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# Process Design of Digital Platform for China's Industrial Investment Fund

Xuan Yang<sup>1</sup>✉, Jin Chen<sup>2</sup>, Yanbo J. Wang<sup>3,4</sup>

<sup>1</sup> School of Information Technology & Management, University of International Business and Economics

hlyangxuan@126.com

<sup>2</sup> School of Information Technology & Management, University of International Business and Economics

chenjin@uibe.edu.cn

<sup>3</sup> Department of Development Planning, China Minsheng Banking Corp., Ltd.

<sup>4</sup> Institute of Finance and Banking, Chinese Academy of Social Sciences  
wangyanbo@cmbc.com.cn

**Abstract.** Nowadays, the Industrial Investment Fund is booming in China. Though it has achieved big success till now, there are still some key problems troubling the further development of Industrial Investment Fund. Two major challenges are the recognition of appropriate industries and also related companies. In order to solve such problem, we propose a design for the digital platform of Industrial Investment Fund. In the process of this platform, Web Text Extraction and Data Mining techniques are employed in order to help investors to make decisions in a Big Data Analysis manner.

**Keywords:** Industrial Investment Fund, Digital Platform, Process Design, Data Mining, Web Text Extraction.

## 1 Introduction

In recent years, Industrial Investment Fund is booming in China. According to *Interim Management Measures of China's Industrial Investment Fund* published by Chinese government, Industrial Investment Fund is defined as a collective investment system, which makes equity investment on the unlisted enterprises. The main investment approaches of China's Industrial Investment Fund include venture capital investment, corporate restructuring investment, and basic facilities investment and so on.

Having studied the literature related to Industrial Investment Fund, we find that the research is mainly focused on general operational mechanism, such as capital resource, organizational structure and withdrawal approaches of Industrial Investment Funds. However, there are few scholars talking about the specific problem which is of vital importance, that is, how to make investment decisions for Industrial Investment Fund. In order to fill this blank, we tried to propose a design for the digital platform of Industrial Investment Fund, which helps to recognize appropriate industries and related companies whom to invest. In the process of this platform, Web Text

Extraction and Data Mining techniques are applied in order to help investors to make decisions, in a Big Data Analysis manner.

The rest of this paper is organized as follows. In section 2, we study the current situation of China's Industrial Investment Fund. Section 3 describes some related work relevant to our study. In section 4, we propose our design of digital platform to identify appropriate industries and related companies for the Industrial Investment Fund. Finally discussions and open issues for further research are given in section 5.

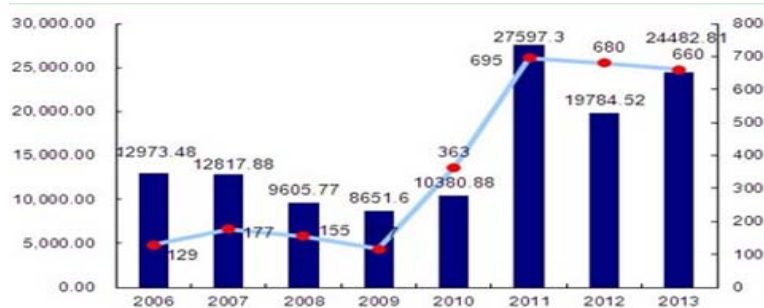
## 2 Current Situation of China's Industrial Investment Fund

Compared with other investment modes in the international market, China's Industrial Investment Fund is quite similar to Private Equity Fund. However, Industrial Investment Fund has its own characteristics, which are listed as follows.

**Table 1.** Characteristics of China's Industrial Investment Fund

<b>Organizational Pattern</b>		Two major types: Sino-foreign Joint Venture Fund and Large Chinese Fund
<b>Financing Pattern</b>	Sponsor	Generally some government departments, government policy banks or large state-owned enterprises
	Financing Size	Increasing greatly, less than one billion RMB before year 2005, and usually more than ten billion RMB after 2005.
	Financing Channel	Private
<b>Investment Pattern</b>	Investment Orientation	Usually some growing enterprises in the industries, which are booming or supported by the government.
	Investment Size	Quite large, usually millions RMB for a single investment project.
	Investment Period	Long-term investment, nearly ten years.
	Investment Tools	1. Equity investment 2. Quasi-equity investment 3. Investment on other funds
<b>Exit Pattern</b>		Usually through pre-IPO exit.

Since Chinese State Development Planning Commission (SDPC) has started making researches upon Industrial Investment Fund in 1995, China's Industrial Investment Fund has achieved great progress. According to the data published by Qingke Research Centre, till the end of 2012, there are nearly 560 Industrial Investment Funds in China, and the capital in this market reaches 30 billion US dollars. Since there are still many investors who would like to enter this market, the number mentioned above is estimated to keep growing. Taking 2013 market for example, there were 660 cases of investment in the market and the capital reaches 24.48 billion US dollars, with an increase of 23.7%.



