

## Research Article

# Latest Lessons from the Bankruptcy of State-Owned Enterprises (SOEs) in China: An Interpretative Structural Model (ISM) Approach

Qin Lin <sup>1,2</sup>, Lin Feng,<sup>3</sup> Chatchai Khiewngamdee,<sup>4</sup> Pingping Li,<sup>4</sup> and Xiaofei Ye <sup>1</sup>

<sup>1</sup>Faculty of Maritime and Transportation, Ningbo University, Ningbo 315211, China

<sup>2</sup>Barcelona Innovation in Transport (BIT), Barcelona School of Nautical Studies, Universitat Politècnica de Catalunya—BarcelonaTech, Barcelona 08003, Spain

<sup>3</sup>Secondary School, Lanna International School, Chiang Mai 50200, Thailand

<sup>4</sup>Faculty of Economics, Chiang Mai University, Chiang Mai 50200, Thailand

Correspondence should be addressed to Xiaofei Ye; [yexiaofei@nbu.edu.cn](mailto:yexiaofei@nbu.edu.cn)

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State-owned enterprises (SOEs) play an important role in China. During the transformation from a planned to a market economy, plenty of Chinese SOEs fell into trouble. Dalian machine tool group (DMTG) who was once a leading enterprise in the Chinese machine tool industry bankrupted in 2017. To explore the causes of its collapse, we employ the interpretative structural model (ISM) to investigate the reasons for its failures from multi-aspect and at different levels. The results indicate that the root cause of this bankruptcy is the top manager's mismanagement; the lack of a reasonable strategic positioning and long-term product planning are also important factors of DMTG's failure, and the problems of human resource management accelerated the bankruptcy. Findings provide lessons to be learned from the bankruptcy for SOEs and offer managerial insight into SOEs.

## 1. Introduction

China is a rapidly developing economy with a special economic system. In respect of development paths, China differs not only from traditional socialist countries (i.e., Russia) but also from Western countries (for instance, the USA). Its socialist market economy consists of five components: state-owned enterprises (SOEs), enterprises under collective ownership, private enterprises, foreign enterprises, and joint ventures [1]. Among them, SOEs are the mainstay of China's economy [2]. In 2017, China's GDP was RMB 82 trillion, and the SOEs count for RMB 52.2 trillion [3]; that is to say, the SOEs create 63.6% of China's GDP. Due to their characteristics, for instance, a large scale of assets, complex organizational structure, low efficiency, and slow market response [4], SOEs have been controversial subjects for decades. In the past forty years, China has been continuously deepened the reform of SOEs and efforts to solve the shortcoming of SOEs. However, with the global economic

slowdown and economic structural changes, the economic environment has changed greatly since the financial and economic crisis in late 2008 [5]. The economic change has led to a slowdown of business. In this circumstance, the system reform of SOEs faces great challenges.

The reform of SOEs is a popular topic in China, and plenty of scholars have investigated the success or failure factors of SOEs from various aspects. A case study is used by Wang et al. [6] and Huang and Snell [7]. The reform was evaluated by documentation analysis [8, 9]. These methods have been widely used, but the logic of dealing with complex problems is often not strict enough; therefore, some scholars choose quantitative analysis. Altman's *Z*-scores [10] are expounded by Ni et al. [11]; these classical bankruptcy prediction models (for instance, Springate and Meachin [12], Saladi and Yarlagaadda [13], and Legault and Kirton [14]) are widely used by researchers [15]. Meanwhile, structural models, e.g., the Merton, Black–Cox, Leland–Toft, Longstaff–Schwartz, flat barrier, and Geske models, are hot

applications in bankruptcy prediction. Among them, there is little research on the systematic approach to endogenous problems of SOEs' bankruptcy, and the research on network stratification is more like a water chestnut. In this paper, the interpretative structural model (ISM) is employed to analyse the relationships and hierarchy of the complicated internal causes leading to the bankruptcy of the Dalian machine tool group (DMTG). ISM decomposes the complex and disordered relationships into various and directly related identified factors, which is an efficient application to clarify the structure of factors of DMTG's bankruptcy. The results displayed in this way of hierarchical topology are very intuitive. Through the hierarchical graph, it can clearly understand the causes and effects of various factor hierarchies and cascade structures leading to DMTG's bankruptcy.

DMTG was built in 1947 and renamed as Dalian Machine Tool Factory in 1953. In November 1995, Dalian Machine Tool Factory as the core, major enterprises of the machine tool industry in Dalian Municipal, Liaoning Province, China, were merged and formed Dalian Machine Tool Corporation (i.e., DMTG). In 2001, the revenue of DMTG reaches RMB 1.12 billion, and it was listed among China's top 100 enterprises in 2002. In March 2004, DMTG was transformed from an SOE into a joint venture. Since then, it grew rapidly. In 2006, DMTG invested in Zhuhua Industrial Park in Wafangdian, which mainly produced small general machine tools, CNC machine tools, turret milling machine tools, and other products. In 2007, DMTG invested in the construction of Shenyang Zhongmei drilling and Boring Machine Co., Ltd., whose production was radial drilling and boring machines. In 2009, DMTG invested the world's first machine tool industry machine assembly line. In 2012, according to the world machine tool industry survey conducted by Gardner Intelligence, DMTG ranked among the world top 10 machine tool enterprises. On November 21, 2016, DMTG for the first time reported a bond default, "15 machine tool CP003" overdue, but the company completed the payment on the second day. Since then, nine bond defaults witnessed in a row until November 10, 2017. In December 2017, DMTG went bankrupt, which once led enterprise of China machine tool industry and ranked first in China's revenue of enterprises for two consecutive years. (see Figure 1) and finally went bankrupt. What happened to DMTG? What caused its failure? And what could we learn from its collapse? Those questions would help to rethink the contribution of SOEs.

