensitivity Analysis</b>	<b>43</b>
<b>Reference</b>	<b>45</b>



**Part II:**

**Software Engineering Economy**

# 1. Company Overview

## 1.1 Company Profile

The company's mission is to provide customers with a convenient, friendly and fast online physical game platform. The ultimate goal of the company is to be able to build a healthy, friendly and cooperative company, and to have a group of loyal customers and partners. In order to achieve our ultimate goal, game companies, etc. whose physical game resources carry out online sales business, we hope to be favored by customers in the annual customer satisfaction survey and get our suggestions for development and improvement from loyal customers

The company's business philosophy is Q (quality), S (service), S (speed), quality is that the online physical game platform we sell must be easy to use, user-friendly, and excellent quality; service is our Customer services such as pre-sales consulting services/after-sales services/ are all quick to give feedback, attentive and thoughtful; speed lies in the response speed of our online physical game platform is good, and the feedback speed of the company's customer service is rapid.

The online physical game platform can be regarded as a branch of the online shopping platform, but it is not the same. We can focus on meeting the preferences of customers and provide customers with a more convenient, friendly and faster online physical game system. Ability to focus on how to improve the quality of your game resources and increase your game sales. In the information age, the reality of physical game stores will be too few people because of the fast pace of life, the online physical game platform will give customers a channel to develop personal or company online sales of physical games, improve sales, and improve themselves Operating income. Therefore, the company's advantage lies in following the trend of social change, and at the same time seizing the customer's reform ideas, which can help customers increase operating income while reducing the economic burden and labor burden of operating physical game stores.

## 1.2 Market Analysis

For the company's business, the underlying market is mainly the changes in the physical game market. When the physical game market changes, it will also have an impact on the business strategy of the physical game store operator, and then the operator may consider expanding or Change the operating channel, that is, turn to the understanding of the online physical game platform.

From 2010 to 2020, the 10 years of China's physical game retail market is the 20 years that the market has developed from immature to mature. According to relevant data from the National Bureau of Statistics, the retail sales of physical games reached 71.185 billion yuan in 2018, an increase of 413.72% from 2010. In 2019, the total number of physical games in China reached 6.4 billion, an increase of 29.8% from 2010.

---

### 1.2.1 Feasibility Analysis

#### 1. High-quality low-price competitive advantage of online physical game stores

Online shopping has the characteristics of low price, high efficiency, convenience, and a full range of types. Compared with the traditional physical game store business model, online physical game stores can save a lot of cost expenses such as mall rent, employee management salary, and trial loss. Obviously, this will provide a basis for the online physical game store to sell goods at a low price. The best-selling CDs, game cassettes and other products in the traditional game store can be purchased at a low price in the online physical game store.

#### 2. Online physical game store delivery speed is fast

With the rapid development of the network technology and logistics industry, the e-book bookstore has a reliable space for development, which will provide buyers with great convenience, subscribe online, communicate online with the online store, try it directly in the online store, online After the store receives the purchaser's subscription information, the purchaser can immediately play the game they want.

#### 3. Buying customer groups faced by online physical game stores

The current number of people on the Internet in our country will reach 80 million, most of whom are under 30 years old, and the category of college students accounts for more than 60%. In this category of user groups, I like to buy CD games, cassette games, and browse some physical games online. It is easy to accept new things, accept online shopping, and form a new trend of buying. It will form a huge target market. At the same time, the purchase of CD games and cassette games selected by the user group in this category has different levels of selection, that is, the price is low and cheap, which is the appetite for the low price sales of online physical game stores.

Online physical game stores take advantage of the low price, high efficiency, convenience, and full range of features provided by the Internet. Buyers can directly query and select, and then directly order games online. The settlement method can be mobile phone charging, credit card settlement, mail order, wire transfer, etc. After the online physical game store confirms that the purchaser has paid, the physical game is delivered to the reader through its own delivery system.

---

## 1.2.2 Ecosystem Analysis

The data shows that in 2015, my country's software and information technology service industry achieved 37 trillion yuan in software business revenue, a year-on-year increase of 2092%, a growth rate of 148 percentage points lower than 2015, but still higher than the electronic information manufacturing industry by about 10 percentage points. In the first half of 2016, my country's software and information technology service industry as a whole operated steadily, with software revenue growth picking up, margins increasing slightly, the central and western regions maintained rapid growth, and the scale of the central city's software industry continued to expand. In the first half of the year, my country's software and information technology service industry completed software business revenue of 20217 billion yuan, a year-on-year increase of 171%, and the growth rate was flat from January to May. Among them, the revenue from completed software business in the second quarter was 114.3 billion yuan, an increase of 30% over the first quarter. In the first half of the year, the total profit of the software and information technology service industry was 219.3 billion yuan, a year-on-year increase of 126%. The growth rate was still 94 percentage points lower than the same period last year, but an increase of 35 percentage points from the first quarter.

According to the 2017-2023 in-depth survey analysis and development prospect research report of the Chinese software market released by the China Market Research Online. According to the report, there are currently about 1,000 new domestic software products listed each year. General software product hotspots are mainly concentrated on educational software, game software, e-book CD/multimedia software, anti-virus software, PC operating system and Chinese platform, cad/cam software. In my country, the life span of general game products is only about three months; the life span of educational software and e-book discs is about six months; the life cycle of other kinds of software is slightly longer, about one year. As technology advances and competition intensifies, the software life cycle tends to shorten. 80% of the products use CD as the carrier, and the operating environment is mostly based on windows. The purchasing power of group users is stronger than that of individual users. The purchase varieties are mainly concentrated in operating systems, databases, tool software, cad/cam software, office suites, etc., and they pay more attention to services; the consumption growth of individual users is higher than that of group users. Pay more attention to price in tools, games, education, e-books, etc. The seasonality of consumption is weak.

---

## 1.2.3 Customer Analysis

Our customers are mainly for people who want to develop online game stores. Most of these customers have some game resources offline, want to develop online game sales business to promote sales growth, or want to operate low-cost game stores, Unable to develop offline physical game stores. The income level of these people is higher than that of ordinary people, and their education level is also relatively high.

## 1.3 Competition Analysis

For the online physical game platform system, we can find many similar platforms, such as Nintendo and other game companies, and there are also many examples of developing from offline game stores to online, such as various physical game online stores in Taobao. Companies that develop online physical game systems do not open source online physical game systems, so competitors are mainly software outsourcing teams.

### 1.3.1 Competitive Advantages

#### 1. Performance characteristics

Response time: The average response time of API requests is less than 2s, and the opening speed of WEB pages is under 5s.

Online users: The system can support more than 10,000 users online at the same time.

Throughput: The system can support 1,000 users to pay orders at the same time.

Pressure resistance: The system can run stably for 12 hours under the condition that the operating pressure of the actual system is doubled.

Online time: The system works 24 hours a day, 7 days a week.

#### 2. Performance characteristics

##### 1. Reliability

Average failure time: less than 0.1% of system running time.

Average repair time: The average repair time of the fault is less than 3 hours.

##### 2. Effectiveness

The user-friendly interface makes users feel comfortable.

There are fewer errors in user understanding and operation.

User learning operation time is shorter.

In abnormal environments and situations, users can still operate normally.

##### 3. Safety

User passwords and other private information use encryption algorithms.

Database operations prevent injection.

The user login needs to enter the verification code.

The coupling of different modules in the system is low.

##### 4. Maintainability

##### 3. Other features

1. The database sets different permissions for different users to ensure that you should not access things that should not be accessed. At the same time, an efficient index is established to ensure that the database query is rapid to support high concurrent access.

2. The system is internationalized. Temporarily supports Chinese and English.

3. The core business of the project, such as the following orders, payment, commodity information and other modules can be reused.

4. The system is easy to transplant. When the whole system is in a bottleneck after a few years, it can be easily transplanted and expanded.

### 1.3.2 Competitive Disadvantage

Similar systems (such as Nintendo, Xbox, etc.) that have existed on the market have been developed for a long time, and a large number of sources and users have been gathered. The initial benefits of this system are low.

### 1.3.3 Competition Analysis Form

1=critical 5=not critical

Factor	This project	Software outsourcing team	Importance
Product	Online physical game platform	Online physical game platform	1
Price	Lower	General	3
Quality	General	General	2
Service	Thoughtful and comprehensive	Thoughtful	3
Reliability	Relatively reliable	Relatively reliable	3
Stability	Stable	Stable	2
Professional knowledge	Profession	Profession	1
Company reputation	Good	General	3
Location	Immobilized	May flow	2
Exterior	Friendly interface and easy operation	Friendly interface	3
Sales method	Portals website	Outsourcing website	2
Ad	Portal website and cooperation website	Outsourcing website	3

## 1.4 Assumption & Prerequisites

To insure that our project develops stably and the website works responsibly, we make the following assumptions.

1. Before the development, we cost totally ¥71240 to buy necessary devices and software.
2. At the start of each month, we need to pay ¥35,000 for the rent and the miscellaneous office expenses. Suppose it will not change during the period we report
3. We use the first year to develop the website and insure it runs stably. According to our project management, we spend 3 months to develop the website and the next following 6 months we will focus on the maintenance of it.
4. We record the financial data from year1 to year4, and the staff training is only in the first 3 months of year1.
5. In the following 3 years, there will be little fluctuation in the profit and loss projection. We consider a inflation of 2.5% and make some adjustment in profit and loss.

