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Business failure research

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ABSTRACT

In spite of a growing body of literature on business failures in China and effects of government policy, our understanding of the current state of knowledge remains unclear. The study advances research on the subject by developing the “four-parties” framework to review and synthesise the literature. The paper lays the groundwork for an integrated understanding of the causes and consequences of business failure. In sharp contrast with the evolution and development of Western-based business failure research, much of the literature on China and Chinese firms has focused largely on business failure prediction models by bypassing the traditional evolution from qualitative case study/story approaches to quantitative-based approaches. The study outlines the important implications and promising avenues for future research.

Keywords: Government policy; business failure; China; industrial policy

Introduction

Over the past half a century, a plethora of scholarly works has focused on mainly business failure of Western companies, with little attention to firms originating from emerging economies (e.g. Baum and Oliver, 1991; Hambrick and D'Aveni, 1992). In a departure from past tradition, the last few years have witnessed a burgeoning stream of research on business failure in emerging economies, in general, and China, in particular (e.g. Bottini, 2003; Li and Sun, 2009) and the effects of government policies (see Zheng and Zheng, 2013).

Despite this stream of research, somewhat surprisingly, scholars have overlooked the need for a comprehensive overview of the state of knowledge in this unique area. One of the main explanations for this is that studies have emerged across multiple disciplines such as information systems, international business, public policy organisation studies and entrepreneurship. As such, there has been little cross-fertilisation of ideas and concepts.

The purpose of this article is to review the literature on the causes and consequences of business failures in China. We depart from much of the existing literature by offering a unifying perspective on the causes and antecedents of business failure. Our work also presents fruitful avenues for future research. This study adds to our understanding of why companies fail in an increasingly globalised world (Mellahi and Wilkinson, 2004) and the concept of scenario planning (Sarpong, Maclean and Davies, 2013). Another contribution stems from developing the organisational failure framework to review and synthesise the literature.

The rest of the paper is organised as follows. In the next section, we set out the rationale for focusing on China. This overview is then followed by an examination of the approaches to journal selection. We then set out the key findings. The final section outlines the implications of the review and directions for future research.

Business failure research: a conceptual development

By organisational failure, we mean “the actual demise of the organization when an entire company goes out of business or a plant, office, or other unit is closed ... the organization completely ceases to exist” (Marks and Vansteenkiste, 2008, p. 810; see also Amankwah-Amoah and Durugbo, 2015). We focus on dissolved firms. We contend that there are four main parties to a business failure event: failed firm, former employees/owner, outside firms and external organisations (see Figure 1). The reasons why firms fail have been identified to be of interest to diverse external organisations including investors, banks and policy makers (Reynolds, 1987).

Our argument is that these parties and factors connected to them interact to determine whether business failure occurs, how it occurs, how it unfolds and how it affects various parties. The framework accounts for the role of key players as business failure occurs and its effects on other firms. The failed firm is the firm that has ceased operations due to its inability to adapt to changes in the business environment. The outside firm refers to other firms connected (directly or indirectly) to the collapsed business either as alliance partners, customers or suppliers (Amankwah-Amoah, 2014a, 2014b; Amankwah-Amoah and Zhang, 2015). Outsider firm factors such as aggressive competitive strategies can undermine and weaken the basis of the focal firm’s successes and thereby precipitate its demise.

Former employees/owners are the internal constituents of the collapsed firm. External organisations refer to third-party firms such as courts, regulatory bodies and governments that provide support and legitimacy to aid or hinder the smooth functioning of the organisations. These also include banks, consultancy firms and market intermediaries that provide some kind of market-supporting mechanisms to enable firms to function effectively (Baum and Oliver,

1991; Meyer and Rowan, 1977; DiMaggio and Powell, 1983). These organisations may include bank lenders who can suggest changes in declining organisations (Gilson, 1989).

Insert Figure 1 about here

China in context

Since 1978, when the third plenum of the Eleventh Congress of the Communist Party of China started the “Open Door” policies, China’s economy has achieved remarkable successes with an annual growth rate of around 9.6% (Naughton, 2014). In 1983, the Central Committee provided further support to individuals in urban areas and eliminated the limitations that individual business owners could not hire more than eight employees.

In 1992, the Fourteenth Congress announced the goal that China’s economy was to further develop as a socialist market economy. The nature of the debate at the time was whether the private economy was to be more “socialist” or “capitalist” to enhance economic development and improve living standards (Deng, 1993, p. 372). Following this, the Fifteenth National Congress repositioned the private economy from the “supplement of socialist economy” to an “important” constituent of the socialist market economy.

During the administration of General Secretary Hu Jintao and Premier Wen Jiabao from 2003 to 2012, China’s economy reached an annual 10.4% average rate of GDP growth and responded to the challenges of the global financial crisis by implementing a massive stimulus amounting to 4 trillion RMB in investment projects. Although the market-oriented economic reform suffered stagnation under the Hu and Wen administration, there has been major progress since (Naughton, 2014). It has been suggested that vested groups, as one part of the Communist party, are enjoying privileges in many vital industries through a close relationship with corrupt officials and thus they have caused serious corruption in Chinese society (Naughton, 2014; The Economist, 2013). The invested groups had placed a lot of pressure on

government to restrict private enterprises from entering into some vital industries. Indeed, state capitalism has formed with the rise of vested groups, which is bound by national economy and affects the stability of China. Although state-owned enterprises (SOEs) are inefficient and bureaucratic, they continue to enjoy political support. Under the current economic situation and relatively weak institutions, it is difficult for private enterprises to innovate and grow.

