

Research on the Influence of Digital Innovation of Financial Risks on Strategic Emerging Enterprises

-- Take Longji Green Energy Technology Co., Ltd. as an Example

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Abstract

With the deep integration of the digital economy and the real economy, the digital innovation of strategic emerging industries has become the core driving force of scientific and technological revolution and industrial transformation. However, as an unavoidable part of enterprise operation, financial risk and its potential inhibiting effect on corporate innovation activities have not been fully studied and analyzed. This article focuses on strategic emerging enterprises, taking LONGi Green Energy Technology Co., Ltd. as an example, and presents specific cases of corporate financial risk mitigation to empower digital innovation at the practical level.

Keywords

Digital Innovation; Financial Risk; Strategic Emerging Industries; Innovation Subsidies; Informal System.

1. Research Background

Under the guidance of the 14th Five-Year Plan, China is committed to accelerating the development of "strategic emerging industries" to promote the construction of a modern industrial system and high-quality economic development. This is not only a strategic plan for building a modern socialist country in an all-round way, but also a key strategy to cope with the scientific and technological revolution and industrial transformation that are taking place in the global economic structure and industrial map. Strategic emerging industries and future industries, as the new track of international enterprise competition and the main battlefield for the development of new quality productive forces, have a decisive impact on the country's scientific and technological progress and industrial innovation.

Entering a new era, based on an accurate assessment of the global trend of scientific and technological progress and industrial transformation, China needs to firmly grasp the initiative of innovation and development. By focusing on major technological breakthroughs and development needs, China will accelerate the expansion and strengthening of strategic emerging industries, thereby enhancing the modernization of industrial and supply chains and their ability to resist risks. This will promote an industrial development pattern with outstanding characteristics, complementary advantages and reasonable structure, and significantly enhance China's position and competitiveness in the global industrial chain and value chain, thereby promoting economic stability and far-sighted development.

2. Research on Financial Risk and Digital Innovation

There is no consensus in the academic community on how financial risk affects corporate innovation. Some scholars argue that financial risk inhibits firms' motivation to innovate, while other studies suggest that in specific circumstances, financial risks may actually promote firms' innovation efforts. Mone et al. (1998) pointed out that when a firm experiences financial risk,

managers may choose to respond through risky innovation, which may lead to two outcomes: one is to help the firm adapt to the rapidly changing market environment through innovation, thereby reversing the decline; The other is that a large amount of resources are invested in innovation, and if innovation is not successful, it may accelerate the depletion of enterprise resources and exacerbate the decline of enterprises^[1].

When the business is financially risky, managers' decision-making tendencies are different from those in non-crisis times. Laughhunn et al. (1980) found that policymakers tend to accept risk when initial losses are light; However, when losses are exacerbated and may even lead to corporate bankruptcy, decision-makers are more inclined to avoid risks^[2]. As financial conditions deteriorate, business managers tend to adopt more conservative business strategies and pay more attention to short-term issues related to declining performance, such as strengthening cost control, reducing innovation and risk-taking behaviors (Gaba & Joseph, 2013; Paeleman et al., 2023)^[3,4]. The formation of this behavior pattern is mainly due to the psychological stress caused by financial stress, which reduces the ability of decision-makers to deal with financial distress, leading to the formation of a conservative style in the organization (Staw et al., 1981)^[5]. While companies can also respond to this dilemma by increasing R&D and innovation activities, this often requires high costs and risks, and has a long payback cycle. When a company is in high financial distress, if it continues to increase R&D investment, it may deplete the limited resources of the company, not only will it not improve the current situation, but may exacerbate the company's distress (McKinley et al., 2014)^[6].