## 1.5 Operation Plan

### 1.5.1 Product

#### 1.5.1.1 Production Technology

1. The overall project adopts a microservice architecture to ensure the customizability of functions and code reuse.
2. Highly cohesive production methods, modular product components to meet the needs of customers of all levels.
3. The front-end template can be customized, the front-end functional components are modularized and the display components are templated to achieve the ultimate development purpose.

#### 1.5.1.2 Customer Service

In the business tenet of "bringing customers the most satisfactory products and services", xxx Company solemnly promises: while ensuring the advancedness, reliability, and stability of the equipment, it will continuously improve the quality of service, from sales to after-sales. Cargo, commissioning, equipment maintenance management, technical services, user technical training and other aspects to ensure that customers can get the best service, so that customers are satisfied and assured.

1. Ensure that the system is correct, safe and the quality meets national standards, and submit it to the customer in time.
2. Provide high-quality and fast technical services

In order to better ensure the normal operation of the equipment, answer questions raised by users in time, and help users solve problems, the company's maintenance center and local maintenance outlets are responsible for the service of opening, maintenance, and technical consultation. Full-time engineers are responsible for the maintenance center to provide free technical consultation services to customers at any time.

Ensure that Jiangsu, Zhejiang, Shanghai and Anhui will rush to the site within 24 hours after receiving the user's fault call, and rush to the site within 48 hours in other regions, and solve the problem within 24 hours.

The company's maintenance center has a 24-hour telephone service, and full-time engineers accept user calls to ensure that users receive technical support in the process of using the equipment.

Hotline: 8008208820 24 hours: 13141592126

### 3. Free debugging and activation for users

Engineers are responsible for the installation, commissioning, commissioning and testing of on-site systems. After the system is successfully debugged, the supplier shall bring the test results to the user in writing, and the supplier's technical personnel may evacuate the site only after obtaining the user's consent.

### 4. Regular inspection

Our company regards the inspection system as one of the routine maintenance tasks, that is, the company organizes the inspection of the running equipment every six months. The company mainly inspects engineering and technical personnel, and has designers involved. And listen to the problems and recommendations reflected by user maintenance personnel, and constantly improve the software and hardware functions and quality of the product.

### 5. Warranty

The warranty period of the equipment under the contract is 18 months after successful installation and commissioning. During the warranty period (except for natural disasters and man-made damage), the maintenance costs and business travel costs are borne by the supplier.

### 6. Lifetime maintenance to ensure user benefits

The company's system is guaranteed free of charge for 18 months under normal conditions (excluding natural disasters and man-made damages) from the date of opening and acceptance. Outside the warranty period, the company will provide lifetime paid service.

### 7. Establish user files and improve product quality

In addition to carrying out user technical consulting services, the company's maintenance center is also responsible for accepting and collecting user complaint and consulting information, ensuring that users' questions and requirements can be handled in a timely manner, and tracking and verifying the processing status. At the same time, establish user files to record the product usage status, and provide a basis for future product quality improvement. We will continue to strive for excellence and bring customers the most satisfactory products and services.

### 8. The company's spare parts library can bring users 15 years of use and bring spare parts at the best price.

#### 1.5.1.3 Product Development

9. Back-end services are assembled strictly in accordance with modularization to improve code reuse rate and reduce code error rate.

10. The front-end functional components are highly modular, and the non-functional display components provide users with customized services to meet the needs of various types of users.

#### **1.5.1.4 Product Pricing**

##### **1. Pricing method:**

Based on the product's high reusability and module customization, and a certain market share brought by the company's customized services, we decided

The target profit pricing method is adopted to price the products based on the company's annual estimated total cost and expected profit rate.

##### **2. Data collection:**

1. Based on R&D costs, operating costs, and interest on overdue loans, the expected total cost for 2 years is: 5935580 yuan
2. Software development VAT rate is 3% of sales
3. See sales forecast for expected sales
4. Expected profit rate is 10% of total operating expenses for 2 years

##### **3. Pricing calculation:**

$$2\text{YearSales} = (2\text{YearsExpectedCost} + 2\text{YearsSales} * 0.03) * 1.1$$

Calculated 2-year projected sales are: 6751952 yuan

Based on the expected sales volume, the 2-year sales volume is predicted to be 100

That is, the product is priced at 68,000 yuan

---

#### **1.5.2 Office Environment**

Location: Hongqiao Vanke Center, Lane 988, Shenchang Road, Changning District, Shanghai

Area: 90m<sup>2</sup>, can accommodate 15-24 seats

Property: Hongqiao Vanke Center

Transportation: Metro Line 17 Hongqiao Railway Station 702 meters, Line 2 Hongqiao Railway Station 758 meters, Line 10 Main Line Hongqiao Railway Station 758 meters

Building area: 123000m<sup>2</sup>

---

### **1.5.3 Personnel**

#### **1.5.3.1 Number and Position**

<b>Job Title</b>	<b>Number (person)</b>
Project Manager	1
Software Engineer	3
Test Engineer	2
Architect	1
Department Manager	1
Quality Assurance Supervisor	1
Marketer	2
Configuration Administrator	1
Process Improvement Engineer	1
Accountant	1
Cleaner	1
<b>Total</b>	<b>15</b>

### 1.5.3.2 Workforce Type

Job Title	Unskilled (person)	Skilled (person)	Profession (person)
Project Manager			1
Software Engineer		2	1
Test Engineer		1	1
Architect			1
Department Manager		1	
Quality Assurance Supervisor		1	
Marketer	1	1	
Configuration Administrator		1	
Process Improvement Engineer		1	
Accountant		1	
Cleaner		1	
Total	1	10	4

### 1.5.3.3 Salary Structure

Job Title	Salary (yuan/month)
Project Manager	14000
Software Engineer	18000
Test Engineer	16000
Architect	20000
Department Manager	12800
Quality Assurance Supervisor	9000
Marketer	8500
Configuration Administrator	7500
Process Improvement Engineer	8000
Accountant	7000
Cleaner	5000

### 1.5.4 Sales

#### 1.5.4.1 Promotions

The promotion activities adopted for the online book shopping platform developed by the company mainly include two types. The daily promotion includes the company's official website promotion, cooperation website promotion, brochure promotion, periodic promotion includes game APP promotion, WeChat public account promotion, external activities sponsor;

Among them, the promotion of game APPs is promoted in a traffic game APP every month, depending on whether the promotion effect needs to choose another game APP, WeChat public account promotion chooses WeChat public account related to game recommendation for article promotion, and external event sponsorship to The frequency of twice a month selects sponsorship for game-related activities such as campus game festivals.

#### **1.5.4.2 Promotional Budget**

Promotion Items	Promotion cost (yuan)
Company official website promotion	1500
Cooperation website promotion	1500
Game APP promotion	2000
Brochure promotion	500
Sponsorship for external events	2500
WeChat public account promotion	2000
Total	10000

#### **1.5.4.3 Sales Forecast**

Through the sales of related systems on outsourcing websites, combined with the actual situation of our online physical game platform, we price the online physical game system at 68,000 yuan/set; the system will be developed from scratch in the first two months of the company. As a result, there is no sales volume. With the development and technological progress, and the promotion of promotion, the third month to the fifth month are expected to be able to sell three online physical game systems every month, the sixth month By the ninth month, it is expected to be able to sell four online physical game systems each month, and then gradually stabilize on the baseline of five systems sold per month.

# 2. Budget

## 2.1 Statement

Before the content of the financial management document, we first explain our basic conditions and premises:

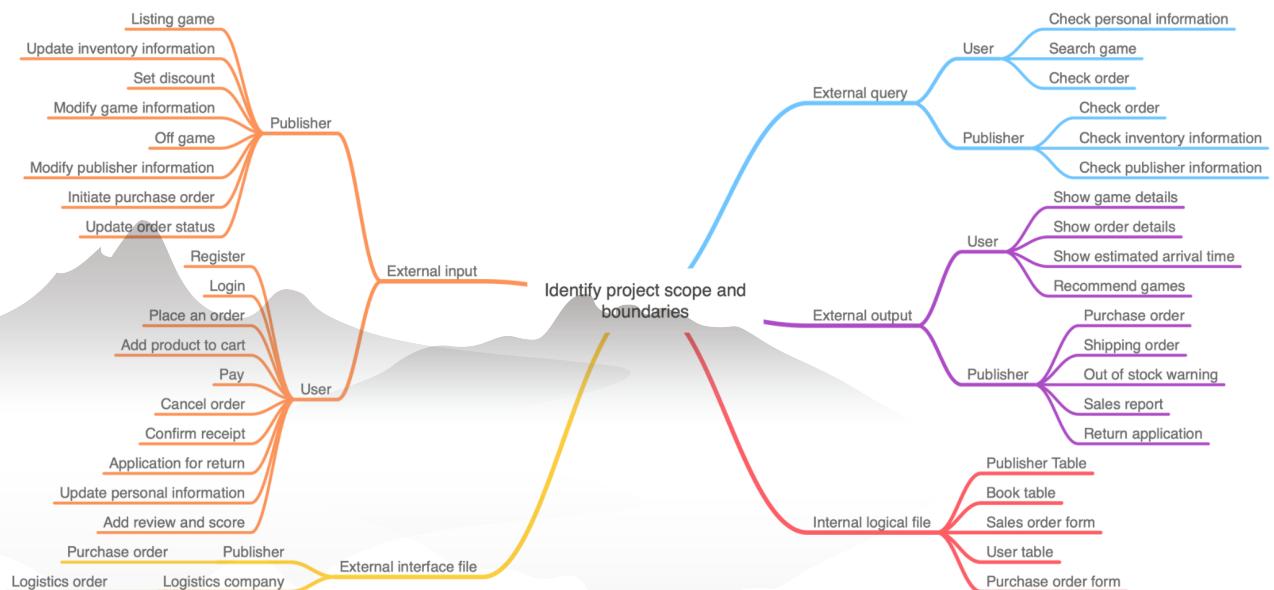
1. Our company is an independent Internet company that aims to develop a console game platform. At first, it may not pay attention to revenue and value the popularity and the number of users. After delivery, we will continue to maintain and improve the system.
2. The development cycle of the game platform ICE starts on March 10 and lasts about 4 months (17 weeks according to the plan).
3. Suppose our staff trains ICE platform administrators for 3 weeks, and it is only needed in the first month of a development cycle.
4. Apply for a loan at the beginning of the development process.
5. The length of the recorded financial data is 4 years.

## 2.2 Effort Estimation

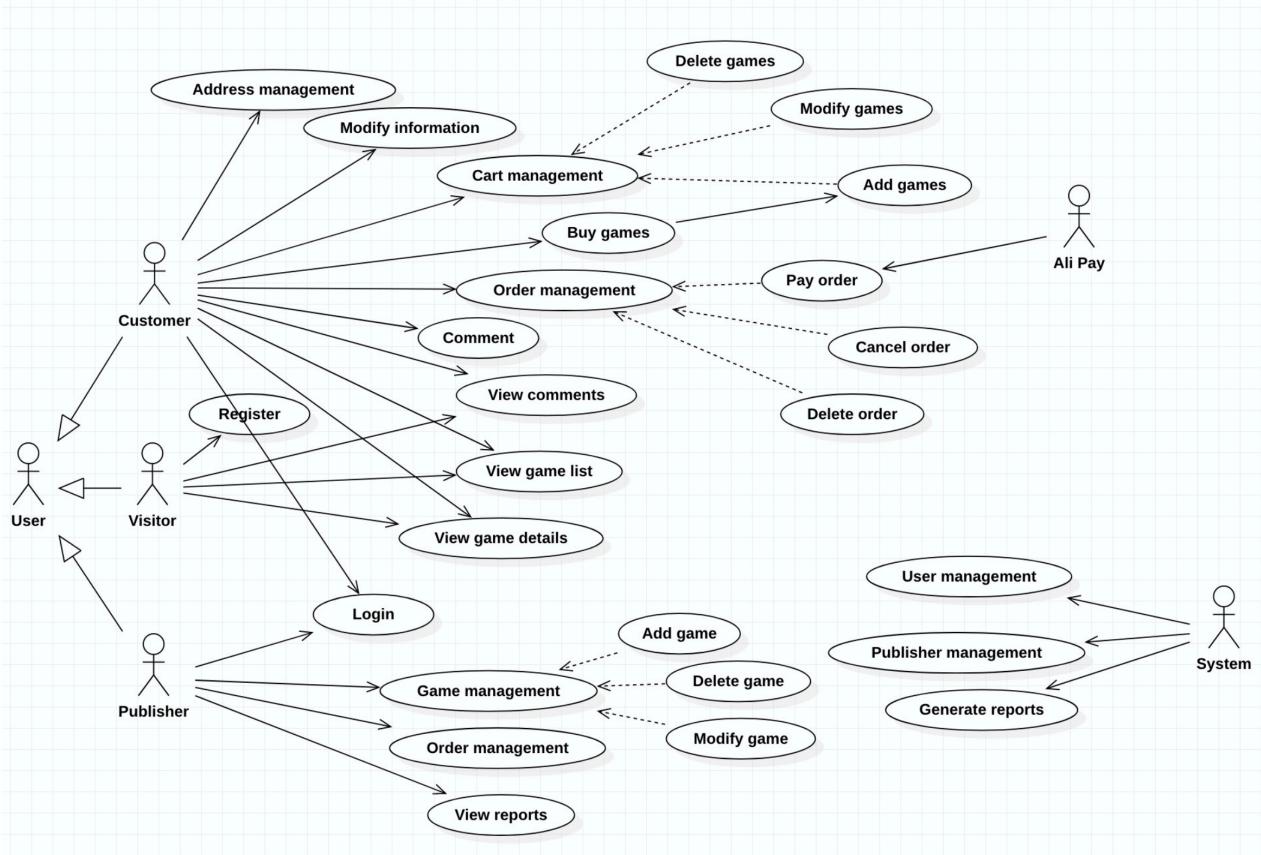
### 2.2.1 Function Points Estimation

This project adopts the project estimation method based on **Function Points**, focusing on the value of information domain, external input, external output, external query, internal logic document, external interface file identification and counting. We use **IFPUG standard** to analysis Function Points of our project, the steps are as following:

1. Identify project scope and boundaries



2. Use usecase diagrams to visualize the use cases(According to the scope and boundaries, but we make some adaptive adjustment here)



3. According to the five basic function types, we can get the **unadjusted function points**(based on both the mind map and the usecase diagram)

External User Type	Complexity Level									Total UFP	
	Simple			Average			Complex				
	Count	Score	Points	Count	Score	Points	Count	Score	Points		
EI	17	3	51	1	4	4	0	0	0		
EO	9	4	36	0	0	0	0	0	0		
EQ	6	3	18	0	0	0	0	0	0		
ILF	4	7	28	1	10	10	0	0	0		
EIF	2	5	10	0	0	0	0	0	0		
Total UFP			143			14			0	157	

4. The complexity matrix is calculated based on the complexity of the external user types, and the functions points of each complexity level are obtained by multiplying the number of external user types by the score value. As a result, we got the total UFP: 157.

5. The adjustment factor VAF is determined according to the 14 basic system characteristics by **Relative Complexity Adjustment Factor(RCAF)**, and the adjustment factor is applied to the unadjusted function point. Then we calculate the adjusted function points as follow:

No.	System Characteristic	Score
1	Requirement for reliable backup and recovery	2
2	Requirement for data communication	3
3	Extent of distributed processing	2
4	Performance requirements	5
5	Expected operational environment	2
6	Extent of online data entries	3
7	Extent of multi-screen or multi-operation online data input	0
8	Extent of online updating of master files	2
9	Extent of complex inputs, outputs, online queries and files	1
10	Extent of complex data processing	3
11	Extent that currently developed code can be designed for reuse	3
12	Extent of conversion and installation included in the design	2
13	Extent of multiple installations in an organization and variety of customer organizations	0
14	Extent of change and focus on ease of use	4
	<b>Total</b>	<b>32</b>

Then we can get **VAF(Value Adjustment Factor)** by

$$VAF = 0.65 + (0.01 * SUM(score)) = 0.97$$

ICE is a new development project and there is no need to integrate with other systems, and it does not involve a conversion function point (CFP).

6. Finally, we can get AFP (Adjusted Function Point) by

$$FP = UFP * VAF = 152.29$$

## 2.2.2 Development Effort Estimation

### 1. Software scale estimation

Scale calculation formula:

$$S = US * CF$$

S: Adjusted scale, unit is function point (FP).

US: Without adjusting the scale, the unit is function point (FP) , which is the calculated above.

CF: The scale change factor, which estimates the later planning stage, takes a value of 1. (Judging from the late estimation of the benchmark data of the Chinese software industry in 2019)

The calculation is:

$$S = 152.29FP$$

### 2. Adjusted effort estimates

According to the unadjusted workload calculation formula:

$$UE = C * S^a$$

UE: Unadjusted workload, unit is man-hours (ph).

C: Productivity adjustment factor, the median value of software development productivity of industry benchmark data is 7.10 person-hours/FP. (2019 China Software Industry Benchmark Data)

表 3.1 软件开发生产率基准数据明细

软件开发生产率详细信息（单位：人时/功能点）				
P10	P25	P50	P75	P90
2.29	4.08	7.10	12.37	17.31

Take the productivity adjustment factors at the time points 25, 50, and 75 of the function points as follows:

$$P_{25} = 4.08$$

$$P_{50} = 7.10$$

$$P_{75} = 12.37$$

a: The software scale adjustment coefficient calculated based on the benchmark data , which is assumed to be 1.

The calculation is:

$$UE_{25} = 621.34$$

$$UE_{50} = 1080.26$$

$$UE_{75} = 1883.83$$

According to the adjustment workload calculation formula:

$$AE = UE * A * IL * L * T$$

A E: Adjusted workload, unit is man-hour (ph).