Scope of the review

In order to ensure a comprehensive overview of the business failure literature, we adopted the best practice advocated by past studies (e.g. Cropanzano, 2009; Webster and Watson, 2002) and utilised by other review studies such as Short, Ketchen, Shook and Ireland (2010). We followed a two-stage approach to the review. First, we used keywords used by past studies to search electronic databases such as the Business Source Complete, JSTOR, Web of Science and Google Scholar. The keywords used included exit, default, insolvency, liquidation, death, failure, closure, loss and bankruptcy as used by past studies. These words were used in tandem with nouns such as Chinese firms, China, businesses in China and Chinese entrepreneurs.

Second, we then used the keywords in combination to reduce the number of studies that did not fit the scope of the review. We combined keywords (such as “bankruptcy” and “Chinese firms”, “insolvency” and “China”) to help narrow studies down. We then manually screened the articles by reading abstracts to ascertain the alignment to our main focus. We then limited our focus to studies where companies have actually exited an industry. We did not limit ourselves to any particular journals. Based on the above, we identified too many articles for inclusion in the review. After the general collection of articles, we classified them into several groups in terms of their relevance to the main topic and their position within that field.

An overview of the rate of business failure

Historically, firms of all sizes including SOEs, multinational enterprises (MNEs) and private enterprises fail. Our review indicates that from 2000 to 2012, nearly one third of firms exited within five years and nearly half of the firms failed within five to 10 years (SAIC, 2013). The high rate of business closure for local firms within three to seven years was similar to the US and Japan. One of the most compelling streams of scholarly works and practitioner literature related to the variation in rate of business failure across multiple industries and sectors.

From early 2008 to late 2012, around 3.94 million local firms exited to the Chinese market (SAIC, 2013). Table 1 shows the rate of business failure by sector from 2008 to 2012. The table demonstrates a high rate of business failure in retailing and wholesaling, manufacturing, leasing and commercial service, and transport and telecommunications.

As can be seen from the table, around 1.42 million wholesale and retail businesses accounted for 36.2% of the failure rate; 26.8% of the failed firms were in manufacturing and 17.1% in leasing and commercial service industries. The high rate of business failure in the three industries poses challenges for China's economic development.

In addition, the average lifespan of global corporations and multinational enterprises in the US can be between 40 and 42 years and more than eight years in SMEs in the US (D&B, 2011), but the number drops to about seven to eight years in Chinese corporations and only 2.9 years in Chinese SMEs (SAIC, 2013). The highest rate of business failure occurred within three to seven years (SAIC, 2013); specifically, the highest rate was in the third year of business in China with around 9.5%. After the third year of business operations, firms enter into a period with a high rate of business failure until the end of seventh year.

Insert Table 1 about here

The rate of business exit showed a decrease from 9.3% in 2008 to 6.1% in 2012 with an increase in the number of registered companies during the same period (SAIC, 2013). By the end of 2012, the number of Chinese firms was 13.2 million, 6.52 million of which were under five years old while 4.35 million operated within five to 10 years, accounting for 32.9%. In addition, 2.35 million of businesses had been in operation for more than 10 years, accounting for 17.7%. This means that around two million private firms filed for bankruptcy annually.

Although the first corporate bankruptcy law was adopted in 1986, it was not until June 2007 that the revised version of the law took effect with the passing of the Enterprise Bankruptcy Law of the People's Republic of China (Leng, 2013; International Insolvency Review, 2008). The new law included a re-organisation procedure analogous to the US bankruptcy law, a fundamental shift from the liquidation-oriented process associated with the old law (Leng, 2013; Evans and Borders, 2014). In so doing, the law now provides failed firms with an opportunity to recover. In 2013, the rate of bankruptcy for private enterprises increased to 15% (China Forbes, 2013).

It is worth noting, however, that the average lifetime of Chinese firms is around 6.09 years (Teikoku Databank (TD), 2012). In the service sector, the number was 5.93 years. In all firms, the average lifetime of SMEs was about 2.9 years and large firms can last around eight years (SAIC, 2013). Compared with Chinese firms, the average lifetime of SMEs in the US was more than seven years and the average age of large firms was about 40 years which was far higher than that of China (SAIC, 2013). Furthermore, the rate of business failure in manufacturing, related trades and commercial services was far higher than other emerging

economies such as South Africa and Russia (D&B, 2011, 2012). Figure 2 demonstrates an overview of the average rate of business failure.

Insert Figure 2 about here

Methods in use and evolution of business failure research

The vast majority of what scholars have uncovered emerged from laboratory experiments, observations and business-failure prediction models, with notable exceptions (e.g. Zhang and Alon, 2010). A number of studies have adopted bankruptcy prediction models such as logit model (e.g. Li, Lee, Zhou and Sun, 2011), case-based reasoning models (e.g. Li and Sun, 2009), neural networks (e.g. Tang and Chi, 2005) and decision trees (Li, Sun and Wu, 2010). These signify the appeal of such approaches to scholars. However, beneath this veneer of similarity lies the failure to capture how managers reacted to early warning signals and consequently learn from such action. Table 2 summarises the studies in this area and methods used.