3. Case Study

3.1. Case Selection and Introduction

(1) Company Profile

Founded in 2000 and headquartered in Xi'an, China, LONGi Green Energy Technology Co., Ltd. ("LONGi") is the world's leading manufacturer of monocrystalline silicon solar products. LONGi Green Energy focuses on the R&D, production and sales of high-efficiency monocrystalline silicon wafers and solar modules, and its products are widely used in photovoltaic power generation projects in many countries and regions around the world. Adhering to the concept of technological innovation, the company is committed to promoting the transformation and upgrading of the global energy structure by providing high-efficiency and high-reliability solar products. Through continuous technology research and development and innovation, LONGi Green Energy has successfully developed a variety of high-performance monocrystalline silicon products, including monocrystalline silicon cells and modules with industry-leading efficiency. The R&D and promotion of these products not only improve the economy of solar power plants, but also accelerate the popularization and application of solar energy technology. In addition, LONGi Green Energy has also continued to invest in intelligent manufacturing and automation technology, and has established a number of fully automated production lines, which have effectively improved production efficiency, product quality, and reduced production costs. In terms of global business strategy, LONGi Green Energy has set up production bases and sales networks in key markets such as Asia, Europe, and North America, forming a global operation system. The company not only pays attention to market expansion, but also attaches importance to cooperation with governments and energy companies, participates in energy reform and new energy projects in many countries, and promotes the development and application of renewable energy.

In the face of the drastic price fluctuations within the photovoltaic industry, the ever-changing policy environment and the uncertainty of international trade, LONGi Green Energy Technology Co., Ltd. has adopted a series of refined financial management strategies to ensure the company's financial stability and capital efficiency. The Company implements a risk

diversification strategy to mitigate the impact of single market or product risk through diversified product lines and global market distribution. In terms of cost control, LONGi Green Energy has reduced production costs by optimizing the procurement process, improving the efficiency of raw material use, and adopting the latest technology. In addition, the company has strengthened liquidity management and maintained appropriate cash reserves to ensure rapid response in times of market volatility, thereby maintaining continued financial health and corporate growth.

LONGi Green Energy has shown obvious foresight and execution in digital transformation, which has not only improved the company's operational efficiency, but also enhanced its market competitiveness. The company has invested heavily in automated production lines and intelligent manufacturing equipment, and the introduction of these technologies has greatly improved production efficiency, reduced labor costs, and improved product consistency and quality. In terms of supply chain management, LONGi Green Energy uses big data analysis and cloud computing technology to realize real-time monitoring and optimization of the supply chain, which not only improves the response speed and flexibility of the supply chain, but also helps the company accurately predict market demand and effectively manage inventory. In terms of customer relationship management, the company has deepened its understanding and response to customer needs through integrated CRM systems and big data analysis, and improved customer service quality and satisfaction.

Through the above strategies, LONGi Green Energy not only effectively coped with financial risks, but also strengthened the company's core competitiveness through technological innovation and digital transformation, ensuring the company's leading position in the global photovoltaic industry. The implementation of these strategies enables LONGi Green Energy to continue to develop steadily in the complex environment of the photovoltaic industry, and at the same time lays a solid foundation for the company's future growth.

(2) Choose a reason

First, typicality and representativeness. As the world's leading manufacturer of monocrystalline silicon solar products, LONGi Green Energy is a significant representative of strategic emerging industries. Its business covers the entire industrial chain from polysilicon materials, silicon wafers to modules, which reflects the typical characteristics of enterprises in strategic emerging industries. As an A-share listed company in Shanghai and Shenzhen, its open and transparent financial reports and data can provide a rich and reliable basis for empirical analysis.

Second, the multi-dimensional display of financial risks. LONGi Green Energy faces many financial risks in the course of its operations, including fluctuations in raw material prices, exchange rate fluctuations, and international trade barriers, which directly affect its financial stability and profitability. This provides a vivid case study of how financial risk affects corporate digital innovation.

Third, the cutting-edge practice of digital innovation. LONGi Green Energy has forward-looking investments and remarkable achievements in digital and intelligent manufacturing, such as its application of automated production lines and intelligent manufacturing systems, as well as the optimization of supply chain and customer relationship management through big data and cloud computing. These practices are leading the industry and provide an empirical basis for exploring the practical effects of digital innovation.

Fourth, the combination of theory and practice. The case of LONGi Green Energy can be used as a bridge between theoretical research and practical operation, and its rich practice and challenges can verify and enrich the theoretical framework of financial management and innovation management, and provide a comprehensive perspective from corporate practice to policy recommendations.