The contributions of this manuscript are 3 folds. Firstly, the relationship between failure factors is discussed and the situation of recent reform on SOEs is summarized. Secondly, the ISM is employed to explain the relationship among those causes to its failure from high to low in the structural hierarchy. Thirdly, it offers a reference for SOEs engaged in reform and provides references for policymakers and helps to change the current dilemma of the transformation of the SOEs system.

The remainder of this paper is structured as follows. Section 2 describes the history of DMTG and investigates DMTG's failure. Section 3 introduces the ISM and analyses the endogenous causes of DMTG's bankruptcy. The model is

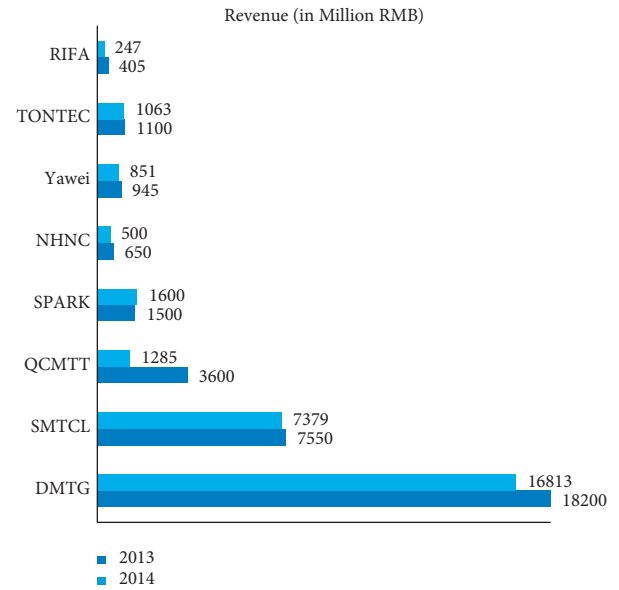


FIGURE 1: Revenue of Chinese machine tool enterprises from 2013 to 2014.

discussed in Section 4, and the managerial implications are concluded finally (Section 5).

## 2. Methodology

The ISM was presented firstly by Warfield to deal with complex socio-economic systems. This model decomposes the complex and disordered relationships into various and directly related identified factors, which is an efficient application to clarify the structure of complex patterns [16], and the ISM modelling process is explicated as following according to Warfield [17].

Before building the ISM, a directed connection graph needs to be understood. A directed connected graph is a set of nodes and directed edges, which is an image connected by several nodes and directed edges. A system consists of at least two distinct elements, and there must be some relationship between the elements. A digraph is an intuitive model for describing such relationships.

As shown in Figure 2, nodes A, B, and C of the graph represent the three elements of the system. The line with arrows from A to B indicates that A has an effect on B, and similarly, B and C have an effect on each other.

The directed connected graph can be expressed as follows:

$$G = \{S, R\}, \quad (1)$$

where  $S = S_i$ ,  $i = 1, 2, 3$  ( $S_1$  is A,  $S_2$  is B, and  $S_3$  is C).

$$R = \{[S_1, S_2], [S_2, S_3], [S_3, S_2]\}. \quad (2)$$

The main steps of the ISM are as follows:

*Step 1.* To set up a correlation structure: According to Warfield, the relationships among all elements in the system would be identified and explored in the self-interaction matrix (self-IM) with the symbols (i.e.,  $V, X$ ,

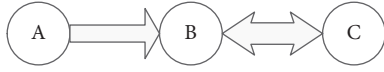


FIGURE 2: Directed connection graph.

A, and O). Herein,  $V$  means element  $i$  results in element  $j$ .  $A$  shows  $j$  results in  $i$ .  $X$  presents  $i$  and  $j$  impact mutually.  $O$  indicates  $i$  and  $j$  are uncorrelated to each other.

*Step 2.* To build the reachability matrix (RM): Two steps are requested to produce the RM from the self-IM. Firstly, as instructed by Shen et al. [18] (see Table 1), the initial RM is transformed. The initial RM only illustrates the direct relationships among elements; therefore secondly, we must find the indirect relationships among those elements with the following:

$$R_f = R_i^k = R_i^{k+1}, \quad K > 1, \quad (3)$$

where  $R_f$  and  $R_i$  are final RM and initial RM individually.