Insert Table 2 about here

Despite the field's burgeoning interest in bankruptcy prediction models which have enriched our understanding, the intricacies inherent in the real world might differ. The study also uncovered that, in sharp contrast with the evolution and development of Western-based business failure research, much of the literature on China and Chinese firms has focused largely on laboratory experiments, observation and business failure prediction models by bypassing the “traditional” evolution from qualitative case study and stories to quantitative-based approaches (see Figure 3). Much of the western literature developed from being qualitative driven and storytelling in nature to a more quantitative approach, however, much of the

literature on Chinese business failure sidesteps these approaches and has leaped directly into largely quantitative approaches. As such, a more fine-grained inductive analysis is needed to enrich further our understanding.

Insert Figure 3 about here

Types of firms (private ownership versus state ownership)

A growing body of literature suggests that the causes of business failure tend to differ among SOEs and privately owned enterprises (POEs). Indeed, most failed firms from 2008 to 2012 were private enterprises (SAIC, 2013). Compared with SOEs, private enterprise SMEs tend to have a higher rate of business failure.

Research on state-owned enterprises

A number of scholars have suggested that in the case of SOEs, failures are often determined by government officials and bureaucrats (Peng, 2009, 2011). In some cases, they decide to allow chronically sick firms to operate with the financial support of the nation state and taxpayer. Indeed, in cases where the state-backed firm is considered “too big to fail”, the level of government support may be unconditional to the disadvantage of rival firms in the private sector (Peng, 2000, 2011). This is particularly important given that unlike privately owned firms, state-owned firms’ objective is not solely to maximise profits. Indeed, it has long been recognised that such firms help to create jobs to protect the public and mitigate social unrest (Peng, 2000).

SOEs, as part of the political system, are responsible for undertaking some social and economic duties in order to protect social security and stability, and thus they have to carry extra costs in operation (Lin et al., 1996; Yang and Temple, 2012). Resistance to SOEs’ failure often means many inefficient SOEs survive in competition for a long period of time.

One explanation for this is that China's commercial banks and investors prefer to offer a loan to SOEs rather than private firms due to government guarantees. Few public firms file for bankruptcy in China under the central planning system (Lin et al., 1996). More recently, it has become apparent that in China, local government officials do "their best to stop businesses from declaring bankruptcy even when they were making heavy losses because of concerns this might stir up social instability and hurt their political careers" (Ruan, 2013, p. nd). With regard to state-owned firms, their failure is often attributed to financial strains and lack of or unwillingness of local government to fund their loss-making businesses (Gao and Yao, 1999; Holz, 2001). Although many SOEs seem to be inefficient, they are more likely to survive in competition under institutional support and soft budget constraints (Jefferson, Rawski, Wang and Zheng, 2000).

Research on privately-owned enterprises

In the case of POEs, studies have uncovered that their exits are often attributed to the forces of competition which drive out inefficient firms and those unable to adapt and respond to technological change (Peng, 2009). Studies indicate that private enterprises in China's mainland accounted for more than 90% in all enterprises (Li, 2011). For the Chinese economy, private enterprise contributes more than 50% tax, 60% GDP, 80% urban job opportunities, 75% new products and 65% patents and inventions (Zhu and Sanderson, 2009). For example, in Shanghai, as China's most developed industrial city, the number of private SMEs accounted for more than 99% of the total number of enterprises, output value accounted for more than 30% of total output value, and the proportion of employment accounted for 71% (Li, 2011).

Despite their contributions, it is extremely difficult for most private enterprises to enter into many important sectors such as financial, petroleum, transportation, aviation and military. Private firms with more autonomy are more efficient than SOEs, but compared with SOEs it is more difficult for them to access resources and capital. For private firms, managers can rely

on informal relationships with government authorities and engage in political activities to increase their firm's chances of survival (Peng and Heath, 1996; Peng and Luo, 2000). This is because governments often control critical resources and opportunities which can fundamentally shape firms' competitive environments.

Research on environmental causes of business failure

In the past two decades, the causes of business failure in China have emerged to become one of the foremost topics of interest to management scholars. This line of studies suggests that business failure can be attributed to general environmental factors such as deregulation of industries (e.g. Zhang and Round, 2008; Zhou, 2011), intense competition in industries such as retail and technology (e.g. Audretsch, 1990; Lee, 2013; Bullis, 2013), declining and uncompetitive industries (see Zhang and Zhang, 2014) and overcapacity within industries such as solar PV (e.g. Lee, 2013; Bullis, 2013). In the case of deregulation, the incremental easing of the protective cover of many regulated industries has led to intense competitive rivalry. New breeds of firms have emerged to exert considerable pressure on existing firms leading to others' exit.

The academic and practitioner literature both indicate that liberalisation has often created the competitive space, thereby fostering the "survival of the fittest" through market competition (Ruan, 2013; Zhou, 2011). Much of the existing stream of research has been into the role of market competition. For instance, Audretsch (1990) suggests that the degree of market competition affects the rate of survival of business. This study shows that for China's private enterprises, it is tough to enter or survive in some industries due to aggressive reactions from SOEs, which serves as a barrier to entry. In 2014, the Ministry of Industry and Information Technology announced new targets for closing down backward production facilities in low-

end manufacturing and high-polluting industries such as steel manufacturing, concrete production, papermaking and coal mining (Zhang and Zhang, 2014).

Another stream of studies has identified external factors such as lack of institutional support for entrepreneurs (see Bruton and Ahlstrom, 2002; Lee et al., 2007), technological change, politics and government policies (e.g. Peng, 2009, 2011) as some of the primary causes of business failure. Recent years have witnessed a flourishing stream of research indicating that government can impose regulatory constraints on firms which stifle their development and eventually lead to their exit.