3.2. Analysis of the Specific Impact of Financial Risk and Digital Innovation

(1) Financial risk

Table 1 shows the results of LONGi's financial risk indicators, namely Z-score and Adj.Z-value, calculated in this paper. The Z-score and Adj.Z-score are indicators that measure the financial health of a company, where the Z-value is a key parameter in the early warning model of enterprise bankruptcy and is often used to predict the likelihood of a business going bankrupt. A Z-score above 3 generally indicates a lower risk of insolvency, while a Z-score below 1.8 indicates a higher risk of insolvency.

As can be seen from LONGi's annual data, the company's Z-score has gradually increased from 1.24 in 2012 to 7.40 in 2021, showing that the company's financial health has improved significantly and its financial stability has been enhanced. This change reflects the positive effects of the company's effective financial management strategy and business expansion. In particular, in 2020 and 2021, the company's Z-score increased significantly, which may be closely related to the strengthening of the company's leading position in the global photovoltaic market and the growth of demand in the photovoltaic industry.

As an adjusted Z-value, the Adj.Z value takes into account changes in a company's market capitalization and can provide a more accurate perspective for assessing a company's market risk. The gradual increase from 1.13 in 2012 to 3.01 in 2021 shows that the company's risk in the market is gradually decreasing and the market value is increasing. This indicates that investors' confidence in LONGi Green Energy has increased, and market expectations are more positive.

Based on a comprehensive analysis, LONGi Green Energy has shown good financial health trends and market performance over the past decade. The company's growing asset size, increased working capital and retained earnings, and the ability to effectively control the growth of total liabilities are indicative of the company's significant performance in managing financial risk. In addition, the continuous expansion of the company's business and investment in digital transformation also provide solid support for its market competitiveness and financial stability. However, companies need to continue to monitor changes in the global market and policy environment to deal with potential uncertainties and risks within the PV industry.

Table 1. Financial Risk Calculation Table

year	Total assets	Working capital	Retained earnings	Market value of equity	Total liabilities	Operating income	EBIT	Z-value	Total market capitalization	Adj.Z-value
2012	4,728,090,297	1,198,256,698	893,582,956	918,000,000	1,808,559,323	1,708,325,053	13,681,175	1.24	4,733,625,960	1.13
2013	4,687,722,379	958,323,884	964,514,735	4,792,932,789	1,695,249,514	2,280,460,647	157,808,336	2.83	3,893,528,520	1.26
2014	6,449,337,831	699,376,540	1,231,142,477	6,481,811,766	3,186,780,206	3,680,168,521	397,994,400	2.39	7,081,590,600	1.46
2015	10,208,709,553	2,658,185,964	1,406,361,544	22,128,186,717	4,554,987,101	5,947,032,617	682,565,568	4.22	28,315,590,747	2.26
2016	19,172,404,496	5,590,630,949	2,873,849,591	23,422,017,705	9,078,794,757	11,530,533,461	1,894,677,888	3.03	22,445,394,359	1.73
2017	32,883,700,260	6,587,280,054	6,239,020,708	71,649,900,714	18,639,555,741	16,362,284,494	4,215,542,784	3.73	31,574,992,915	1.60
2018	39,659,244,131	8,022,404,848	8,438,263,820	48,513,372,525	22,834,483,901	21,987,614,950	3,134,309,632	2.63	68,334,025,271	1.85
2019	59,303,973,111	12,746,682,509	13,384,457,253	93,548,260,963	31,009,156,433	32,897,455,384	6,496,540,672	3.30	72,839,576,274	1.76
2020	87,634,828,684	12,008,753,554	20,503,589,707	347,749,000,000	52,036,767,691	54,583,183,588	10,290,198,528	5.51	93,696,896,244	1.73
2021	97,734,879,282	16,447,898,461	28,622,904,670	466,586,000,000	50,148,006,258	80,932,251,149	11,138,427,904	7.40	340,243,000,000	3.01
2022	139,556,000,000	30,287,447,184	42,027,185,405	320,247,000,000	77,301,291,301	128,998,000,000	14,563,663,872	4.44	390,761,000,000	2.83

(2) Digital innovation

From 2012 to 2022, LONGi's patent applications show several key growth points, especially peaking in 2020, which are closely related to the growing global demand for renewable energy and the widespread application of digital technologies in production processes. With the increasing demand for more efficient and lower-cost photovoltaic products in the global market, LONGi Green Energy has increased its R&D investment in the fields of automation, intelligent manufacturing, and data analysis. The surge in patent applications in 2020, particularly in the invention patent category, reflects the company's major breakthroughs in new product development and production process optimization. This change may also be a direct response to global supply chain disruptions during the COVID-19 pandemic, reducing dependence on the external environment by enhancing the intelligence and automation of internal production processes.