*Step 3.* Level dividing: According to Tan et al. [19], elements of which the reachability set (RS) is equal to its intersection set (IS) would be ranked in Level 1. After deleting the elements in Level 1, a new cycle will begin again until all elements are divided into different levels.

*Step 4.* To plot the directed graph depending on the levels and connections of each element and built the final ISM-based model.

### 3. DMTG's Bankruptcy as a Case Study in ISM Modelling

*3.1. Bankruptcy Reason Analysis.* For many years, SOEs have often been thought to be as durable as the government [20] until Shenyang Explosion Proof Equipment Factory became the first SOE to declare bankruptcy on August 3, 1986. Since then, a variety of SOEs bankruptcies have emerged one after another. The results of bankruptcy are the same, but the reasons are different. Here follows the case of DMTG.

*3.1.1. The Machine Tool Industry in a Slump.* Since the 2008 global financial crisis, China's manufacturing industries have witnessed an overall decline. The machine tool industry, as the foundation of the manufacturing industries, is the first to be hit. The net interest and net interest rate of the Chinese machine tool industry reported a significant decline since 2011 (see Figure 3). In addition, according to research in China [21], the output of metalworking machine tools in China dropped by, respectively, 7.0% and 6.1% during 2012-2013. Undoubtedly, the machine tool industry in China has entered a depression since 2011.

In the meantime, DMTG was constantly planning for seeking new development and integration, through technology and innovation to transform the original production model to enter the high-end product market, in response to the industry recession situation and invested a lot of work capital, which caused insufficient operating capital. The long

TABLE 1: Substitution rule.

Self-IM	Initial RM	
$(i, j)$	$(i, j)$	$(j, i)$
$V$	1	0
$A$	0	1
$X$	1	1
$O$	0	0

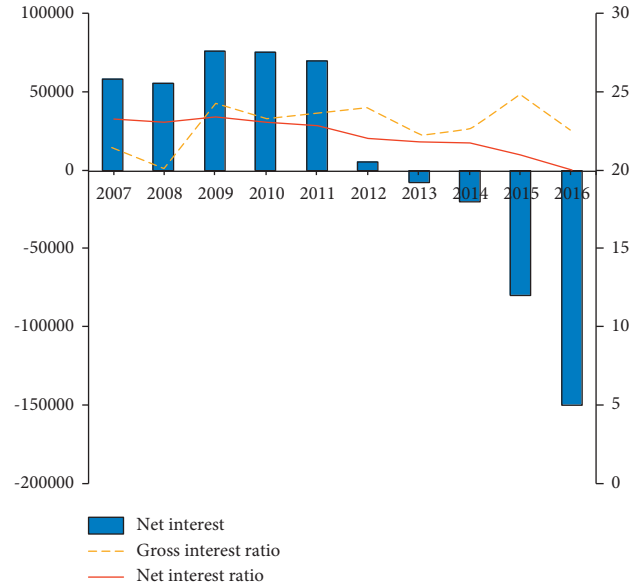


FIGURE 3: Net interest, gross interest rate and net interest rate of the Chinese machine tool industry from 2007 to 2016.

R&D cycle of new products costs too much investment capital, coupled with the economic depression, made it difficult to collect accounts receivable.

*3.1.2. Low-End Products Lack Market Competitiveness.* With the market demand for machine tools, the financial crisis has had a huge impact on China's machine tools market, which from the past low-end demand for products gradually into a large number of high-end products [22]. However, until 2013, the company still made traditional machine tools with old equipment and presents low-end products to occupy quite big, the gross profit is low, and the stock pressure is big situation.

Since 2013, DMTG's capacity utilization is less than 70% [23], revenue can be seen in is declining slightly year by year, and due to inventory and accounts receivable occupation funds, the company's profit realization efficiency continues to be low. However, the research and development of production equipment and technology for medium- and high-end products all require a large amount of working capital, and at the same time, the financial and management expenses for investment in fixed assets and projects under construction are constantly increasing, making the financial risk of DMTG bigger and bigger. The machine tool industry has entered a key period of brand reshuffle and brand development under the background of the decline of the

overall prosperity of the industry. Competition in the machine tool industry has turned into competition in technology and innovation. This made the profit of DMTG products to decrease, whose main inventory is low-end products. Accounts receivable increased further occupied the funds. In addition, the unsatisfactory sales of outdated products forced enterprises to increase marketing costs. The company's profit realization efficiency continues to be a low and net outflow of operating cash in 2015. The debt burden and the turnover pressure maintain the high level (see Figure 4), and the fund chain is tight.