Some scholars have suggested that government can impose regulatory constraints on firms which stifle their development and eventually lead to their exit. An important feature of this line of research suggests that the degree of financing difficulty determines business failure in China (Clementi and Hopenhayn, 2006). Indeed, there is a high probability of business failure due to difficulties in getting access to financial support (Li and Yu, 2009). This is more prevalent in the private sector.

One of the most significant bodies of research suggests that the number of difficult-to-foresee events such as major floods, earthquakes and tsunamis can lead to business closure. These indiscriminate “Acts of God” can cause major disruption leading to exit or even wipe a company from its existence. Organisational decision makers have often found them difficult to predict and act to mitigate them. Figure 4 demonstrated the key determinants of business failure identified.

Insert Figure 4 about here

Research on organisation-specific factors

Current firm/failed firm

From an organisation-specific perspective, a number of factors such as lack of managerial and technical expertise, poor strategy and vision, and inability to understand and respond to environmental change has been identified as major causes of business failure. Research across studies has shown that within the failed firm, leadership and firm-specific factors contribute to business failure. Human capital and financial resources have been identified as antecedents of organisational decline leading to failure.

There is a growing body of literature that suggests that organisational failure may originate from the actions and inactions of the decision-makers in the organisation (Amankwah-Amoah, and Debrah, 2010, 2014; Nutt, 1999). Some studies have uncovered that managers often have the capacity to be able to mitigate or stop organisations from sliding further towards eventual collapse. The level of expertise of the individual within the organisation and his/her level of authority and power in influencing matters play an important role in shaping the fate of the organisation.

External organisation

A growing body of work documents that outside firms may hold a stake in the focal firm and in so doing helps to determine its fate. Some scholars have uncovered that those external agencies/organisations can cause organisations to lose their legitimacy by withdrawing their licences or ability to operate which then tarnishes their image and ability to command public support. Resources, knowledge and expertise transferred from the outside firm may help to prolong the lifespan of the organisation for a period before its demise.

A large stream of research rooted in the financial and accounting literature has uncovered that creditors are a major source of legitimacy which, when removed, leads to the cessation of the business. Some firms depend mainly on creditors for their survival and therefore withdrawal

of support from its operations signals a lack of prospect to the outside firm which eventually leads to the cessation of the business (see Peng, 2009, 2011).

At one extreme, creditors have been found to help in some instances to prolong the survival of some businesses beyond their natural life. This includes instances where financially weak firms are able to secure access to finance for a limited period just before their exit. The external organisation plays an influential role in precipitating business failure and the outcomes. As such, lack of or weak support from external parties can precipitate business failure.

Outside firms

This stream of work suggests that the actions of outside firms can cause a focal firm to lose legitimacy or the backing of key stakeholders, leading to closure. This argument rests on the premise that some outside firms possess considerable slack resources which can buffer them against competitive pressures. Outside firms can aggressively compete to force the focal firms to defend their positions and inability to do so leads to exits. Other actions uncovered which contribute to failure include withdrawal of financial backing, inter-firm backstabbing and over-reliance on others.

Research on consequences of business failure

A growing body of recent research has documented the two sides to studies on the effects of business failure. The review identified both negative and positive effects.

Positive effects

One side of the debate holds that business failure unleashes multiple opportunities for new and surviving firms to thrive and more innovation to emerge. A considerable body of literature has stressed that there is inherent value for organisations and individuals in learning from their own and others' failure experiences. A line of research has pointed out that surviving and efficient firms can expect more resources and capital that can be gained from others' demise.

Recent research suggests that the exit of firms can make a contribution to productivity growth (Yang and Temple, 2012).

A number of studies have suggested that failure of large firms can have significant industry-wide effects on other firms. It is generally accepted that the exit or bankruptcy of inefficient firms is more positive for China's economic transition from its previous extensive pattern to an intensive pattern (Li and Gong, 2013; Naughton, 2014). The past decade has witnessed a stream of research that suggests that the exit of inefficient firms provides a potentially important element in reducing social waste and mobilising resources more efficiently (Jefferson, 2000; Yang and Temple, 2012). The exit of such firms can make a contribution to productivity growth (Yang and Temple, 2012). It is important for inefficient firms, especially SOEs in China, to exit to deploy resources more efficiently (Naughton, 2007; Jefferson et al., 2000).

In recent years, government authorities have instructed local authorities to accelerate the speed of closing down inefficient firms (Li and Gong, 2013). The exit of inefficient firms in transition economies provides a potentially important element in reducing social waste and mobilising resources more efficiently (Yang and Temple, 2012). Our review identified two types of learning from business failure: pre-business closure and post-business closure learning.

On one hand, the pre-business closure stem from learning that occurs as the organisation reaches a point of no return. These conditions provide space for managers to reflect on the experience and devise an action plan for the future. On the other hand, the post-business closure learning occurs after the business has closed and employees have been laid off. This period is often influenced by the role of the individual in bringing about the demise.

Negative effects

Another growing body of research suggests that there is a dark side to business failure. This view contends that business failure is often accompanied by negative effects on all the parties including the former employees and other firms connected to the dissolved firm. The effects identified in the practitioner and academic literature include stigmas and damaged reputation. Due to the stigmatisation of failure in Chinese society, small- and large-business owners often opted to “hide their wealth and secretly exit the market” to avoid their reputation being tarnished (Ruan, 2013, p. nd). In recent years, it has been suggested that the stigma of bankruptcy in China and fear of failure have often deterred individuals from setting up new businesses.