In terms of market adaptability of technological innovation, LONGi's digital innovation is not only limited to improving production efficiency, but also includes improving product performance and enhancing customer service. For example, the company's innovations in intelligent monitoring systems and energy efficiency management technologies make its products more competitive in the global market, while also helping customers better manage and optimize their energy consumption. The proportion of utility patents shows that the company has a high degree of flexibility and pragmatism in quickly adapting to market changes and directly applying new technologies. This ability to balance innovation with practicality allows the company to quickly adopt new technologies in the market and maintain the market leadership of its products.

In terms of the impact of innovation subsidies and policy environment, government subsidies and support policies for innovative technologies have a significant impact on LONGi's R&D activities. During periods of strong policy support, the number of patent applications of companies usually increases, indicating that policy incentives play an important role in promoting technological innovation of enterprises. At the same time, LONGi also needs to deal with uncertainties in the international trade environment, such as trade barriers and anti-dumping investigations. These external challenges have prompted companies to invest more in technological innovation and market adaptability to maintain their global competitiveness.

Table 2. Digital Economy Patent Application Form

year	Digital Economy Patents	Invention patents	Percentage	Utility model patents	Percentage
2012	26	11	42.3%	15	57.7%
2013	11	1	9.1%	10	90.9%
2014	7	1	14.3%	6	85.7%
2015	7	3	42.9%	4	57.1%
2016	15	8	53.3%	7	46.7%
2017	36	17	47.2%	19	52.8%
2018	27	9	33.3%	18	66.7%
2019	25	9	36.0%	16	64.0%
2020	109	78	71.6%	31	28.4%
2021	86	31	36.0%	55	64.0%
2022	62	33	53.2%	29	46.8%

Through an in-depth analysis of LONGi Green Energy's digital economy patent applications, this article shows how the company can use digital innovation to optimize its business operations, improve market adaptability, and respond to external economic challenges. LONGi's case clearly demonstrates how a strategic emerging enterprise can maintain its competitiveness in the global market through continuous technological innovation and achieve sustainable business growth through digital transformation. In addition, the company's experience reminds other companies of the need to take into account changes in macroeconomic policies and market needs when developing their own technology and business strategies.

(3) Financial distress and digital innovation

With the significant growth of LONGi's total assets, working capital, retained earnings and effective liability management, the company has successfully recovered from financial difficulties and grown steadily, providing a solid foundation for its continuous investment in digital innovation. From 2012 to 2022, LONGi's total assets increased from approximately RMB473 million to approximately RMB13.956 billion, reflecting the significant expansion of the company's scale and diversification of its business. During the same period, retained earnings increased from approximately 89 million to approximately 4.203 billion, indicating that the company has strengthened its self-financing capabilities and provided more internal funds for R&D and technological innovation. In addition, the increase in working capital increased from approximately \$120 million to approximately \$3,029 million, ensuring sufficient liquidity, enabling the Company to respond flexibly to market changes and continue to invest in the development of new technologies.

In addition, the year-on-year improvement in the Z-score, especially in 2020 and 2021, which increased significantly to 5.51 and 7.40, reflects a significant improvement in the company's solvency and financial health. This improvement reduces the company's financial risk, allowing LONGi Green Energy to withstand high-risk R&D investments. Behind the high Z-value is the company's effective cost control, capital structure optimization, and revenue and profit growth. The increase in operating income from approximately 171 million in 2012 to approximately 12.9 billion in 2022, as well as a significant increase in EBIT, all mark the company's strong performance in the market and improved profitability. These financial achievements directly support the company's continued investment in digital technology and product innovation.