A: Application field adjustment factor, value range 0.8~1.2, value 1.0 (check parameter table).

IL: Integrity level, value range 1.0~1.8, value 1.1 (check parameter table).

*L*: Development language adjustment factor, value range 0.8~1.2, value 1.0 (check parameter table).

*T*: Maximum team size, value range 0.8~1.2, value 1.0 (check parameter table).

The calculation is:

$$AE_{25} = 638.48$$

$$AE_{50} = 1189.38$$

$$AE_{75} = 2072.21$$

(When unit is ph, subscript represents percentage)

According to the specification, assuming 8 hours of work per day and 21.75 days per month, the converted workload is:

$$AE_{25} = 3.928$$

$$AE_{50} = 6.836$$

$$AE_{75} = 11.909$$

(Unit is pm, the following table represents the percentage)

Subsequent calculations will use the 50th percentile workload of person-months.

### 2.2.3 Operation and Maintenance Effort Estimation

Based on China's software industry benchmark database for operation and maintenance cost estimation, it is also necessary to first estimate the scale, and then estimate the workload and expenses.

From the above, the estimated results of the software scale are:

$$S = 152.29FP$$

Through reference materials, we found a workload calculation method similar to the above:

工作量  $AE$  = 调整后规模 × 生产率调整因子 × 运维水平要求因素 × 运维能力因素 × 运维系统特征因素

Productivity adjustment factor: The software operation and maintenance productivity median value of industry benchmark data is 0.92 person-hours/FP.

表 3.3 应用软件运维生产率基准数据明细

应用软件运维生产率详细信息（单位：人时/功能点）				
P10	P25	P50	P75	P90
0.32	0.57	0.92	1.54	2.16

Take the productivity adjustment factors at the time points 25, 50, and 75 of the function points as follows:

$$P25 = 0.57$$

$$P50 = 0.92$$

$$P75 = 1.54$$

Factors required for operation and maintenance level : value 0.95.

Operation and maintenance capability factor : value 1.00.

Characteristic factors of operation and maintenance system : value 1.14.

The calculated effort is:

$$AE_{25} = 94.01$$

$$AE_{50} = 151.74$$

$$AE_{75} = 253.99$$

(When unit is ph, subscript represents percentage)

According to the specification, assuming 8 hours of work per day and 21.75 days per month, the converted workload is:

$$AE_{25} = 0.540$$

$$AE_{50} = 0.872$$

$$AE_{75} = 1.460$$

(Unit is pm, the following table represents the percentage)

Subsequent calculations will use the 50th percentile workload of person-months.

## 2.3 Development Cost Estimation

### 2.3.1 Direct Labor Cost Estimation

The direct labor cost includes the human resources expenses such as the salaries, bonuses and benefits of the project team members of the developer. Among them, project members include all R&D or support personnel involved in the project's R&D process, such as project managers, requirements analysts, designers, developers, testers, deployers, user documentation writers, quality assurance personnel, configuration managers, etc. . For the part-time personnel engaged in the research and development of the project, the human resources cost is converted according to the proportion of the project workload in their total workload.

Activity	Requirement	Design	Construction	Test	Deployment
Effort percent	13.95%	13.16%	40.26%	21.89%	10.74%
Effort (pm)	0.9536pm	0.8996pm	2.7522pm	1.4964pm	0.7342pm

According to the industry monthly benchmark rate data, the average monthly rate in Shanghai is 28548 yuan/pm. This data represents the median of the regional statistics (P50), which is 21.75 days in January. **Expenses include direct labor costs for software development, indirect labor costs, some indirect non-labor costs and reasonable profits, excluding direct non-labor costs.**

For insurance, the calculation is: **direct labor cost + indirect labor cost = Yuan.** (No longer calculated after indirect labor cost)

### 2.3.2 Direct Non-labor Cost Estimates

Direct non-labor costs mainly include:

1. Office expenses, that is, the administrative office expenses incurred by the developer to develop this project, such as office supplies, communications, mailing, printing, conferences, etc.;
2. Travel expenses, that is, travel expenses incurred by the developer to develop this project, such as transportation, accommodation, and travel subsidies;
3. Training fee, that is, the cost of special training arranged by the developer for research and development of this project;
4. Business expenses, that is, expenses incurred by the developer in order to complete the R&D work of this project, such as hospitality fees, review fees, inspection fees, etc.;
5. Procurement fee, that is, the developer needs to purchase special assets or services for the development of this project, such as special equipment fee, special software fee, technical cooperation fee, patent fee, etc.;
6. Others, that is not listed in the above project but it is the cost of the developer to develop this project.

Cost Category	Amount	
Office expenses	Office Supplies	¥2000.00
	Communication fee	¥1700.00
	Printing fee	¥600.00
	Total	¥4300.00
Travel expenses	Transportation fee	¥4000.00
	Accommodation fee	¥6000.00
	Total	¥10000.00
Training fee	Training fee	¥8000.00
	Total	¥8000.00
Service fee	Review fee	¥3000.00
	Inspection fee	¥2000.00
	Total	¥5000.00
Purchase fee	Equipment rental fee	¥36000.00
	Software purchase fee	¥10000.00
	Equipment purchase fee	¥40000.00
	Total	¥86000.00
Total		¥113300.00

### 2.3.3 Indirect Labor Cost Estimation

Indirect labor cost refers to the allocation of human resources costs of non-project team personnel who serve the overall needs of R&D management. Including the allocation of wages, bonuses, benefits, etc. of R&D department managers, project management office (PMO) personnel, engineering process group (EPG) personnel, product planners, organization-level quality assurance personnel, organization-level configuration management personnel, etc.

### 2.3.4 Indirect Non-labor Cost Estimates

Indirect non-labor cost refers to the non-labor cost allocation that the developer does not incur for a specific project, but serves the overall R&D activities. Including the rent of the R&D site of the developer, water and electricity, and property, the allocation of the daily office expenses of the R&D personnel, and the rental, maintenance, and depreciation of various R&D office equipment.

Cost Category	Amount
Rental fee	¥56000.00
Utilities fee	¥8000.00
Equipment Maintenance fee	¥4000.00
Property costs	¥6000.00
Daily office expenses	¥6000.00
<b>Total</b>	<b>¥80000.00</b>

### 2.3.5 Total Development Cost Estimate

According to the calculation formula of software development cost:

$$SDC = DHC + DNC + IHC + INC$$

*SDC*: Software R&D cost, the unit is yuan;

*DHC*: Direct labor cost, the unit is yuan;

*DNC*: Direct non-labor costs, the unit is yuan;

*IHC*: Indirect labor cost, the unit is yuan;

*INC*: Indirect non-labor costs, the unit is yuan.

Calculated software development cost:

$$SDC = 38854\text{¥}$$

## 2.4 Operation and Maintenance Cost Estimation

### 2.4.1 Labor Cost Estimation (direct + indirect)

According to the benchmark data of the industry monthly rate, the average monthly rate in Shanghai is 23,593 yuan/pm. This data represents the median of the regional statistics (P50), which is 21.75 days in January. **Expenses include direct labor costs for software development, indirect labor costs, some indirect non-labor costs and reasonable profits, excluding direct non-labor costs.**

For insurance, the calculation is: **direct labor cost + indirect labor cost = 20573 Yuan.** (Workload during operation and maintenance period 0.872 person-months)

---

## 2.4.2 Non-labor Cost Estimates (direct + indirect)

Cost Category	Amount
Rental fee	¥28000.00
Utilities fee	¥4000.00
Equipment Maintenance fee	¥2000.00
Property costs	¥3000.00
Daily office expenses	¥3000.00
Communication fee	¥850.00
Printing fee	¥300.00
Travel expenses	¥5000.00
Advertisement fee	¥10000.00
<b>Total</b>	<b>¥56150.00</b>

Addition calculation:

运维成本总计为 : 76723¥

## 2.5 Source of Budgets

Source	Ourselves	ICBC	Total
Amount	¥800000.00	¥1000000.00	¥180000.00
Type	Originator	Liability	

## 2.6 Repayment Strategies

If you want to repay 400,000.00 yuan, and consider that the annual interest rate is 4.75% (medium and long-term loans: one to five years, including five years), which is equivalent to a monthly interest rate of 0.396%, and the plan is to pay off in three years. We can choose two repayment methods: equal principal repayment.

### 2.6.1 Equivalent Principal:

For this method, the loan payment is equal to the sum of principal and interest. For fixed principal loans, the loan repayment amount will decrease during the loan term. The principal included in each payment remains unchanged, but the interest decreases during each payment period. The fixed principal loan plan is also called "fixed principal falling interest loan amortization plan".