**3.1.3. More Prestock, Large Inventory Pressure.** Meanwhile, the import structure of China's machine tool products also changed significantly. The demand for high-precision, high-speed, highly efficient, and intelligent medium- and high-end CNC machine tools has increased remarkably [24]. To meet the development requirements under the market economy, DMTG's inventory faces a severe test but error in the company's operational planning. Part of the ordinary machine tools, economical CNC machine tools, and vertical machining centre used a fixed produce mode to maintain a certain inventory every day, according to market demand. Moreover, the high-end products used order mode of production, such as modular machine tools and automatic lines, having generally 1-2 years production cycles. However, the long cycle led to high inventory. At the end of September 2012, the inventory balance of machine tools in Dalian was 586,349.72 million yuan, accounting for 46.64 percent of current assets. With the lack of a good production plan, the company's inventory increased year on year, with a compound annual increase of 5.62 percent. By the end of 2015, the company's inventory stood at 6.96 billion yuan, up 7.60 percent year on year [25]. DMTG's production system is unable to respond to the new market demand in time, resulting in a continuous decline in sales; a backlog of inventory lost the characteristics of current assets, and a persistent low efficiency of profit realization further increased the operating pressure and financial risk of DMTG.

**3.1.4. High Debt Industry Environment, Bond Default.** Since 1979, China has formulated and implemented a series of financial policies to increase the liquidity of enterprises and promote the development of enterprises. After that, high debt has become a common problem for most Chinese companies and DMTG was one of them. DMTG optimized the strategic allocation of assets of enterprises, and a series of high-end product production lines is developed to promote long-term development.

From 2013, DMTG was planning for the transformation of the original production model to enter the high-end product market. The last time DMTG disclosed its financial data was in the third quarter of 2016. The report shows that DMTG consolidated statement liabilities total of 18.087 billion yuan, the asset-liability ratio of 77.08%, and in the first three quarters of 2016, DMTG consolidated report total revenue of 9.334 billion yuan, the total operating cost of

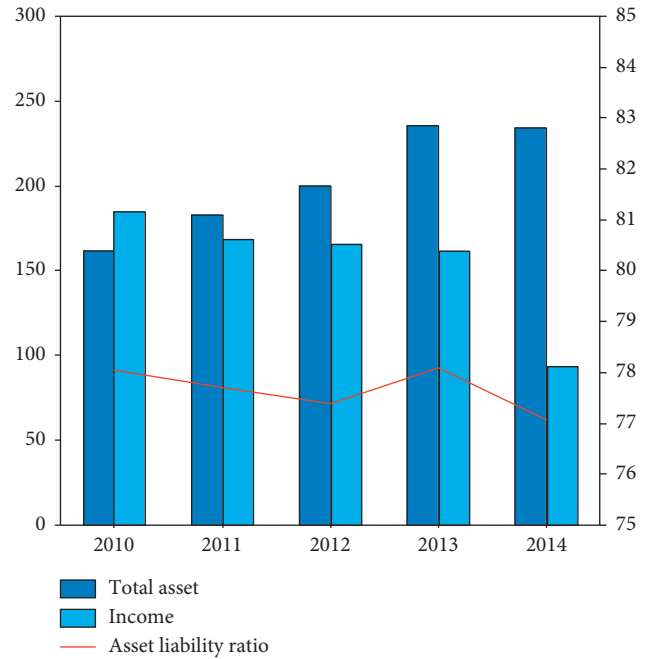


FIGURE 4: 2013–2016 assets and revenue of DMTG.

9.047 billion yuan, the profit margin is only 3%, and the same period operating profit is  $-40.1958$  million yuan [26] until the end of 2016 when bond defaults began.

**3.1.5. Corporate Structure is Unwieldy and Employees Lack Work Motivation.** Like many other Chinese SOEs, DMTG has a complicated organizational structure, a large number of departments, unclear responsibilities; many manage staff, and a few staff at the grassroots level. The structure of the organization has remained unchanged for decades due to unprofessional top-level management. Enterprise Management System cannot keep up with the times, directly leading to the operating system being out of date, and products cannot meet the needs of the new market reform, resulting in employees lost enthusiasm and self-reliance [27]. Yongkai Chen, the legal representative and chairman of DMTG, was listed as a wanted criminal by the Ministry of Public Security for corruption and became the last straw on the back of DMTG.

### 3.2. ISM for the Causes of DMTG's Bankruptcy

**3.2.1. Element Identification.** The investigation in this section indicates that the causes of DMTG's failure are multilevel and multifaceted. In this section, the ISM-based method is established to provide a directed-graph approach for the in-depth understanding of interactive relationships among those causes. With this directed-graph approach, the most direct, fundamental, and core causes of DMTG's bankruptcy could be investigated logically. As mentioned in the Methodology part, the ISM is as follows.

The above causes are numbered from 1 to 16 (see Table 2) and then employed as elements in the ISM-based model. 120

interactive causal relationships among the 16 elements are assessed according to whether one element directly results in another. The results are illustrated as  $V, A, X,$  and  $O$  in Table 3.

3.2.2. *Establish Strucatural Matrix.* By the substitution rule in Table 1, the structural self-IM in Table 3 is converted into an initial RM (see formula (4)). Then, following Singh and Kant [28], the final RM is generated as  $M_f$ :

$$M_i = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}, \tag{4}$$

$$M_f = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}. \tag{5}$$

3.3. *Level Partitioning.* Once the relationships among the factors are demonstrated, the hierarchical structure can be established based on level partitioning [29], which is

conducted from Tables 4 to 9, and these factors can be grouped into six categories in Table 3.