Although bankruptcy can tarnish the reputation of former business owners, the stigma is no longer as powerful as it used to be as wider society evolves and develops more moderate attitudes to failure (see IIR, 2008). An ongoing debate in this literature pertains to the effects of business failure on other firms. The goal of the market-oriented transition in China is to break the monopoly of SOEs and reallocate the resources to their best use (Yang and Temple, 2012).

Conclusion and discussions

The paper sought to review the literature on business failure in China. The review provides a theoretical foundation for better understanding of the subject. The study identified general environmental factors such as deregulation of industries, intense competition, declining and uncompetitive industries, and overcapacity within industries as some of the causes of business failure. Compared with the private sector, public sector firms have a higher rate of survival. Government supports through measures such as soft loans have been identified to help improve the survival chances of state-backed firms.

The study offered a unified framework of the “four parties” of organisational failure to articulate how party-specific factors interact and lead to business failure. As this review has

shown, one cannot explain the causes and consequences of business failure from only the failed firm's perspective without taking into consideration the roles of other parties in precipitating and mitigating business failure. Our review provides evidence to attest to the inseparability of the parties' framework in seeking broader understanding of the causes and consequences of business failure.

From a theoretical standpoint, this study represents one of the first major attempts to comprehensively review the literature on business failure in an emerging economy. In so doing, we shed light on one of the most important and key questions in international business (i.e. "*What determines the international success and failure of firms?*") posed by Peng (2004). Our review of the literature suggests some additional ways to advance our understanding of businesses failure research (Amankwah-Amoah & Debrah, 2010, 2014) and the concept of scenario planning (Sarpong & O'Regan, 2014). There appears to be an exclusive focus on using prediction models.

Although such studies have enriched our understanding, the intricacies inherent in the real world might differ significantly. These models also fail to capture how managers react to early warning signals and consequently learn from such actions. Therefore, there is a need for a more case-based examination of the issue. Another important area for future research will be to explore the interplay between external and internal factors, rather than the current exclusive focus on single factors. Such an analysis would be helpful for Chinese enterprises' self-improvement. There is also a need for studies on the failure of non-governmental and more public organisations to help enrich our understanding of the subject. Until recently, there has been little scholarly attention devoted to these issues.

From a public policy standpoint, the study indicates that firms' ability to pinpoint causes of business failure can help in improving organisational renewal of routines and processes and

chances of survival. By extending this insight, our study helps in fostering a more informed scholarly discourse on learning from business failure.

Although China has enacted law to protect the development of the private sector (Zhu et al., 2011), the preferential treatment by the government of state-owned firms often means less business opportunity for private enterprises and then limited growth and activity. There are inherent benefits in creating organisational environments to foster learning from rival businesses' failure. This article has only begun to outline the current state of knowledge and we hope that it serves as a catalyst in redirecting scholarly attention to important but overlooked issues.

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Figure 1: An integrative framework of business failure

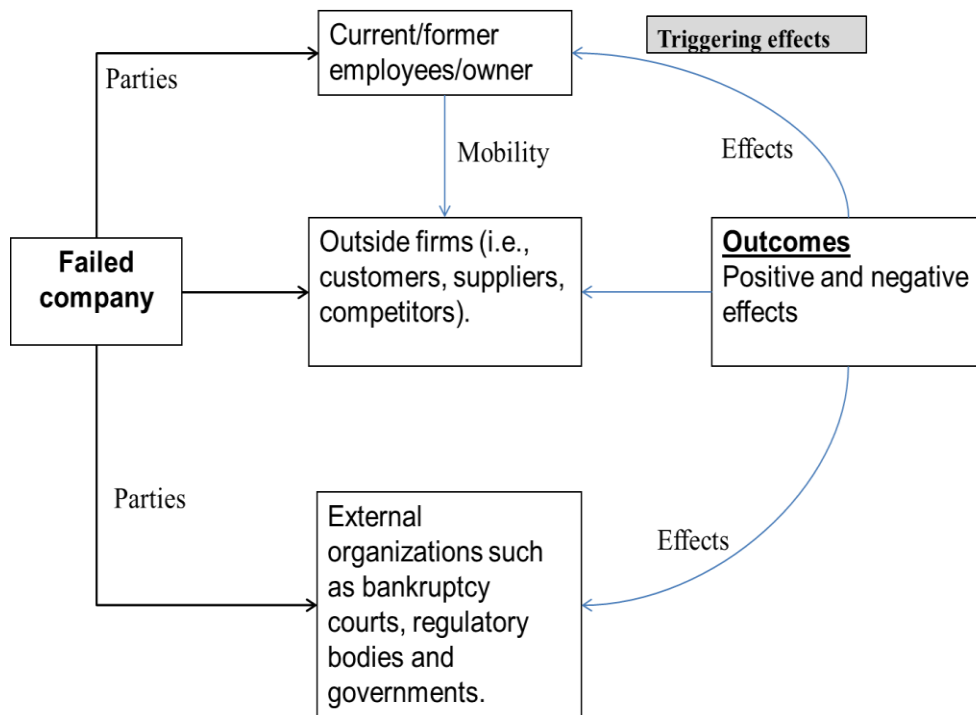


Figure 2: The average rate of business failure.