In terms of digital innovation, LONGi Green Energy demonstrated significant growth in patent activity, especially the surge in patent filings in the digital economy in 2020, which was a positive response to the company's financial stability in the early stage. The increase in the number of patents, especially the significant increase in invention patents, indicates that the company has carried out in-depth technological innovation in basic and applied research. These innovations not only improve production efficiency and product quality, but also enhance LONGi's competitiveness in the global market.

In summary, LONGi's case clearly shows how it can enhance its innovation ability by improving its financial difficulties. Positive changes in financial metrics are directly related to the company's technological innovation, and this correlation reveals that a healthy financial position is a key factor supporting continued innovation and technological development. LONGi Green Energy has successfully combined financial management strategies with technological innovation to form a strong business model, allowing it to stay ahead of the fierce market competition.

3.3. Insights of The Case

The case of LONGi Green Energy Technology Co., Ltd. provides insight into the interplay between financial management and technological innovation, showing how the company can strengthen its innovation ability by optimizing financial metrics in high-tech and fast-changing industries.

First, LONGi Green Energy has successfully improved its self-financing capability by enhancing its total assets and retained earnings, which is key to supporting continuous technological innovation. The increased self-financing ability reduces the dependence on external financing, reduces the potential costs and financial risks caused by capital raising, and increases the autonomy and flexibility of the company in investment decisions. This is especially important for technology companies, as technology research and development often require huge upfront investment and a long payback period.

Secondly, an effective liability management strategy and sufficient working capital ensure that the company can maintain sufficient liquidity even during market fluctuations, ensuring that daily operations and R&D investment are not affected. In LONGi's case, despite the significant increase in total debt, the company successfully maintained financial stability and solvency through refined debt structure adjustment and cost control, which is reflected in the continuous improvement of the Z-score. This solid financial position provides a guarantee for the company to take on high-risk innovation projects.

Finally, LONGi's growth strategy also reflects the emphasis on operating income and EBIT, which not only improves the company's profitability, but also reflects the competitiveness of its products and services in the market. The increase in profitability has allowed the company to reinvest in new R&D projects, driving the development of new products and improvements to existing products, which is reflected in the significant growth of patents in its digital economy. Therefore, LONGi's experience is an important reference for other companies, especially those seeking to strengthen their R&D capabilities and market competitiveness through financial optimization. This two-wheel drive strategy of finance and innovation is the key way to achieve sustainable development in modern enterprise management.

4. Research Recommendations at the Local Government Level

Considering the significant heterogeneous impact of city-level factors, this paper puts forward suggestions from the local government level to help enterprises cope with the challenges of financial risks and promote the balanced development of regional economies.

(1) Strengthen the local financial support system. Local governments should establish special financial support mechanisms for non-municipalities and non-central cities, including the provision of targeted innovative financial support, venture capital and insurance products to reduce the financial risks of enterprises. This support is particularly needed for companies in heavily polluting industries that seek technological innovation to achieve environmental and sustainability goals. In this way, the risk-taking capacity of companies in these regions can be strengthened, and they can be incentivized to invest in innovation over the long term.

(2) Formulate differentiated regional innovation policies. In view of the significant differences in the impact of financial risks on enterprise digital innovation in different cities, local governments should formulate differentiated innovation policies according to the specific situation of their regions. This includes tax breaks, R&D subsidies, and tailored policy support, especially in non-central cities. In addition, the development of local innovation ecosystems can be further promoted by establishing or strengthening collaborations with higher education institutions and research institutions to provide technical support and R&D resources to enterprises.

(3) promote the positive impact of culture and values. Integrate the core values of Confucianism and red culture into policy formulation to enhance entrepreneurship and corporate social responsibility. Through education and public awareness, local governments can promote these cultural values and raise awareness among businesses and citizens about innovation and ethical management. For example, the importance of historical and cultural traditions and their

impact on contemporary corporate innovation can be taught through commemorative exhibitions, cultural festivals and lectures.

Through these measures, local governments can not only help companies mitigate financial risks, but also promote innovation and technology development in the wider region, contributing to overall and balanced economic growth. This will provide a more stable and stimulating external environment for strategic emerging enterprises, thereby accelerating their innovation process and competitiveness.

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