3.4. *Output of ISM Graph and Model.* The description model is generated from the final reachability matrix by the ISM method. After eliminating the transitive link and replacing the number of nodes with statements, the ISM is established, which can be explained in different hierarchical levels that display the direct and indirect interrelationships between these sixteen elements in Figure 5. The one-way arrow from element  $i$  to element  $j$  means element  $i$  leads to element  $j$ . A two-way arrow indicates the mutual cause between the elements  $i$  and  $j$ .

### 4. Discussion

DMTG’s failures are multifaceted and multidimensional as discussed in Section 3. Next, the ISM approach was adopted to determine binary interactive relationships among those identified bankrupt reasons as Figure 5. Consequently, a directed graph (see Figure 6) derived from the ISM method was obtained to understand the interrelationships among those impact factors about DMTG’s bankruptcy.

The topmost level implies F1 (Monotonous product), F3 (Limited product profit), F14 (High debt), and F16 (Lack of staff motivation) with the same reachability set and inter-section set, while “Insufficient working capital” (F6) and “Failure in funds recovery” (F10) are the most critical impact factors. “Inventory backlog” (F2) and “Obsolete product” (F5) are top third-level objective indicators. Moreover, “Old equipment” (F4), “Lack of product planning” (F7), “High marketing costs” (F8), and “Blind expansion insufficient working capital” (F9) are the impact factors about enterprise operation and further. “Inappropriate strategic positioning” (F11), “Top management corruption” (F13), and “Out-moded operation management” (F15) are the second to last layer. “Unprofessional top management” is the only factor at the bottom level.

It is obvious that the top of the ISM structure contains four factors (Level 1), which are called direct factors, and these explicated that the DMTG’s bankruptcy is directly influenced by F1, F3, F14, and F16. These four factors were independent of each other, and monotonous product was a common problem faced by old-brand SOEs after China’s reform and opening up [30]. It leads to the lack of core competitiveness and sustainable development ability of the enterprise, and the product cannot always guarantee a good profit space. Over time, that may lead to limited product profit if a more competitive product comes along it. The high debt was the universal reason under the background of China’s reform and opening up [31] which directly led to compete fiercely and update quickly. It is conceivable that DMTG’s high debt shrunk the profit and prolonged the deficit. DMTG’s highly indebted development pattern cannot be sustained for a long time. It is only a matter of time before its bubble bursts. The human resource was the foundation of an enterprise’s development. DMTG’s workforce is large, and employees lack

TABLE 2: Element identification.

No.	Impact factor
F <sub>1</sub>	Monotonous product
F <sub>2</sub>	Inventory backlog
F <sub>3</sub>	Limited product profit
F <sub>4</sub>	Old equipment
F <sub>5</sub>	Obsolete product
F <sub>6</sub>	Insufficient working capital
F <sub>7</sub>	Lack of product planning
F <sub>8</sub>	High marketing costs
F <sub>9</sub>	Blind expansion
F <sub>10</sub>	Failure in funds recovery
F <sub>11</sub>	Inappropriate strategic positioning
F <sub>12</sub>	Unprofessional top management
F <sub>13</sub>	Top management corruption
F <sub>14</sub>	High debt
F <sub>15</sub>	Outmoded operation management
F <sub>16</sub>	Lack of staff motivation

TABLE 3: Structural self-IM.

—	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>	F <sub>5</sub>	F <sub>6</sub>	F <sub>7</sub>	F <sub>8</sub>	F <sub>9</sub>	F <sub>10</sub>	F <sub>11</sub>	F <sub>12</sub>	F <sub>13</sub>	F <sub>14</sub>	F <sub>15</sub>	F <sub>16</sub>
F <sub>1</sub>	—	O	O	O	O	O	A	O	O	O	A	O	O	O	O	O
F <sub>2</sub>		—	O	O	A	O	A	O	O	V	A	O	O	O	O	O
F <sub>3</sub>			—	O	O	O	A	O	O	O	A	O	O	O	O	O
F <sub>4</sub>				—	V	O	A	O	O	O	O	O	O	O	A	O
F <sub>5</sub>					—	O	A	O	O	O	A	O	O	O	O	O
F <sub>6</sub>						—	O	A	A	O	O	A	A	V	O	O
F <sub>7</sub>							—	O	O	O	O	O	O	O	A	O
F <sub>8</sub>								—	O	O	O	O	O	O	A	O
F <sub>9</sub>									—	V	O	A	O	V	O	O
F <sub>10</sub>										—	O	A	O	V	O	O
F <sub>11</sub>											—	A	O	O	O	O
F <sub>12</sub>												—	V	O	V	O
F <sub>13</sub>													—	O	O	O
F <sub>14</sub>														—	O	O
F <sub>15</sub>															—	V
F <sub>16</sub>																—

TABLE 4: Level partitions for level 1.