#### Equal Principle Repayment

Repayment	Equal Principle Repayment	Total repayment: ¥1073260.00		Total interest: ¥73260.00
Number of Period	Monthly Supply	Monthly Principle	Monthly Interest	Principle Balance
1	¥31737.78	¥27777.78	¥3960.00	¥972222.22
2	¥31627.78	¥27777.78	¥3850.00	¥944444.44
3	¥31517.78	¥27777.78	¥3740.00	¥916666.66
4	¥31407.78	¥27777.78	¥3630.00	¥888888.88
5	¥31297.78	¥27777.78	¥3520.00	¥861111.10
6	¥31187.78	¥27777.78	¥3410.00	¥833333.32
7	¥31077.78	¥27777.78	¥3300.00	¥805555.54
8	¥30967.78	¥27777.78	¥3190.00	¥777777.76
9	¥30857.78	¥27777.78	¥3080.00	¥749999.98
10	¥30747.78	¥27777.78	¥2970.00	¥722222.20
11	¥30637.78	¥27777.78	¥2860.00	¥694444.42
12	¥30527.78	¥27777.78	¥2750.00	¥666666.64
13	¥30417.78	¥27777.78	¥2640.00	¥638888.86
14	¥30307.78	¥27777.78	¥2530.00	¥611111.08
15	¥30197.78	¥27777.78	¥2420.00	¥583333.30
16	¥30087.78	¥27777.78	¥2310.00	¥555555.52
17	¥29977.78	¥27777.78	¥2200.00	¥527777.74
18	¥29867.78	¥27777.78	¥2090.00	¥499999.96
19	¥29757.78	¥27777.78	¥1980.00	¥472222.18
20	¥29647.78	¥27777.78	¥1870.00	¥444444.40
21	¥29537.78	¥27777.78	¥1760.00	¥416666.62
22	¥29427.78	¥27777.78	¥1650.00	¥388888.84
23	¥29317.78	¥27777.78	¥1540.00	¥361111.06
24	¥29207.78	¥27777.78	¥1430.00	¥333333.28
25	¥29097.78	¥27777.78	¥1320.00	¥305555.50
26	¥28987.78	¥27777.78	¥1210.00	¥277777.72
27	¥28877.78	¥27777.78	¥1100.00	¥249999.94
28	¥28767.78	¥27777.78	¥990.00	¥222222.16
29	¥28657.78	¥27777.78	¥880.00	¥194444.38
30	¥28547.78	¥27777.78	¥770.00	¥166666.60
31	¥28437.78	¥27777.78	¥660.00	¥138888.82
32	¥28327.78	¥27777.78	¥550.00	¥111111.04
33	¥28217.78	¥27777.78	¥440.00	¥83333.26
34	¥28107.78	¥27777.78	¥330.00	¥55555.48
35	¥27997.78	¥27777.78	¥220.00	¥27777.70
36	¥27887.70	¥27777.70	¥110.00	¥0.00
Total	¥1073260.00	¥1000000.00	¥73260.00	

## 2.6.2 Equal Repayment of Principal and Interest: (selected)

For this method, the repayment amount remains unchanged during the mortgage period. Each payment will reduce the principal, resulting in a reduction in interest payable. During the loan period, the payment amount is the same, but the payment method has changed: the portion of the payment applied to the principal increases with time, and the portion used for interest decreases because the principal owed is less.

**Equal Repayment of Principle and Interest**

Repayment	Equal Principle Repayment	Total repayment: ₩1074948.48	Total interest: ₩74948.48	
Number of Period	Monthly Supply	Monthly Principle	Monthly Interest	Principle Balance
1	₩29859.68	₩25899.68	₩3960.00	₩974100.32
2	₩29859.68	₩26002.24	₩3857.44	₩948098.08
3	₩29859.68	₩26105.21	₩3754.47	₩921992.87
4	₩29859.68	₩26208.59	₩3651.09	₩895784.28
5	₩29859.68	₩26312.37	₩3547.31	₩869471.90
6	₩29859.68	₩26416.57	₩3443.11	₩843055.33
7	₩29859.68	₩26521.18	₩3338.50	₩816534.15
8	₩29859.68	₩26626.20	₩3233.48	₩789907.95
9	₩29859.68	₩26731.64	₩3128.04	₩763176.30
10	₩29859.68	₩26837.50	₩3022.18	₩736338.80
11	₩29859.68	₩26943.78	₩2915.90	₩709395.02
12	₩29859.68	₩27050.48	₩2809.20	₩682344.55
13	₩29859.68	₩27157.60	₩2702.08	₩655186.95
14	₩29859.68	₩27265.14	₩2594.54	₩627921.81
15	₩29859.68	₩27373.11	₩2486.57	₩600548.70
16	₩29859.68	₩27481.51	₩2378.17	₩573067.19
17	₩29859.68	₩27590.33	₩2269.35	₩545476.86
18	₩29859.68	₩27699.59	₩2160.09	₩517777.27
19	₩29859.68	₩27809.28	₩2050.40	₩489967.99
20	₩29859.68	₩27919.41	₩1940.27	₩462048.58
21	₩29859.68	₩28029.97	₩1829.71	₩434018.61
22	₩29859.68	₩28140.97	₩1718.71	₩405877.65
23	₩29859.68	₩28252.40	₩1607.28	₩377625.24
24	₩29859.68	₩28364.28	₩1495.40	₩349260.96
25	₩29859.68	₩28476.61	₩1383.07	₩320784.35
26	₩29859.68	₩28589.37	₩1270.31	₩292194.98
27	₩29859.68	₩28702.59	₩1157.09	₩263492.39
28	₩29859.68	₩28816.25	₩1043.43	₩234676.14
29	₩29859.68	₩28930.36	₩929.32	₩205745.78
30	₩29859.68	₩29044.93	₩814.75	₩176700.85
31	₩29859.68	₩29159.94	₩699.74	₩147540.90
32	₩29859.68	₩29275.42	₩584.26	₩118265.49
33	₩29859.68	₩29391.35	₩468.33	₩88874.14
34	₩29859.68	₩29507.74	₩351.94	₩59366.40
35	₩29859.68	₩29624.59	₩235.09	₩29741.81
36	₩29859.68	₩29741.81	₩117.87	₩0.00
<b>Total</b>	<b>₩1074948.48</b>	<b>₩1000000.00</b>	<b>₩74948.48</b>	

We chose this method to repay the loan, because the payment for the first three months is much lower than the latter method. In addition, the difference between the two methods in the final payment is small. Therefore, considering these factors, we decided to choose the second factor.

# 3.Financial Evaluation

## 3.1 Pricing Strategy

Business may benefit from lowering or raising prices, depending on the needs and behaviors of customers and clients in the particular market. Finding the right pricing strategy is an important element in running a successful business. So at the beginning of financial evaluation of our ICE project, we concrete on the pricing strategy.

### 3.1.1 Factors Affecting Pricing

According to the *SEE.ch09.lecture 8<sup>th</sup> PPT of Prof. Huang*, there are 8 essential factors that are supposed to be taken into consideration, they are showing as follow:



### 3.1.2 Six Steps For Pricing Decision

And after compare the 5 main pricing strategies of software which are Personalized Pricing, Group Pricing, Versioning Pricing, Bundling Pricing, Usage-based Pricing. We make a 7 steps procedure for determine the pricing strategy.

#### 1. Organization and market objectives

1. a more convenient online entity game trading environment
2. a more direct interactive platform for game publisher and game buyer and lovers
3. a more convenient way for entity game lover compare to online game and other electronic game

## **2. Determining the pricing objective**

- survival
- maximum current profit
- maximum market share
- quickly occupy the direct sales licenses of large entity game publishers

## **3. Considering the demand**

- elasticity
- the relationship between price and demand
- the sensitivity for demand to price
- adjust business strategy in real time

## **4. Estimating the cost in 4 aspects mentioned in The National Standard**

- direct labor costs
- direct non-labor costs
- indirect labor costs
- indirect non-labor costs

## **5. Analysis competitor's price strategy**

- competitor's costs
- competitor's prices
- competitor's market share compare to me
- competitor's market share to the whole market
- competitors products

## **6. Legal and regulatory issues**

According to the relevant regulations of the Chinese government, we must supervise the types of entity games on sale, which may also bring costs for labors.

---

### **3.1.3 Determine the Final Price Strategy**

#### **1. Selecting the final pricing method**

There are 6 method of pricing we can choose

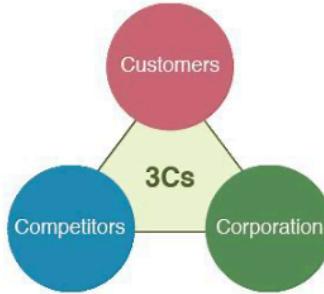
- Mark up pricing
- Target - return pricing
- Perceived - value pricing
- Value - pricing
- Going - rate pricing
- Sealed - bid pricing

After considering the pricing objects and the determine demand, we chose the **Mark-up pricing** finally

$$Price = Cost + ProfitMargin$$

Also we take **Bundling pricing** into combination, this means we open up different interfaces for customers which is similar to Prime users on Amazon. And with different payment strategies or policies, they can enjoy different services including ideal products recommendation, more convenient shopping experience, less uncorrelated ads, multiple themes and patterns and so on...

## 2. Setting the price by using **3 Cs Strategic Triangle Model**



### For entity games publishers:

Firstly, the entity game publishers who want to use our platform should pay ¥5,000 for their credits and the guarantee of their record in the ministry of industry and information technology annually.

By considering competitor's prices and profit margins, we determined our final profit as 20%. This mean we want to gain 20% of the cost we spend from the entity games publishers.