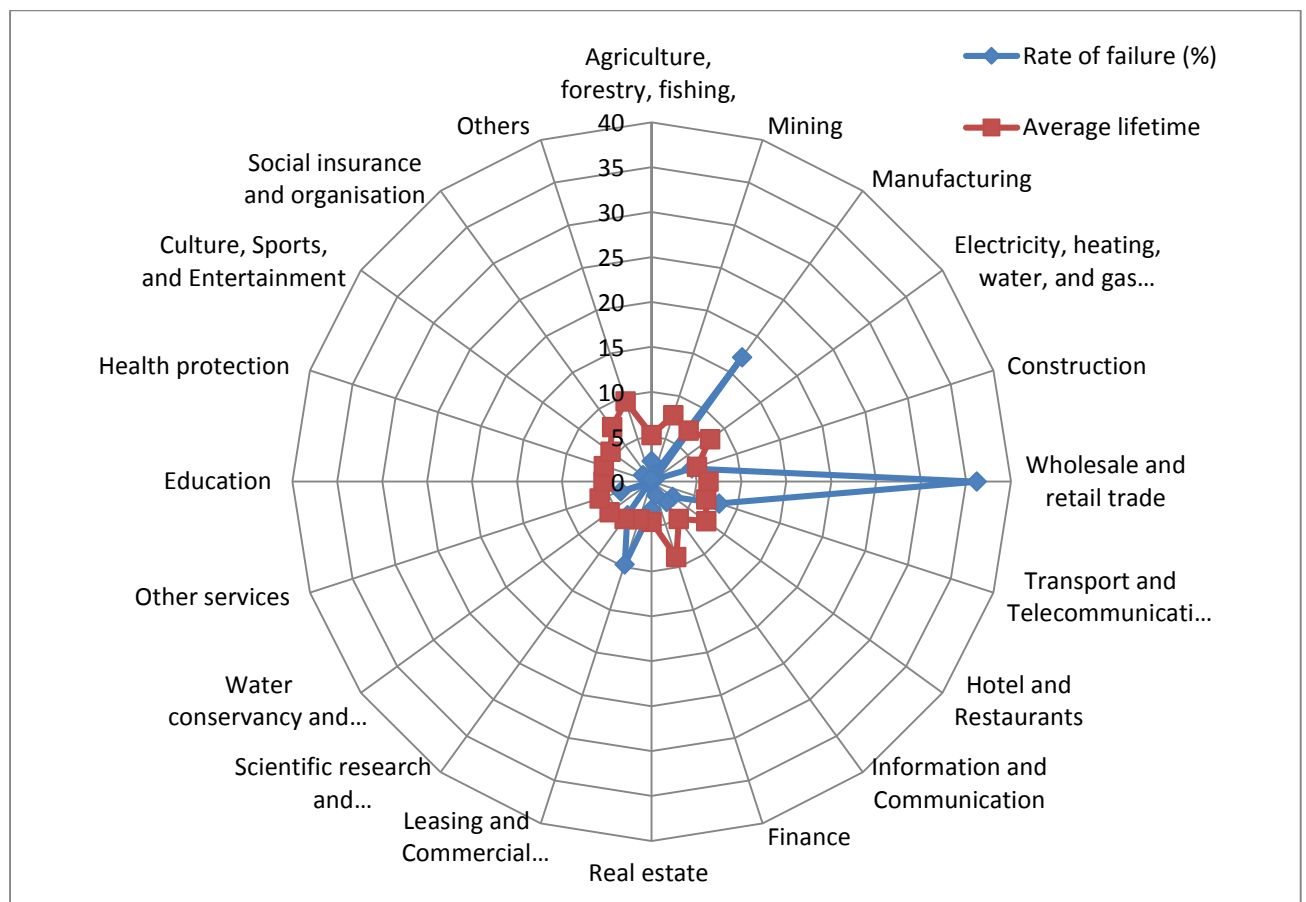


Figure 3: The evolution of the business failure research

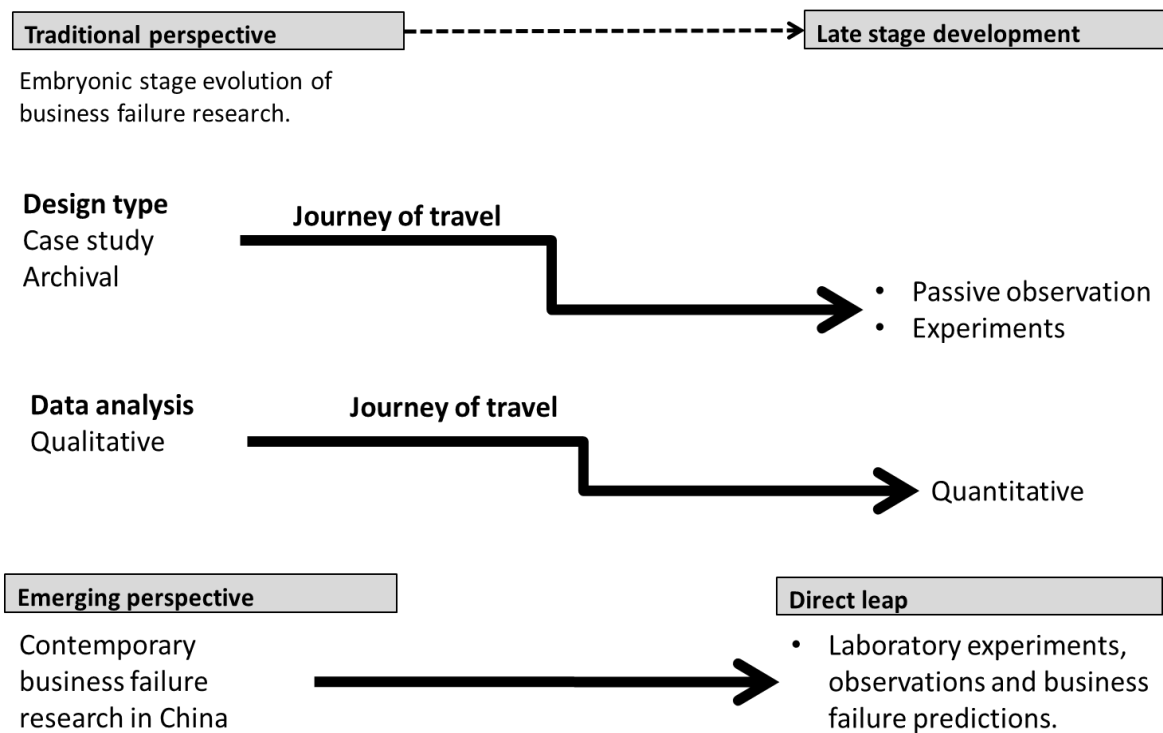


Figure 4: Framework of the causes of business failure

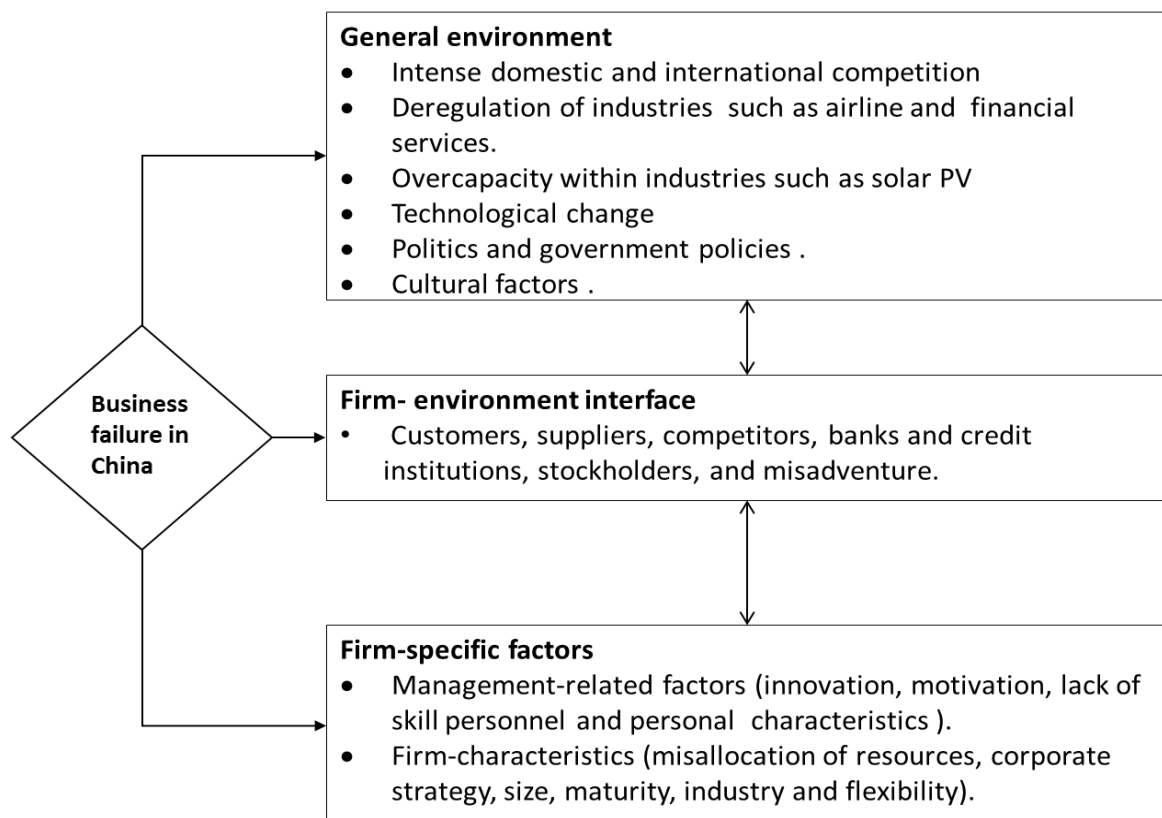


Table 1: The rate of business failure by sector in China from 2008 to 2012

| Sector | Number of Chinese firms (10,000) | Rate of failure (%) | Average lifetime |
|--|---|----------------------------|-------------------------|
| Agriculture, forestry, fishing, | 8.90 | 2.3 | 5.19 |
| Mining | 2.97 | 0.8 | 7.75 |
| Manufacturing | 67.43 | 17.1 | 7.01 |
| Electricity, heating, water, and gas production | 1.64 | 0.4 | 8.02 |
| Construction | 18.63 | 4.7 | 5.32 |
| Wholesale and retail trade | 142.84 | 36.2 | 6.32 |
| Transport and Telecommunications | 31.31 | 7.9 | 6.38 |
| Hotel and Restaurants | 11.34 | 2.9 | 7.49 |
| Information and Communication | 11.02 | 2.8 | 5.14 |
| Finance | 6.29 | 1.6 | 8.84 |
| Real estate | 12.41 | 3.1 | 4.49 |
| Leasing and Commercial services | 38.26 | 9.7 | 4.42 |
| Scientific research and Poly-technical services | 18.26 | 4.6 | 5.14 |
| Water conservancy and Environment and Public Establishment | 1.62 | 0.4 | 5.79 |
| Other services | 14.09 | 3.6 | 6.09 |
| Education | 0.56 | 0.1 | 5.36 |
| Health protection | 0.41 | 0.1 | 5.60 |
| Culture, Sports, and Entertainment | 4.79 | 1.2 | 5.67 |
| Social insurance and organisation | 0.44 | 0.1 | 7.50 |
| Others | 1.00 | 0.3 | 9.38 |
| Total | 394.22 | 100% | 6.09 |