Factor	Reachability set	Antecedent set	Intersection set	Level
F <sub>1</sub>	1	1, 7, 11, 12, 15		1
F <sub>2</sub>	2, 5, 9, 10, 14	2, 4, 7, 11, 12, 15		
F <sub>3</sub>	3	3, 7, 11, 12, 15		1
F <sub>4</sub>	2, 4, 5, 9, 10, 14	4, 7, 11, 12, 15		
F <sub>5</sub>	5, 9, 10, 14	2, 4, 5, 7, 11, 12, 15		
F <sub>6</sub>	6, 9, 14	6, 11, 12, 15		
F <sub>7</sub>	1, 2, 3, 4, 5, 7, 9, 10, 14	7, 12, 15		
F <sub>8</sub>	8, 9, 14	8, 12, 15		
F <sub>9</sub>	9, 14	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15		
F <sub>10</sub>	9, 10, 14	2, 4, 5, 7, 10, 11, 12, 15		
F <sub>11</sub>	1, 2, 3, 4, 5, 6, 9, 10, 11, 14	7, 11, 12, 15		
F <sub>12</sub>	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	7, 11, 12, 15		
F <sub>13</sub>	9, 13, 14	7, 11, 12, 15		
F <sub>14</sub>	14	7, 11, 12, 15		1
F <sub>15</sub>	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16	7, 11, 12, 15		
F <sub>16</sub>	16	7, 11, 12, 15		1

TABLE 5: Level partitions for level 2.

Factor	Reachability set	Antecedent set	Intersection set	Level
F2	2, 5, 9, 10, 14	2, 4, 7, 11, 12, 15		
F4	2, 4, 5, 9, 10, 14	4, 7, 11, 12, 15		
F5	5, 9, 10, 14	2, 4, 5, 7, 11, 12, 15		
F6	6, 9, 14	6, 11, 12, 15		2
F7	1, 2, 3, 4, 5, 7, 9, 10, 14	7, 12, 15		
F8	8, 9, 14	8, 12, 15		
F9	9, 14	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15		
F10	9, 10, 14	2, 4, 5, 7, 10, 11, 12, 15		2
F11	1, 2, 3, 4, 5, 6, 9, 10, 11, 14	7, 11, 12, 15		
F12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	7, 11, 12, 15		
F13	9, 13, 14	7, 11, 12, 15		
F15	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16	7, 11, 12, 15		

TABLE 6: Level partitions for level 3.

Factor	Reachability set	Antecedent set	Intersection set	Level
F2	2, 5, 9, 10, 14	2, 4, 7, 11, 12, 15		3
F4	2, 4, 5, 9, 10, 14	4, 7, 11, 12, 15		
F5	5, 9, 10, 14	2, 4, 5, 7, 11, 12, 15		3
F7	1, 2, 3, 4, 5, 7, 9, 10, 14	7, 12, 15		
F8	8, 9, 14	8, 12, 15		
F9	9, 14	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15		
F11	1, 2, 3, 4, 5, 6, 9, 10, 11, 14	7, 11, 12, 15		
F12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	7, 11, 12, 15		
F13	9, 13, 14	7, 11, 12, 15		
F15	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16	7, 11, 12, 15		

TABLE 7: Level partitions for level 4.

Factor	Reachability set	Antecedent set	Intersection set	Level
F4	2, 4, 5, 9, 10, 14	4, 7, 11, 12, 15		4
F7	1, 2, 3, 4, 5, 7, 9, 10, 14	7, 12, 15		4
F8	8, 9, 14	8, 12, 15		4
F9	9, 14	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15		4
F11	1, 2, 3, 4, 5, 6, 9, 10, 11, 14	7, 11, 12, 15		
F12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	7, 11, 12, 15		
F13	9, 13, 14	7, 11, 12, 15		
F15	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16	7, 11, 12, 15		

TABLE 8: Level partitions for level 5.

Factor	Reachability set	Antecedent set	Intersection set	Level
F11	1, 2, 3, 4, 5, 6, 9, 10, 11, 14	7, 11, 12, 15		5
F12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	7, 11, 12, 15		
F13	9, 13, 14	7, 11, 12, 15		5
F15	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16	7, 11, 12, 15		5

TABLE 9: Level partitions for level 6.

Factor	Reachability set	Antecedent set	Intersection set	Level
F12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	7, 11, 12, 15		6

enthusiasm for their work limiting their potential for further development [32]. Understandably, DMTG in human resources is not ready to keep pace with the pace of reform and opening up. A seemingly unrelated set of factors, i.e., their joint action under a certain condition made the situation worse and directly resulted in the collapse of DMTG.

The impact factors in the second, third, and fourth layers are called indirect factors; these eight factors influence bankruptcy through conducting direct factors. These factors play the role of intermediary agents and conduct between direct factors and root factors. Furthermore, these factors influence direct factors and are influenced by root factors at the same time.