### For entity games customers:

According to our developing cost ¥388,454 and maintenance cost ¥76723 monthly, we finally make 3 kinds of services for entity games publishers to choose, they are:

Service A: 50% common customers. ¥10,000 per year (basic)

Service B: 30% customers and a slightly lower promotion effort than Service A. ¥30,000 per year. (middle)

Service C: 20% customers, promotion by our website and their entity games can be chosen firstly. ¥50,000 per year (prime)

## 3.2 Cash Flow

### 3.2.1 Statements of Cash Flow

Before we use the techniques we learnt from the course based on Prof Huang's lecture, we make some statements on our cash flow:

1. Each cash flow is calculated at the end of the year.
2. For the 12 month cash flow from 2020 to 2022, we definite one season as one software development cycle.
3. For the 3 year cash flow, estimate costs and sales are based on the data of the first year.
4. The first four months are development months, and the other is maintenance months.

5. Sales of our ICE online Entity Game increase every year and with a normal rate. This means the number of publisher, number of normal customer, number of prime customer will increase with a normal rate(also we take a slight random distribution into consideration).
6. Rent costs, miscellaneous increase with currency inflation.
7. According to the national policies on software industry, at the first two years, we needn't to pay any tax. The tax rate of year 3 is 12.5%.
8. Basic formula for cash flow calculation we use is:

$$CashFlow_t = TotalInflow_t - TotalOutflow_t + CashFlow_{t-1}$$

9. The salary of our team members increases with a 10% rate per year.

According to these 9 statements we mentioned above, we make the cash flow of the first three years of our company and also we make a global cash flow for all of the three years.

First, we divide the cash flow into 2 aspects.

Cash flow inflows

Cash flow outflow

As for the total product sales, we divide it into 3 parts which is mentioned in the **Part II: 2.2.2**

**Development Effort Estimation.** As for development costs and operating costs, we divide the development costs into labor costs and non-labor costs which is mentioned in the **Part II: 2.2.3 Operation and Maintenance Effort Estimation.**

And after that, we transform our point of view into another aspect, in which we divide the cash flow table into 3 parts:

Operating cash flow

Investing cash flow

Financing cash flow

We transform total product sales which come from the cash flow inflows above, and we expand the non-labor costs into 10 parts(office expenses, travel expenses, staff training, service expenses, equipment and software purchase, rent, utilities, equipment maintenance fee, property costs, daily office expenses). Also we expand the investment into investing inflows and investing outflows consist of several subjects. Thirdly we combine start-up capital, loan and other related financing into the financing cash flow.

From the second form of cash flow table we can get the details of cash flow more visually and we can also understand the significant of cash flow more meaningful.







### 3.2.5 Project Cash Flow in 3 years

Finally, the following table is the 3-year cash flow chart. We assume that the revenue from selling services for entity game publishers and entity game customers rises at a reasonable rate. At the same time, miscellaneous fees and rents are also rising accordingly due to inflation. And also we draw a 3-year cash flow trend which shows that the overall company's cash flow rising in the last column of the project cash flow in 3 years.

3 Year Cash Flow Plus				
	Year 1	Year 2	Year 3	Total
<b>Operating Cash Flow</b>				
<b>Operating Inflows</b>				
Total product sales	¥2810000.00	¥6000000.00	¥6000000.00	¥14810000.00
Publisher: Rent and Service charge	¥674400.00	¥1440000.00	¥1440000.00	¥3554400.00
Customer: Transaction draw	¥1714100.00	¥3660000.00	¥3660000.00	¥9034100.00
Customer: VIP Service	¥421500.00	¥900000.00	¥900000.00	¥2221500.00
Others related to operating inflow	¥0.00	¥0.00	¥0.00	¥0.00
<b>Total of operating inflows</b>	<b>¥2810000.00</b>	<b>¥6000000.00</b>	<b>¥6000000.00</b>	<b>¥14810000.00</b>
<b>Operating Outflows</b>				
Personal costs(wage)	-¥2506432.00	-¥2588724.00	-¥2588724.00	-¥7683880.00
Non-labor costs	-¥1138100.00	-¥553800.00	-¥553800.00	-¥2245700.00
Office expenses	-¥22100.00	-¥13800.00	-¥13800.00	-¥49700.00
Travel expenses	-¥80000.00	-¥60000.00	-¥60000.00	-¥200000.00
Staff training	-¥32000.00	¥0.00	¥0.00	-¥32000.00
Service expenses	-¥20000.00	¥0.00	¥0.00	-¥20000.00
Equipment and Software purchase	-¥344000.00	¥0.00	¥0.00	-¥344000.00
Rent	-¥448000.00	-¥336000.00	-¥336000.00	-¥1120000.00
Utilities	-¥64000.00	-¥48000.00	-¥48000.00	-¥160000.00
Equipment maintenance fee	-¥32000.00	-¥24000.00	-¥24000.00	-¥80000.00
Property costs	-¥48000.00	-¥36000.00	-¥36000.00	-¥120000.00
Daily office expenses	-¥48000.00	-¥36000.00	-¥36000.00	-¥120000.00
Loan interest	-¥40677.82	-¥25232.57	-¥9055.20	-¥74965.59
VAT	¥0.00	¥0.00	-¥750000.00	-¥750000.00
Others related to the operating outflow(Ad)	-¥80000.00	-¥120000.00	-¥120000.00	-¥320000.00
<b>Total of operating outflows</b>	<b>-¥3765209.82</b>	<b>-¥3287756.57</b>	<b>-¥4021579.20</b>	<b>-¥11074545.59</b>
<b>Investing Cash Flow</b>				
<b>Investing Inflows</b>				
Sales of fixed assets and intangible assets	¥0.00	¥0.00	¥0.00	¥0.00
Sales of investment products (such as bonds)	¥0.00	¥50000.00	¥150000.00	¥200000.00
Interest income from investment products	¥0.00	¥3105.00	¥9315.00	¥12420.00
Others related to investing inflow	¥0.00	¥0.00	¥0.00	¥0.00
<b>Total of investing inflows</b>	<b>¥0.00</b>	<b>¥53105.00</b>	<b>¥159315.00</b>	<b>¥212420.00</b>
<b>Investing Outflows</b>				
Buying of investment products (such as bonds)	¥0.00	-¥50000.00	-¥150000.00	-¥200000.00
Acquisition of fixed assets and intangible assets	¥0.00	-¥51000.00	¥0.00	-¥51000.00
Others related to investing outflow	¥0.00	¥0.00	¥0.00	¥0.00
<b>Total of investing outflows</b>	<b>¥0.00</b>	<b>-¥101000.00</b>	<b>-¥150000.00</b>	<b>-¥251000.00</b>
<b>Financing Cash Flow</b>				
<b>Financing Inflows</b>				
Received Investment	¥800000.00	¥0.00	¥0.00	¥800000.00
Loan	¥1000000.00	¥0.00	¥0.00	¥1000000.00
Others related to financing inflow	¥0.00	¥0.00	¥0.00	¥0.00
<b>Total of financing inflows</b>	<b>¥1800000.00</b>	<b>¥0.00</b>	<b>¥0.00</b>	<b>¥1800000.00</b>
<b>Financing Outflows</b>				
Loan Principles Repaid	-¥317655.44	-¥333083.59	-¥349260.97	-¥1000000.00
Dividends of shareholders	¥0.00	¥0.00	¥0.00	¥0.00
Others related to financing outflows	¥0.00	¥0.00	¥0.00	¥0.00
<b>Total of financing outflows</b>	<b>-¥317655.44</b>	<b>-¥333083.59</b>	<b>-¥349260.97</b>	<b>-¥1000000.00</b>
<b>Net profit</b>	<b>-¥83832.00</b>	<b>¥2860581.00</b>	<b>¥2116791.00</b>	<b>¥4142840.00</b>
<b>Total Cash Flow Inflow</b>	<b>¥4610000.00</b>	<b>¥6053105.00</b>	<b>¥6159315.00</b>	<b>¥16822420.00</b>
<b>Total Cash Flow Outflow</b>	<b>-¥4087165.26</b>	<b>-¥3721840.16</b>	<b>-¥4520840.17</b>	<b>-¥12325545.59</b>
<b>Total Net Cash Flow</b>	<b>¥522834.74</b>	<b>¥2331264.84</b>	<b>¥1638474.83</b>	<b>¥4496874.41</b>
<b>Cumulative Cash Flow</b>	<b>¥522834.74</b>	<b>¥2854099.58</b>	<b>¥4492574.41</b>	

From the cash flow of these three years, there are something deserved to mention:

- For operating cash flows: Inflows of operating flow are mainly came from sales of good which is a circle in every season. For operating outflows, at the beginning of the project, we spent ¥388454 for development costs monthly sustain for 4 months. And ¥195154 for operating costs monthly from the 5th month to the end. Personal cost is stable every month within one year. Miscellaneous expenses and rent is the same in each month.

2. For investing cash flows: We have no plan on any investment since we are a start-up company and we don't have relevant skills in this area currently in the first year. And as for the last two years, we spent some money for buying of investment products(such as bonds).