Data source: SAIC (2013: 8)

Table 2: Type of prediction models and representative studies

| Model category | Representative studies | Key contributions and findings |
|-----------------------------------|--------------------------------|--|
| Logit model | Li, Lee, Zhou and Sun (2011). | <ul style="list-style-type: none"> The study found that the proposed RSBL model significantly improves the predictive ability of classical statistical models such as multivariate discriminant analysis, logit model and probit model. Thus, the proposed model should make logit model more suitable for predictive problems in academic and industrial uses. |
| Case-based reasoning (CBR) models | Li and Sun (2009). | <ul style="list-style-type: none"> The results indicated that GCBR produces superior performance in short term BFP of Chinese listed companies in terms of both predictive accuracy and coefficient of variation. |
| | Li and Sun (2010). | <ul style="list-style-type: none"> The study developed a hybrid case-based reasoning (HCBR) by integrating hybrid case representation into the forecasting tool. |
| | Li and Sun (2010). | <ul style="list-style-type: none"> The hybrid2 CBR (H2CBR) forecasting method was constructed by integrating six hybrid CBR modules. |
| | Li, Huang, Sun and Lin (2010). | <ul style="list-style-type: none"> The study found that the CBR is sensitive to optimal feature subsets with data for medium-term BFP. The stepwise method of MDA, a filter approach, is the first choice for CBR to select optimal feature subsets, followed by the stepwise method of Logit and the wrapper. The two filter approaches of ANOVA and t-test are the fourth choice. If MDA stepwise method is employed to select optimal feature subset for the CBR system, there is no significant difference on predictive performance of medium-term BFP between CBR and the other three models. |

| | |
|--------------------------------|--|
| Li, Adeli, Sun and Han (2011). | <ul style="list-style-type: none"> The results indicate that this new case-based reasoning forecasting method can produce significantly better short-term discriminate capability than comparative methods, except for the support vector machine, in normal economic environment. |
| Li and Sun (2011). | <ul style="list-style-type: none"> This research improves performance of ranking-order case-based reasoning by combining it with forward feature selection. The new method is applied to predict business failure of Chinese listed companies. The results show that the new method produced superior performance to classical algorithms of case-based reasoning, statistical methods, and a support vector machine. |
| Li and Sun (2011). | <ul style="list-style-type: none"> Support vector machine (SVM) is employed to be a baseline model for comparison. The results indicate that pseudo CBR produces better performance in Chinese BFP than classical CBR and grey CBR significantly on the whole, and it outperforms SVM marginally by total predictive accuracy and sensitivity, while it is not significantly worse than SVM by specificity. |
| Li and Sun (2011). | <ul style="list-style-type: none"> The study statistically validated the method by comparing it with other methods, including the best base model, multivariate discriminant analysis, logistic regression and the two classical CBR algorithms. One-tailed significance test indicated that PC-CBR-E produced superior predictive performance in Chinese short-term and medium-term BFP.) |
| Li and Sun (2013). | <ul style="list-style-type: none"> Using a CBR ensemble (CBRE) forecasting method constructed from the use of random similarity functions (RSF), dubbed RSF-based CBRE. The results from Chinese hotel BFP indicate that the RSF-based CBRE forecasting method could significantly improve CBR's upper limit of predictive capability. |

| | | |
|----------------------------------|----------------------------|---|
| | Li, Yu, Yu and Sun (2014). | <ul style="list-style-type: none"> The results show that compared with the other four methods, clustering-based case-based reasoning (CBCBR) performed significantly better in terms of sensitivity for identifying the minority samples and generated high total accuracy meanwhile. |
| Neural networks (NN) | Tang and Chi (2005). | <ul style="list-style-type: none"> The results show that the neural network models provide good classification capability in both cross-industry and industry-specific contexts. |
| Decision trees (DT) | Li, Sun and Wu (2010). | <ul style="list-style-type: none"> Empirical results indicated that the optimal algorithm of CART (classification and regression tree) outperforms all the comparative methods in terms of predictive performance and significance test in short-term BFP of Chinese listed companies. |
| Case study (multiple cases) | Li, Andina and Sun (2013). | <ul style="list-style-type: none"> The research statistically validated the results of the CBR ensemble from multiple case bases by comparing them with those of multivariate discriminant analysis, logistic regression, classic CBR, the best member CBR predictor and bagging CBR ensemble. The results from Chinese EOPFOF prior to three years indicate that the new CBR ensemble, which significantly improved CBR's predictive ability, outperformed all the comparative methods. |
| Case study (multiple cases)+SVMs | Li and Sun (2009). | <ul style="list-style-type: none"> The multi-CBR-SVM is feasible and validated for listed companies' business failure prediction in China. |
| k-NN+SVMs | Li and Sun (2012). | <ul style="list-style-type: none"> The proposed sampling approach helped models produce more accurate performance on minority samples, with accuracy rates in excess of 90 per cent. This method of using nearest-neighbour support vectors and correcting imbalanced samples is useful in controlling risk in tourism. |