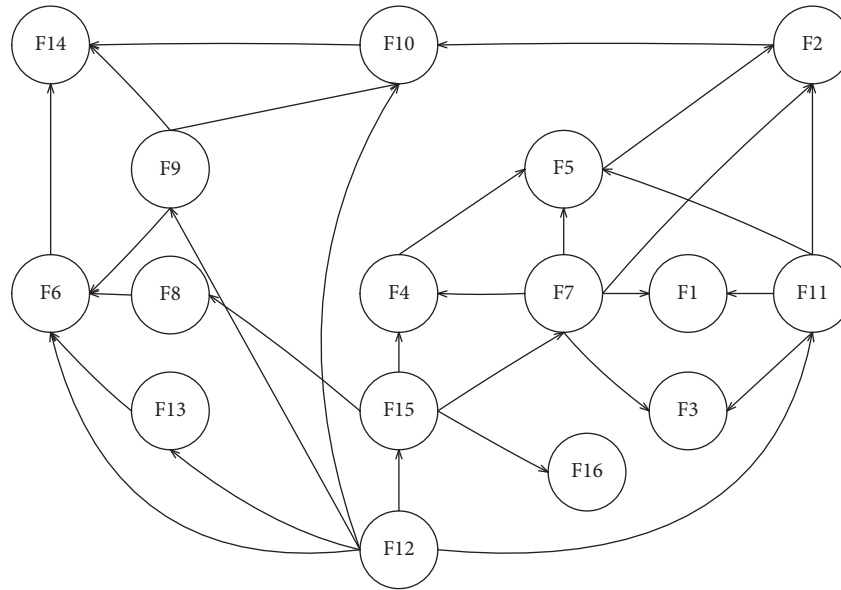


FIGURE 5: ISM-based graph.

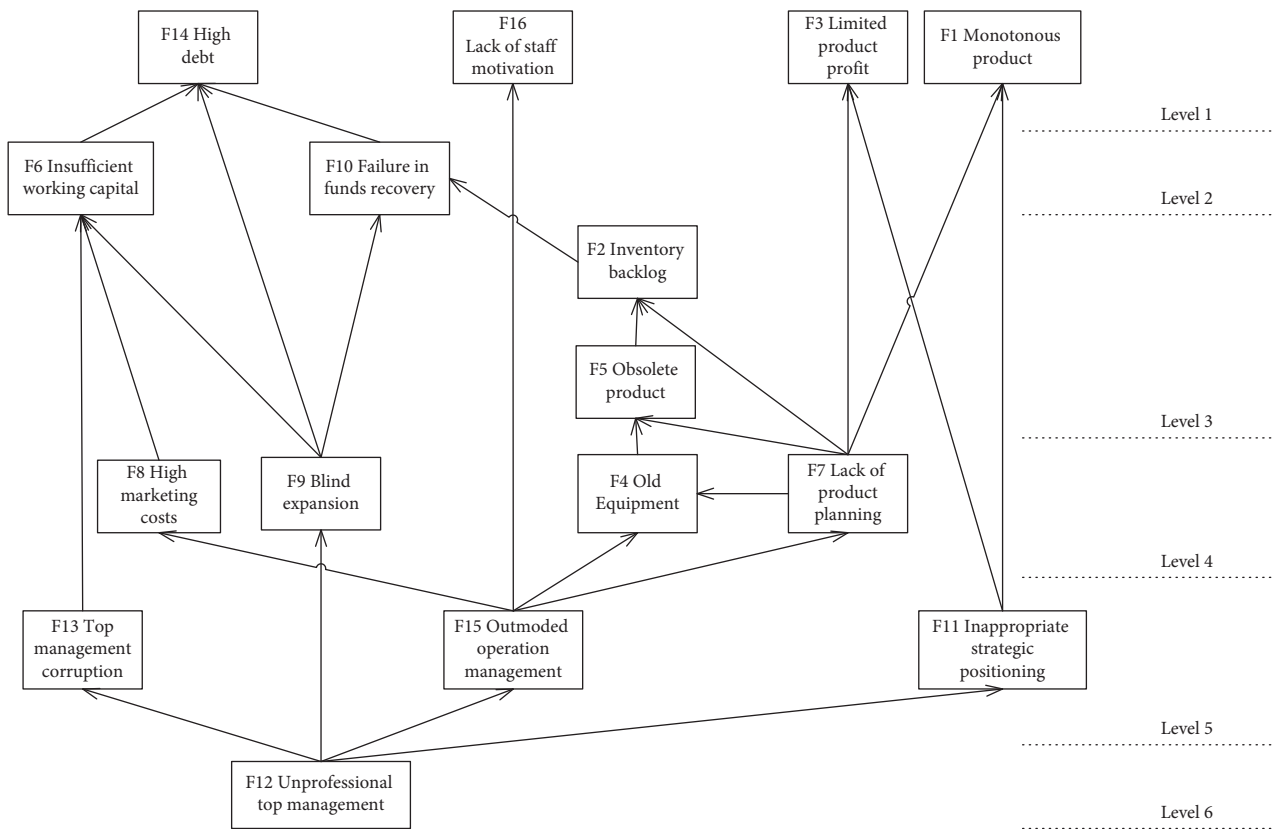


FIGURE 6: The hierarchical structure among sixteen factors.