**Figure 1.** Market Situation of 2013 China's Private Equity Investment

Source: Qingke Research Centre

Moreover, in order to support the development of Industrial Investment Fund, not only the central government but also many local governments, have made a series of policies and regulations. Till now a legal environment, which contains basic regulations, subsidiary assurances and specific policies, has been established.

### 3 Related Work

#### 3.1 Foreign Industrial Investment Fund

In western countries, especially in the US, Industrial Investment Fund is considered as "Organized Private Equity Market". As the US is one of the earliest countries which have started to develop Industrial Investment Fund and it has the most influential financial market in the world, a vast number of related researches are about American's Industrial Investment Fund.

Many scholars are interested in the information transmission mechanism of Industrial Investment Fund. Hobbert proposed a theoretical model for the Industrial Investment Fund [7]. In this paper, Hobbert further pointed out that as a financial intermediary, the most important feature of Industrial Investment Fund is that it can effectively reduce the information asymmetry, investment risk and agency cost between the investors and entrepreneurs. Trester thought that the agreement between the investors and entrepreneurs can be made only when the information is symmetry between both sides. However, once the agreement has been made, the information may gradually become asymmetry [12].

Besides, many scholars have contributed to the risk assessment of Industrial Investment Fund. Reid came up with the idea that the biggest risk Industrial Investment Fund confronted was principal-agent problem [11]. Cornelli and Yosha made more detailed illustration about this case. They found that in a multi-stage investment program, since entrepreneurs always hope to get continuous investment, they are inclined to manipulate the short-term projects performance so as to get a next-stage investment [4]. Based upon these achievements, Kut *et al.* furthered the study and found that the principal-agent problem was caused by asymmetric information between the investors and entrepreneurs [8]. In order to deal with this

challenge, Gompers pointed out that diversify investment portfolio is an effective approach to reduce adverse selection and moral risk [6].

### **3.2 China's Industrial Investment Fund**

Different from foreign scholars, Chinese researchers are more concerned on practical operation of Industrial Investment Fund in China. Related work contributed by Chinese scholars is mainly in two fields:

1. Introduction about the operational mechanism of foreign Industrial Investment Fund. Ye and Li introduced organizational structure, operational process and management mechanism of both American and Japanese Industrial Investment Fund [13] [9]. Bao studied the partnership structure of foreign Industrial Investment Fund, and suggested it may also apply to Chinese market [2]. Cao compared operational pattern both at home and abroad, and suggested China need to develop different withdraw approaches for Industrial Investment Fund [5].
2. Suggestions about development of Chinese Industrial Investment Fund. Ai suggested that Chinese government should establish more regulations on foreign capital investment in order to make the market more efficient [1]. However, Bian hold a different view, and believed that government should make more encouraging regulations to help Industrial Investment Funds grow up rather than restrict them [3].

### **3.3 Our Contribution**

Having reviewed literature work related to Industrial Investment Fund both at home and abroad, we found that the research is mainly focusing on general operational mechanism field, such as capital resource, organizational structure and withdraw approaches of Industrial Investment Funds. However, there are few scholars talking about the specific problem which is of vital importance: how to make investment decisions.

Through our investigation, we found that the major problem troubling Industrial Investment Fund investors is the recognitions of appropriate industries and related companies, which could be further illustrated as follows.

First of all, different from other investment modes, Industrial Investment Fund has a comparatively longer investment period. In light of current practice of China's Industrial Investment Fund, the investment period is approximately five to seven years. The longer investment period means the investors may face higher liquidity and credit risks.

Secondly, for Industrial Investment Fund investors, the total amount of invested capital is usually quite large. Given the possibility of investment loss constant, investors may have to suffer larger loss amount once they fail. Specifically, different from Private Equity investors in western countries, Industrial Investment Fund in China is more similar to the "Government Investment Pattern" that is popular in Japan, in which the investment are made by the large financial groups dominated by the government. Similarly, in China most Industrial Investment Funds are strongly influenced by government departments or state-owned policy banks, so the loss of

investment will not only affect their financial status but also decrease the total social welfare.

