Investigating taiwanese and Mainland China foundry industries by spectral analysis

Investigación sobre industrias de fundición taiwanesas y de China Continental, a través de análisis espectral

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Abstract

Increasing numbers of Taiwan investors are investing in Mainland China foundry industry. This paper examines the existing development, difficulties and risk encountered for Taiwanese foundry industry in Mainland China and Taiwan. Telephone surveys and structured interviews are conducted with 50 foundry companies of 100% response rate. A novel research methodology, spectral analysis, is used for the analysis in identifying dominant factor(s) in the development of Taiwanese and Mainland China foundry industries. From the survey results, it is found that Taiwanese foundry companies tackle a multitude of management issues in both Mainland China and Taiwan; practical strategies must be implemented early to alleviate potential management risks and to promote smooth business operations. Providing enough cash flow and understanding cultural differences between two countries are suggested and encouraged to be concerned for Taiwanese when establishing their business in Mainland China foundry industry.

Keywords: Business environment, strategy, foundry industry, Mainland China, Taiwan

Resumen

Un creciente número de inversionistas taiwaneses se encuentran capitalizando en la industria de la fundición de China Continental. Este artículo examina el desarrollo actual, las dificultades y los riesgos enfrentados por la industria de la fundición taiwanesa en China y en Taiwán. Se han realizado encuestas telefónicas y entrevistas formales. Una innovadora metodología de investigación – análisis espectral – es empleada para el análisis de identificación del factor o factores predominantes para el desarrollo de las industrias de la fundición en Taiwán y China Continental. A partir de los resultados de las encuestas, se ha determinado que las compañías de fundición taiwanesas enfrentan una multitud de temas administrativos, tanto en China como en Taiwán. Es necesario implementar estrategias prácticas a la brevedad, con el fin de aliviar los potenciales riesgos administrativos y promover operaciones comerciales fluidas. Se recomienda proporcionar suficientes flujos de caja y comprender las diferencias culturales entre los dos países, así como fomentar la atención hacia los taiwaneses cuando éstos inician sus actividades comerciales dentro de la industria de la fundición en China

Palabras claves: Medioambiente comercial, estrategia, industria de la fundición, China Continental, Taiwán

1. Introduction

Mainland China economy has dramatically improved since the development of its open policy in 1978 (Yang, Kang, Liu, 2007). Development of the foundry industry is closely related to economy growth in Taiwan (Huang, 2004). Different materials and production methods are used in the production of casting products in the foundry industry. The most common types of materials used in the industry are iron, steel, aluminium, copper and magnesium (Huang, 2005). In Taiwan, the annual productivity of foundry products is about 73.550.000 tonnes (Huang, 2005), which is one of the highest in the world. The annual productivity of foundry industry has fluctuated since 2000. The total productivity peaked at about 1.7 million tonnes in 2004 (Shivappa, Babu, 1997). Due to China's massive investment market, there has been a dramatic surge for Taiwanese foundry companies investing in Mainland China (Ribeiro, Fiho, 2006). Figure 2 and 3 present the current development of Taiwanese industry investing in Mainland China and other countries respectively from 1991 to 2006.

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The figures show that the taiwanese foundry companies invest about 54% of the outward investment to Mainland China (Trading Database, 2006). After numerous years of development, the Taiwanese foundry industry has become an automotive industry, which builds up networks for different industries (Chen, Wu, Wu, 2006). The survival of the industry is crucial to success of other industries which rely on heavy machineries and casting components.

Figure 1. Un factor predominante fue identificado empleando el método de energía del espectro, por el contrario el método índice de importancia relativa (IRR) no pudo identificar el factor (Tam, Le, 2006)

Figure 1. A dominant factor identified using the power spectrum method while the relative importance index (RII) method cannot locate the factor (Tam, Le, 2006)

Figure 2. Inversión taiwanesa en China (Registro de Comercio, 2006)

Figure 2. Taiwan investment in Mainland China (Trading Database, 2006)

Figure 3. Taiwán aprobó la inversión hacia el extranjero, por país, en el período comprendido entre 1991 y 2006 (Registro de Comercio, 2006)

Figure 3. Taiwan approved outward investment by country in the period of 1991-2006 (Trading Database, 2006)

Due to the strict environmental laws and lack of attraction for young people to enter the industry in Taiwan, Mainland China becomes attractive to the Taiwanese foundry business because of their low labour cost and sufficient workers. The economic environment in Mainland China has rapidly improved in recent years. The automobile industry is also developing very quickly which means that the foundry industries are significantly growing. In 2000, the total number of Chinese foundry companies was about 12,000 which dominated about 62% of the world foundry market (Weng, 2001). The annual productivity in Mainland China has rapidly reached about 17 million tonnes which is ranked first in the world (Gao, 2006). The Chinese foundries produce casting products to supply various industries locally and overseas. These casting products are the cheapest around the world due to low resources and labour costs (Rabah, 1999). However, their quality is varied among Chinese foundries. For this reasons, the Taiwanese foundry industry has a gentle chance of competing in the Mainland China foundry industry.