Blind expansion and failure in funds recovery make the operating capital of enterprises tight [33], while the lack of product development planning allows enterprises to maintain the established mode of operation, using old equipment to produce unpopular products; in consequence, poor sales lead to inventory backlog, enterprises have to increase the cost of marketing, which further increased the

pressure on the funds of enterprises. The tension or break in the capital chain often pushes a business into a corner. Under the comprehensive effect of these factors, DMTG cannot survive without working capital, which was one step closer to bankruptcy.

The fifth-level and the sixth-level influential factors are collectively called root factors and as the fundamental



factors; root factors are the origin of the bankruptcy: Inappropriate strategic positioning" (F11), "Top management corruption" (F13), and "Outmoded operation management" (F15).

These four factors are related to business management. According to Peter Drucker's law of management, business management is the core of business development and the only fundamental factor that can be intervened. The capital market strongly promoted SOEs to develop in the hinterland. However, many SOEs had a lot of problems in the process of the reform. Fundamentally speaking, it is a management problem. The Middle Manager of DMTG has not adjusted its operating system to the reform and opening up. The immediate cause is that top managers do not conduct effective performance reviews on them [34]. Top managers do not have enough management experience in managing market economy systems. They made up their decisions mindlessly and developed inappropriate strategic positioning or even no positioning [35]. During the operation of the capital market, managers did not resist the temptation of money, illegal corruption, and bribery. As a result, poor management led to a serious imbalance between revenue and expenditure [36] and aggravated the debt crisis of DMTG. Developing new markets mindlessly, the expenses of new product development and market promotion increased unceasingly, resulting in DMTG debt default.

To sum it up, the root cause of the failure of DMTG is the improper management of senior managers, which leads to the outbreak of other levels of causes in different intervals and dimensions and finally leads to its bankruptcy. Therefore, the collapse of the DMTG seems to be accidental but inevitable. In this sense, this is the story of a top manager's management failure.

## 5. Conclusion

As the economic base of China, SOEs have played an important role and achieved great success and also faced a lot of problems. Taking DMTG as an example, this research analyses the network structure of a series of problems encountered by SOEs in the process of reform and opening up with the ISM method. These problems may be of relevance to other emerging enterprises, and therefore the lessons drawn from these problems would be helpful for similar enterprises to evade certain risks in the process of development.

This paper classifies 16 factors that cause DMTG's bankruptcy and finds that the root cause of bankruptcy is the top manager's mismanagement. Poor top management leads to improper strategic positioning, seeking personal interests, and enterprises are stuck in their ways and do not seek development. Since the reform and opening up of China's SOEs in the internal governance system reform process to give state-owned enterprise managers too much autonomy, however, a more centralized structure for SOEs may not be the best option because of political constraints and the balancing of local reforms faced by Chinese SOEs. Even so, imposing bureaucratic controls on large SOEs means that the entire operating system cannot keep up with the times, and businesses are highly likely to lose market

competitiveness and fail in a depression. It is suggested to supervise and examine the top managers of SOEs; the government should reform the bureaucratic selection mechanism for the managers of SOEs or carry out the reform of mixed ownership of SOEs and require enterprises to establish a clear management system for strengthening the supervision and assessment of the state-owned enterprise operators to strengthen the defence of enterprise management, promote the diversification of SOEs, and expand to different industries.

In addition, the lack of a reasonable strategic positioning and long-term product planning are also important factors of DMTG's failure. The key to a company's survival is its market and its profits, both of which are tied to its products. The dull product line of DMTG is greatly dependent, and the competition of development is difficult to break through the market barrier. Under this kind of situation, once a crisis occurs, it will cause a devastating blow to the enterprise. Unfortunately, encountering the financial crisis, Industry Depression, DMTG is on the road to ruin. China's old-brand SOEs generally have dull products, lacking completely profit models. Insufficient core competitiveness and comprehensive strength are not strong enough to support the development of enterprises. The capital market intends to enrich the working capital of enterprises. However, this mode of operation cannot be the pursuit of capital markets and investors' favor. For example, *Xiangpiaopiao*, a well-known milk tea company, failed IPO three times in six years. The selection of a diversified product strategy is the most important business development. Carrying out the strategy of diversification is not only the inevitable trend of enterprise development but also plays an active role in resisting risk, developing potential and enhancing expansion ability.

Finally, the problems of human resource management also accelerated the bankruptcy of DMTG. Its huge staff structure and ageing system and innovative awareness had blocked the spread of advanced ideas, as well as made the entire enterprise staff from top to bottom to lack ambition and sense of responsibility, overstaffing, and low efficiency. In other words, the planned economy's personnel management model does not adapt to the development of the market economy, and its failure is inevitable. Human resources are one of the core resources of modern enterprises, and talent is a very important strategic resource for enterprise development. In the process of the reform of SOEs, how to arouse the enthusiasm of employees and transform the old, planned economy human resource management system into one that can adapt to the development of the market economy is a great challenge for enterprise managers.

In addition to the practical implications of the research mentioned above, this paper also has some limitations. After modelling and analysis, there is not any dynamic analysis and actual calculation of the weight of the bankruptcy-related factors; this calculation process needs a large number of accurate data support, which is the author's follow-up research direction.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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