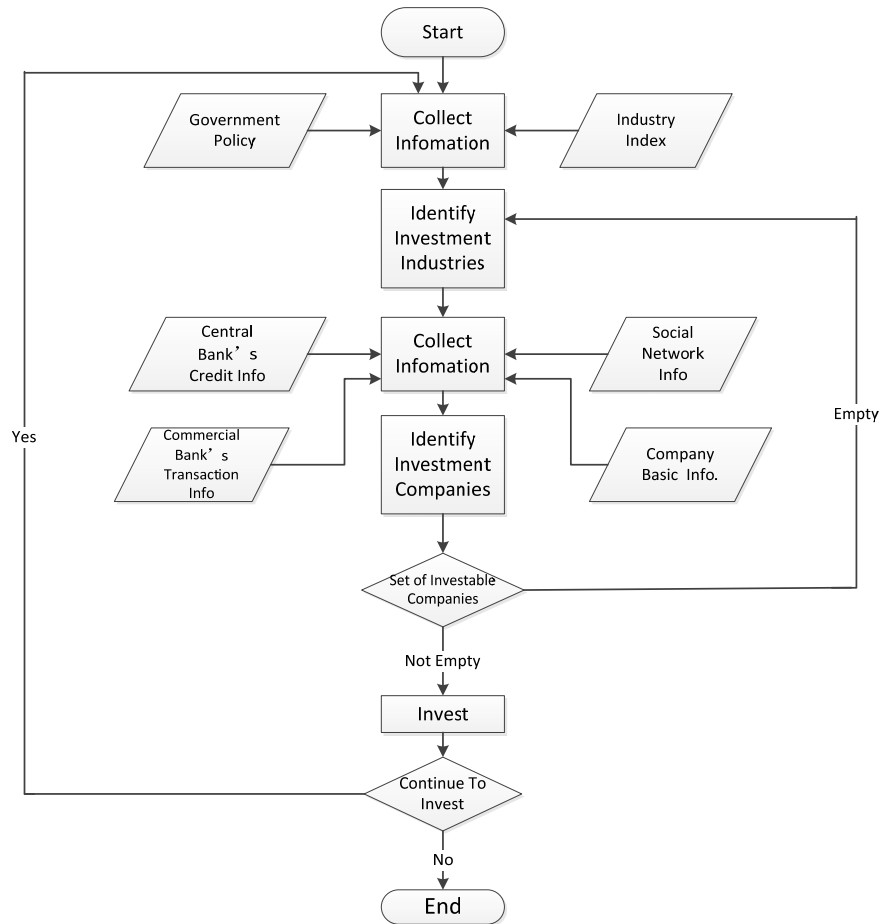
Last but by no means the least, the investment targets of Industrial Investment Fund are usually unlisted enterprises. Compared with listed companies, they have much fewer information available to the public, and investors may suffer from serious asymmetric information problem.

Based upon the reasons above, we see that Industrial Investment Fund is facing great risk in defining the investment targets. An effective process is urgently needed to identify appropriate industries and related companies to invest in order to control the investment risk.

#### **4 Design of Digital Platform for Industrial Investment Fund**

Having identified the main challenges of Industrial Investment Fund, we believe one of the most effective ways to solve these problems is to establish a digital platform for the Industrial Investment Fund and make information symmetric for both investors and enterprises. There are two functions of this platform: firstly, it helps to match the information between two sides effectively, thus reducing the investment risk; secondly, it could help to allocate the resources, so that the capital could be invested to the right enterprises. Hence, the goal of this digital platform is to achieve a win-win situation between investors and enterprises.

In order to achieve the functions mentioned above, the design of this platform could be divided into two stages: firstly, identify the specific industry (or industries) for the investment fund; secondly, identify the specific enterprises which have comparatively higher growth potential and lower risk. Our platform design is demonstrated as follows.



**Figure 2.** Process Design for the Industrial Investment Fund Platform

#### 4.1 Identification of Investment Industries

Generally speaking, for Industry Investment Funds, there are strict restrictions on which industries to invest. So the first stage is to establish an effective investment industrial portfolio with limited choices.

##### 4.1.1 Description of Data Source

When deciding which industries are worth investing, we believe two factors are of vital importance for consideration: one is the government's policy concerning different industries; the other is industry index, which is widely accepted as the indicator of development status for an industry.

First of all, investors should fully consider the influence that government policies have made on industries. Through our investigation, some source of government's policy concerning Industrial Investment Funds is listed as follows.

**Table 2.** Some Source of Chinese Government's Policy Concerning Industrial Investment Fund

	<b>Regulation Name</b>	<b>Publishing Institution</b>	<b>Publishing Time</b>
Central Government's Regulations	Interim Management Measures of China's Industrial Investment Fund	National Development and Reform Commission	2012
	Interim Management Measures on Emerging Industry Venture Capital	National Development and Reform Commission; Ministry of Finance	2011
	Notice on the Implementation of the Venture Capital Enterprise Income Tax Preferential Policies	Ministry of Finance; State Administration of Taxation	2009
	Acquisition management practices of listed companies	China Securities Regulatory Commission	2008
	Notice of the tax policy to promote the development of the venture capital business	State Administration of Taxation; Ministry of Finance	2007
	Interim Management Measures on Venture Investment Management	National Development and Reform Commission	2005
Local Government's Regulations	Notice on Approaches to promote equity investment fund industry development	Tianjin Local Government	2009
	Reply About agreed to support the construction of the Zhongguancun Science Park, National Innovation Demonstration Zone	Beijing Local Government	2009
	Promotion on Equity Investment Enterprises in Pudong	Shanghai Local Government	2009
	A number of provisions on the promotion of equity investment enterprise development fund	Shenzhen Local Government	2010

Secondly, as the key factor which indicating the potential and current development of the industry, industry index should also be taken into account. Taking energy industry for example, a number of index indicators are listed as follows.