There are a lot of researches related to foundry industry on the technology development. Foundry by products, clay sand bricks fired at 1050°C, were found to have a better physical properties values, while the mineralogy is not significantly affected (Alonso-Santurde, Coz, Viguri, Andres, 2012). Two-stage process was used for the regeneration of waste foundry sand by recycling and residue stabilization (Park, Kim, Yu, 2012). Waste foundry sand was found be able to use in manufacturing controlled low-strength materials and concrete (Siddique, Singh, 2011; Singh, Siddique, 2012). Strength, durability and micro-structural properties of concrete made with waste foundry sand were found effective as an alternative material, as partial replacement of fine aggregate in concrete (Siddique, Aggarwal, Aggarwal, Kadri, Bennacer, 2011; Siddique, Kadri, 2011; Kaur, Siddique, Rajor, 2012; Pathak, Siddique, 2012; Singh, Siddique, 2012).

There is limited study researching the management approach for improving foundry industry development. There are strong correlations between Taiwan economy and business investment opportunities in Mainland China. Many Taiwanese traditional industries including the foundry industry have established several new branches and production sites in Mainland China (Yang, Kang, Liu, 2007). Nevertheless some companies have failed to attain their expected business objectives due to difference business environment (Ku, Gurumurthy, Kao, 2006). Hence it is helpful to investigate effects of the business environment in Mainland China on the foundry firms of Taiwan-invested for foreign enterprises in Mainland China.

This paper focuses on: (1) studying the existing development of Taiwanese foundry industry in Mainland China and Taiwan; (2) introducing a novel research methodology, spectral analysis, for the analysis of survey results in identifying the dominant factor(s) in the development of Taiwanese and Mainland China foundry industries; (3) investigating difficulties and risk encountered for the development of Taiwanese foundry industry in Mainland China and Taiwan; and (4) suggesting strategies for Taiwanese in establishing business in the Mainland China foundry industry.

2. Research Methodology

To investigate difficulties and risks encountered by the Taiwanese foundry companies investing in the Chinese foundry market, a telephone survey has been conducted to increase the possible response rate. There are 50 Taiwanese foundry companies who have branches in both Mainland China and Taiwan. The survey was sent to 50 foundry companies and 50 responses were received with the response rate of 100%.

This survey results have been analysed by using relative importance index and have been published in 2007 (Tam, Zeng, 2007). With additional responses, this paper aims to use another methodology to analyses the survey and to provide an in-depth understanding from the industry. The questions of the survey can be seen in Tables 1 and 2.

It is the first time that data and signal processing methods are used to identify dominant factor(s) using their spectral energy level. The proposed method is expected to be better than the normal approaches, including mean and relative importance index because the energy associated with each factor is assessed (Lathi, 1998). From that, dominant factors can be easily identified as can be seen in Figure 1. This proves that the relative importance index or average value is not able to identify the dominant factor, but the power spectrum method can clearly identify the dominant factor among criterion. Because the spectral method reflects directly to the energy of an event, not the average value in the case of the normal approaches. It truly shows the effectiveness of the event, which is this case, the strength of each factor.

Power spectrum is used for the analysis in this paper. Before discussing the analysis details in the power spectrum, background of Fourier transform needs to be discussed as the power spectrum is based on the development from the Fourier transform.

The Fourier transform is a useful and powerful tool employed to study "frequency" components of signals and discrete data which are usually recorded in the time domain. After transforming the data into the frequency domain using the Fourier transform, signal energy distribution at different frequencies is revealed. Effectively, the Fourier transform can be considered as a prism where white light can be split into its individual spectra. For the case of the Fourier transform, the signal energy is split over the signal's spectrum which consists of a number of frequencies at which the frequency components are displayed (Lathi, 1998).

Frequency is normally defined as the number of repetitions over time and the concept of "frequency domain" is believed to be new in the field of project management. Frequency is inversely proportional to time, which means the larger the time, the smaller the frequency and vice versa. Using the concept of frequency and time, it can be said that data which have a long time span have densely concentrated spectra over a short frequency range and vice versa. The magnitude of the frequency components which are displayed over a frequency range or spectrum is defined as proportional to the signal energy. Signals which are continuous and periodic in time have densely concentrated energy spectra. For ease of understanding, the Fourier transform can be viewed as a mapping energy distribution in the signal in the frequency domain at which harmonic peaks or dominant peaks represent the peak energy concentration in the waveform. The concept of peak energy concentration can be analogously considered as dominant peaks in assessing criteria in surveys.