3. For financing cash flow: We have ¥800000 by investment and ¥1000000 from loan in the first month in 2020. And we should also pay taxes according to laws and regulations.

From the figure, we can see that our profit keeps increasing in this 3 years.

## 3.3 Depreciation & Amortization

To develop our ICE online entity game website, we spent totally ¥40,000 on hardware(devices) and ¥10,000 on the software, so we have to discuss about their depreciation and amortization when calculating the profit.

### 3.3.1 Depreciation

Depreciation are not cash-flow instances actually, it refers to the decline in the value of fixed assets. Depreciation is assessed according to the established method.

We use the **Declining Balance Depreciation method** as mentioned in the lecture of Prof. Huang's lecture. The formulas are shown as follows:

$$\begin{aligned} \text{Depreciation}_{\text{year}(t)} &= a * \text{BookValue}_{\text{year}(t-1)} \\ \text{BookValue}_{\text{year}(t)} &= \text{AcquisitionCost} * (1 - a)^t \end{aligned}$$

As for our research, the depreciation period of electronic hardware and other devices are usually 4~10 years. The residual value is 5% of the initial value. So we set as 0.33 and the results is shown as follow:

### Depreciation

End of Year	Depreciation in that year	Book Value at end of year
0		¥40000.00
1	¥4000.00	¥36000.00
2	¥3600.00	¥32400.00
3	¥3240.00	¥29160.00
4	¥2916.00	¥26244.00
5	¥2624.40	¥23619.60

### 3.3.2 Amortization

The software we purchased at the beginning of the development should be managed as intangible assets. They are in accordance with the annual cost of their use and similar to the depreciation of fixed assets, and they should be amortized.

We use **Straight-line method of amortization** to calculate the amortization. The formula are shown as follows:

$$Amortization = \frac{(AcquisitionCost - SalvageValue)}{Lifespan}$$

$$BookValueYear(t) = AcquisitionCost - (t * Amortization)$$

According to the relevance provision of the government, we choose 5 years as the amortization since the software we purchased doesn't have a defined benefit period. The result is shown as follow:

**Amortization**

End of Year	Amortization in that year	Book Value at end of year
0		¥10000.00
1	¥1000.00	¥9000.00
2	¥900.00	¥8100.00
3	¥810.00	¥7290.00
4	¥729.00	¥6561.00
5	¥656.10	¥5904.90

# 3.4 Profit & Loss Statement

## Statements

- According to the national policies, we needn't to pay any tax in first two years, and we should pay 12.5% of VAT in the third year.
- Depreciation, miscellaneous and amortization are decreasing through these years.
- We pay the salary to the team members monthly.
- We repay the loan in the first 3 years, so the the interest rate becomes 0 at the end of the 3rd year.
- From the total net income, we can see that the net income is increasing with increase of year.

**12 Months Profit and Loss Projection**

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Total product sales	¥0.00	¥0.00	¥0.00	¥0.00	¥204000.00	¥246000.00	¥288000.00	¥330000.00	¥372000.00	¥414000.00	¥456000.00	¥500000.00
Produce costs	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00	-¥199154.00
<b>Gross income</b>	<b>-¥199154.00</b>											
Office expenses	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00	-¥4300.00
Travel expenses	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00	-¥10000.00
Staff training	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00
Service expenses	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00	-¥5000.00
Equipment and Software purchase	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00	-¥86000.00
Rent	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00	-¥56000.00
Utilities	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00	-¥8000.00
Equipment maintenance fee	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00	-¥4000.00
Property costs	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00
Daily office expenses	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00	-¥6000.00
Depreciation	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33	-¥333.33
Amortization	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33	-¥83.33
<b>Operating income</b>	<b>-¥388870.66</b>											
Loan interest	-¥3560.00	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44	-¥3575.44
<b>Income before tax</b>	<b>-¥392330.66</b>	<b>-¥392746.10</b>	<b>-¥392525.13</b>									
Tax	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00	¥0.00
<b>Income after tax</b>	<b>-¥392330.66</b>	<b>-¥392746.10</b>	<b>-¥392525.13</b>									
<b>Other Net Profit</b>	<b>¥0.00</b>											
<b>Total Net Income</b>	<b>-¥392830.66</b>	<b>-¥392746.10</b>	<b>-¥392525.13</b>									

**3 Year Profit and Loss Projection**

	Year 1	Year 2	Year 3	Total
Total product sales	¥2810000.00	¥6000000.00	¥6000000.00	¥14810000.00
Produce costs	-¥2506432.00	-¥2588724.00	-¥2588724.00	-¥7683880.00
<b>Gross income</b>	<b>¥303568.00</b>	<b>¥3411276.00</b>	<b>¥3411276.00</b>	<b>¥7126120.00</b>
Office expenses	-¥26400.00	-¥138000.00	-¥138000.00	-¥54000.00
Travel expenses	-¥80000.00	-¥60000.00	-¥60000.00	-¥200000.00
Staff training	-¥32000.00	¥0.00	¥0.00	-¥32000.00
Service expenses	-¥20000.00	¥0.00	¥0.00	-¥20000.00
Equipment and Software purchase	-¥344000.00	¥0.00	¥0.00	-¥344000.00
Rent	-¥448000.00	-¥336000.00	-¥336000.00	-¥1120000.00
Utilities	-¥64000.00	-¥48000.00	-¥48000.00	-¥160000.00
Equipment maintenance fee	-¥32000.00	-¥24000.00	-¥24000.00	-¥80000.00
Property costs	-¥48000.00	-¥36000.00	-¥36000.00	-¥120000.00
Daily office expenses	-¥48000.00	-¥36000.00	-¥36000.00	-¥120000.00
Depreciation	-¥4000.00	-¥3600.00	-¥3240.00	-¥10840.00
Amorization	-¥1000.00	-¥900.00	-¥810.00	-¥2710.00
<b>Operating income</b>	<b>-¥843832.00</b>	<b>¥2852976.00</b>	<b>¥2853426.00</b>	<b>¥4862570.00</b>
Loan interest	-¥40677.82	-¥25232.57	-¥9055.20	-¥74965.59
<b>Income before tax</b>	<b>-¥884509.82</b>	<b>¥2827743.43</b>	<b>¥2844370.80</b>	<b>¥4787604.41</b>
Tax	¥0.00	¥0.00	¥355546.35	¥355546.35
<b>Income after tax</b>	<b>-¥884509.82</b>	<b>¥2827743.43</b>	<b>¥3199917.15</b>	<b>¥5143150.76</b>
<b>Other Net Profit</b>	<b>¥0.00</b>	<b>¥0.00</b>	<b>¥0.00</b>	<b>¥0.00</b>
<b>Total Net Income</b>	<b>-¥884509.82</b>	<b>¥2827743.43</b>	<b>¥3199917.15</b>	<b>¥5143150.76</b>

## 3.5 Balance Sheet

Because the balance sheet is based on accuracy data, we are supposed to choose a specific point in time for analysis. In the following calculating we choose December 31th of each year for checkpoint to calculate the balance sheet.

In intangible assets, we have to think about intellectual assets. Here, we have searched for information about intellectual assets. This is because the value of knowledge assets is difficult to measure, so there is no need to consider amortization.

**Balance Sheet**

	Year 1	Year 2	Year 3
<b>Assets</b>			
<b>Current Assets</b>			
Cash and Cash Equivalents	¥522834.74	¥2854099.58	¥4492574.41
Temporary Investment	¥0.00	¥0.00	¥0.00
Accounts Receivable	¥0.00	¥0.00	¥0.00
Inventory	¥0.00	¥0.00	¥0.00
Prepaid insurance	¥0.00	¥0.00	¥0.00
Others	¥0.00	¥0.00	¥0.00
<b>Long-term Assets</b>			
Long-term Investments	¥0.00	¥0.00	¥0.00
Others	¥0.00	¥0.00	¥0.00
<b>Fixed Assets</b>			
Equipments	¥40000.00	¥40000.00	¥40000.00
Less: Accu Depreciation	-¥4000.00	-¥3600.00	-¥3240.00
Others	¥0.00	¥0.00	¥0.00
<b>Intangible Assets</b>			
Intellectual Assets	¥293409.18	¥659257.81	¥769428.20
Software	¥10000.00	¥10000.00	¥10000.00
Less: Accu Amorization	-¥1000.00	-¥900.00	-¥810.00
Others	¥0.00	¥0.00	¥0.00
<b>Total Assets</b>	<b>¥861243.92</b>	<b>¥3558857.39</b>	<b>¥5307952.61</b>
<b>Liabilities</b>			
<b>Current Liabilities</b>			
Accounts Payable	¥0.00	¥0.00	¥0.00
Wages Payable	¥0.00	¥0.00	¥0.00
Interest Payable	¥34287.77	¥9055.20	¥0.00
Tax Payable	¥0.00	¥0.00	¥750000.00
<b>Long-term Liabilities</b>			
Loan	¥682344.56	¥349260.97	¥0.00
Others	¥0.00	¥0.00	¥0.00
<b>Total Liabilities</b>	<b>¥716632.33</b>	<b>¥358316.17</b>	<b>¥750000.00</b>
<b>Owner's Equity</b>			
<b>Common Stocks</b>	¥0.00	¥0.00	¥0.00
Net Paid-in Capital	¥0.00	¥0.00	¥0.00
Dividends Payable	¥0.00	¥124817.69	¥154943.86
Retained Earnings	¥144611.59	¥3075723.53	¥4403008.75
<b>Total Owner's Equity</b>	<b>¥144611.59</b>	<b>¥3200541.22</b>	<b>¥4557952.61</b>
<b>Total Liabilities and Owner's Equity</b>	<b>¥861243.92</b>	<b>¥3558857.39</b>	<b>¥5307952.61</b>
<b>Total Liabilities and Owner's Equity = Total Assets</b>	<b>Equal</b>	<b>Equal</b>	<b>Equal</b>