**Table 3.** Some Source of Index Indicators for the Energy Industry

<b>Index Name</b>	<b>Publishing Institution</b>	<b>Publishing Frequency</b>
Power Industry Climate Index	China Economic Information Network	Quarterly
Petrochemical industry sentiment index	China Economic Information Network	Quarterly
Coal Price Index	National Coal Industry Network	Weekly



#### 4.1.2 Technique Applied: Web Text Extraction

Having identified the source of data we need when choosing the investment industry, another challenge is how to extract and analyze the information effectively. One tool that has been generally used is the search engine. Though it's convenient and easy to use, its disadvantage is obvious. Firstly, people inference is needed during the whole searching process. Secondly, the aim of search engines is to cover the web as widely as possible, which may lead to irrelevant results returned by the search engine.

One effective way to solve the problem mentioned above is web crawler. Web crawler is an automatic program, which downloads web pages from World Wide Web. Begin with one or several URL from initial page, web crawler continues to extract new URL from the current page, and put them into a queue until the system meets certain stop conditions.

In our case, with the help with web crawlers, we could grab the government policy we simultaneously monitored. According to the information we got, a list of industries supported by the government may be summarized. Then, we capture the corresponding index of listed industries from the web site. Later, we rearrange the industry list, in a descending order, according to different industries' index. Finally, we choose the top K industries in the list as candidate investment industries.

### 4.2 Identification of Investment Companies

#### 4.2.1 Description of Data Source

After we have chosen the industries to invest, the next stage is to identify the specific enterprises. Traditionally, investors' decisions are based upon mainly two kinds of resources: materials offered by the enterprise, and investors' on-site investigations. However, in the current "Big Data Society", only these two kinds of sources can hardly provide a solid basis for decision, we have to take more information into account and make comprehensive analysis. The information may include (but not limited to): enterprises' credit information from the central bank's credit system, enterprises' cash/deposit transaction information from the commercial banks, and comments or reputation of the enterprise captured from social networks.

For central bank's credit information, we need to reach an agreement with Chinese Central Bank, and get access to its credit system. So we can clearly see whether a company is "will" and "able" to pay for the loans. For enterprises' cash/deposit transaction information as well as their basic information, a company that is willing to be invested by our Industrial Investment Fund is supposed to submit its own information. For the reputation of companies, we could extract web texts concerning such comments - from the social networks through the Web Text Extraction technique mentioned above.

#### 4.2.2 Technique Applied: Logistic Regression

Logistic Regression approach was first introduced in the 1970s; “*it became available in statistical packages in the early 1980s*” [10]. Logistic Regression is a type of regression analysis used for predicting the outcome of categorical dependent variables (i.e. “yes” vs. “no”, or “high” vs. “low”, etc.), based on independent variables (descriptive features). This technique attempts to model the probability of a “class/–class” outcome using a linear function of the descriptive features, and then applying the log-odds of “class” (the *logit* of the probability) to fit the mentioned linear regression.

In our case, a data table is generated according to the information we got. The credit information of different companies, whether defaulted or not, is considered as the class-label. While other sources of data are included as data attributes of companies. Setting companies’ past performance as training data, Logistic Regression model could offer us clues indicating what features may lead to a company’s default. By putting into present performance of companies into this model, we are able to predict whether a certain company can afford to pay the loans or not.

## 5 Discussion

Since Industrial Investment Fund has become increasing important in Chinese financial market, effective investment decision mechanism is more and more important for both theoretical and practical aspects.

In this paper, we analyzed China’s Industrial Investment Fund by clarifying its definition, summarized its characteristics and evaluated its current development situation. We then figured out two major challenges that investors confronted: the recognitions of appropriate industries and related companies, and analyzing the reasons causing the problem. In order to solve it, we came up with a process design of digital platform for the Industrial Investment Fund, and applied Web Text Extraction and Logistic Regression Classification techniques during the whole process.

In the current stage, we mainly focus on the theoretical design of the decision support process for the Industrial Investment Fund. Further research is suggested to make empirical verification of the study we proposed.

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