In the balance sheet:

1. Cash Equivalent is the Cumulative Cash Flow in the 3-year cash flow table, which can be understood as the money in hand at this point of time.
2. Wage Payable is the salary to be paid in December.
3. Interest is the remaining unpaid Interest.
4. Tax Payable
5. Dividends Payable is the dividend in this year, likewise, we will pay for dividends at the end of the year(after the first year)

The formula in the textbook

$$\text{TotalAssets} = \text{TotalLiabilities} + \text{TotalOwner'sEquity}$$

# 4. Economic Evaluation

## 4.1 Break-Even Analysis

Break-Even Analysis				
	Year 0	Year 1	Year 2	Year 3
<b>Cost</b>				
Cost	¥1800000.00	¥4087165.26	¥3721840.16	¥4520840.17
Discount factor	1	0.904977376	0.81898405	0.741162036
Discounted costs	¥1800000.00	¥3698792.00	¥3048127.73	¥3350675.11
Cumulative costs	¥1800000.00	¥5498792.00	¥8546920.00	¥11897595.00
<b>Benefit</b>				
Benefits	¥0.00	¥4610000.00	¥6053105.00	¥6159315.00
Discount factor	1	0.904977376	0.81898405	0.741162036
Discounted benefits	¥0.00	¥4171945.70	¥4957396.45	¥4565050.45
Cumulative benefits	¥0.00	¥4171946.00	¥9129342.00	¥13694393.00
<b>Difference</b>				
Benefits - Costs	-¥1800000.00	¥522834.74	¥2331264.84	¥1638474.83
Discounted benefits - Discounted costs	-¥1800000.00	¥473153.70	¥1909268.72	¥1214375.34
Cumulative benefits - Cumulative costs	-¥1800000.00	-¥1326846.00	¥582422.00	¥1796798.00
Discount rate: 10.50%				

## 4.2 NPV, IRR and Paybackyear

According to the result of break-even analysis, we can calculate NPV, IRR and Payback-year now and the result of calculation is shown as below:

Result	
NPV	¥1796798.00
IRR	73.62%
Payback Year	Year 2

### Conclusion:

It can be shown from the table that the NPV is greater than 0, indicating that the project is worthwhile to be invest. Also, you can see that the cumulative net cash flow is <0 for the first year and >0 for the second year, so the payback year is in the second year. Finally, the calculated IRR is 73% which is very bigger than the discount rate of 10.5%, indicating that the project is profitable.

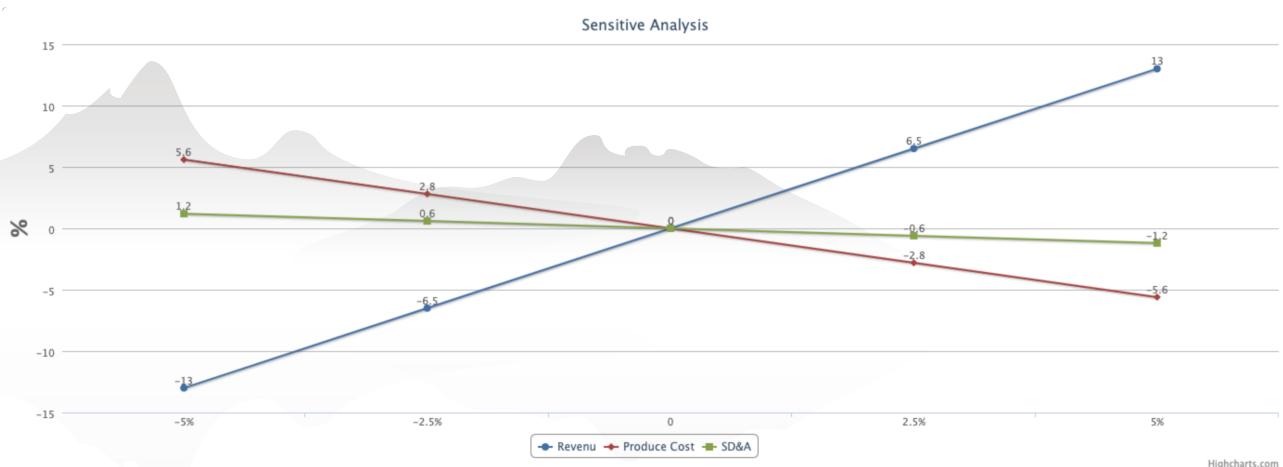
## 4.3 Sensitivity Analysis

Because we will reach the breakeven point at the second year, we selected it to do sensitivity analysis which is based on its cash inflow and outflow. From all these factors concerning about the cash flow, we chose two of them: the revenue(influenced by both prices and sale volumes) and the produce costs.

Then we got a table to illustrate the sensitivity of these factors shown as below:

### Sensitive Analysis of Year 2

	Undiscounted Value	% change in UV	PW	% change in PW
Revenue	¥5750449.75	-5%	¥1661398.90	-12.9824609%
	¥5901777.38	-2.5%	¥1785333.81	-6.9412378%
	¥6053105.00	0%	¥1909269.00	0%
	¥6204432.63	2.5%	¥2033203.63	6.9412085%
	¥6355760.25	5%	¥2157138.54	12.9824317%
Produce Cost	¥2459287.80	-5%	¥2015274.90	5.5521723%
	¥2524005.90	-2.5%	¥1962271.81	2.7760788%
	¥2588724.00	0%	¥1909269.00	0%
	¥2653442.10	2.5%	¥1856265.63	-2.7761081%
	¥2718160.20	5%	¥1803262.54	-5.5522015%
SG&A	¥526110.00	-5%	¥1931946.39	1.18777524%
	¥539955.00	-2.5%	¥1920607.56	0.5938689%
	¥553800.00	0%	¥1909269.00	0%
	¥567645.00	2.5%	¥1897929.89	-0.5938981%
	¥581490.00	5%	¥1886591.05	-1.1877817%



As we can see, just as we expected, when the sales of products increase, the present value will also increase, and vice versa. But in contrast, when the costs increase, the present value will decrease.

Then we pay more attention to their sensitivities. We find that profitability can affect the present value to the greatest extent, and the impact of spending on the present value is smaller. Overall, our projects are generally less sensitive, showing a certain degree of stability while fluctuating costs and profits. In comparison, it is more sensitive to our earnings, which means that we should focus on our pricing plans and revenue to ensure that we understand market changes.

# Reference

1. **GBT36964-2018: Specification for software Development cost measurement**
2. **National development and reform commission of the people's republic of China economic evaluation methods and parameters of construction project**  
We estimate the financial efficiency and cost, choose the source of funds and financing plan, and conduct financial economic cost-benefit analysis and cost-effectiveness analysis of the project according to some content of this material.
3. **Software cost estimation(2005), Barry Boehm** This book focuses on how to estimate the cost of software development.
4. **Software project effort estimation - Foundations and Best Practice Guidelines for Success, Adam Trendowicz · Ross Jeffery**  
This book focus on how to estimate the project effort of software development.
5. **2019 China Software Industry Benchmark Data(CSBMK-201906)** <http://www.is-spec.cn/cms/2019/0628/52861b321c01bc26e360f30ea52e4f14.pdf>
6. **Procedure of practice for software cost evaluation** [http://www.bscea.org/uploads/soft/20\\_0214/1-200214142T8.pdf](http://www.bscea.org/uploads/soft/20_0214/1-200214142T8.pdf)
7. **Pierre, BOurque. Richard, E. (Dick) Fairley. SWEBOK:** Guide to the Software Engineering Body of Knowledge. IEEE, 2014.
8. **Kathy, Schwalbe. Information Technology Project Management.** Boston, MA, 2011.
9. **Bob, Hughes. Mike, Cotterell. \*Software Project Management.\*** 2009.
10. **\*PMBOK® Guide and Standards.\*** Project Management Institute, Inc. [www.pmi.org/pmbok-guide-standards](http://www.pmi.org/pmbok-guide-standards). Accessed 12 April 2020.
11. **\*ISO 31000 RISK MANAGEMENT.\*** ISO. [www.iso.org/iso-31000-risk-management.html](http://www.iso.org/iso-31000-risk-management.html). Accessed 13 April 2020.
12. **Dmitriy, Nizhebetskiy. Software Development Life Cycle and Project Management.** [pmbasics101.com/software-development-life-cycle/](http://pmbasics101.com/software-development-life-cycle/). Accessed 13 April 2020.