By estimating power spectra of the responses, it is possible to study the energy distribution in each criterion, from that, the criterion with the maximum energy distribution can be considered as the most important or most dominant. In other words, the correlation of various criteria can be revealed using the powers spectrum with the phase information being suppressed. The phase information is given by using the bispectral method.

There is no minimum sample required for the analysis; however, it will not suggest for samples less than 30 similar as most of the other analysis available around. All 50 samples are used for the power spectrum analysis in this paper.

After received the questionnaire responses and analysis the collected data by power spectrum, individual structured interviews are arranged with twelve respondents. The interviews are intended for gathering further comments; elaboration and interpretation on the results obtained from the questionnaire. This can ensure the consistency of the questionnaire results and structured interviews. The interviewees refer in this paper in the next section will be representing from individual structured interviewees.

3. Results and analysis

3.1 Difficulties and risks encountered in taiwanese foundry industry

The interviewees are asked to evaluate the Taiwan foundry environment. The results are listed in Table 1. Dishonoured cheques cause serious problems between companies and customers ranked as the major factor affecting the implementation of Taiwan business environment, with the power spectrum magnitude of about 1.57. Inaccurate signature and long usage period are commonly occurred among foundry companies, noted by an interviewee. Another interviewee highlighted that dishonoured cheques can directly affect their cash flow, particular for small-sized companies. The trust between customers and companies cannot be built up. The interviewees suggested the government should launched legislations for protecting the companies with dishonoured cheques.

Tabla 1. Resultados de la encuesta sobre medioambiente de la fundición en Taiwán
Table 1. Survey results on Taiwan foundry environment

	Magnitud de energía espectral/ Power spectrum magnitude	Clasificación/ Ranking
Las tasas de intereses por préstamos bancarios en Taiwán son más bajas que en China./Interest rates on bank loans are lower in Taiwan than in Mainland China.	1.01	10
Existen menos diferencias culturales entre las operaciones de una fundición en Taiwán y China, que en otros países./There is less cultural difference between operating a foundry in Taiwan and in Mainland China than in other countries.	1.15	5
El desempeño eficiente del trabajo en Taiwán es mayor que en China./Efficiency of work performance in Taiwan is higher than in Mainland China.	1.12	7
El gobierno taiwanés otorga tiempo para reaccionar antes de cambiar formalmente las políticas ambientales./The taiwanese government gives time to react before formally changing environmental policies.	1.28	3
Los cheques rechazados causan serios problemas entre las compañías y los clientes./Dishonoured cheques cause serious problems between companies and customers.	1.57	1
Existe una brecha de edad en la fuerza laboral de Taiwán./There is an age gap in Taiwan workforce.	1.13	6
La política medioambiental es estricta, por lo tanto es necesario estar conscientes de las nuevas políticas implementadas./Taiwan environmental policy is strict; therefore it is necessary to aware of new policies launched.	0.89	11
Las alianzas estratégicas son una buena manera de minimizar riesgos operacionales./Strategic alliance is a good way to minimise operational risks.	1.04	9
El empleo de mano de obra extranjera puede beneficiar a las industrias./The use of foreign workforce can benefit the industries.	1.22	4
Acumular ganancias es una excelente estrategia para establecer filiales en China./Accumulating profits is a good strategy to establish branches in Mainland China.	1.31	2
El desarrollo de nuevas técnicas de fundición y la transición de tipo industrial puede contribuir en forma significativa al futuro desarrollo de la industria de la fundición./Development of new casting techniques and transition of industrial type can significantly contribute to the future development of the foundry industry.	0.88	12
Solicitar a los clientes que reduzcan el uso de cheques, puede minimizar la cantidad de cheques rechazados./Requesting customers to shorten usage can minimise the number of dishonoured cheques.	1.05	8

Accumulating profits is a good strategy to establish branches in Mainland China ranked as the second major factor affecting the Taiwan foundry environment and received the power spectrum magnitude of about 1.31 from the survey results. An interviewed large-sized company explained that cash-in-hand is very important when you want to open a new branch before you have the first job. The cost includes deposit for company renting, employing staff and miscellaneous. By accumulating cash-in-hand, risk related to financial problems can significantly be reduced.

The taiwanese government gives time to react before formally changing environmental policies ranked as the third major factor affecting the Taiwan foundry environment and received the power spectrum magnitude of about 1.28. For new business companies first start their business in Taiwan, they experienced a lot of heavy fines with the unfamiliar environmental policies in the country. The interviewees suggested to have a reduction of the fines for new business companies for ensuring them familiar with the environmental policies for the first year after company registration. From the interview discussions, an interviewee stressed that environmental policies in Taiwan are strict; however, the Taiwanese government gives enough time for companies to react and to improve their performance before formal implementation. An interviewee also explained that the Taiwanese government will normally review the policies after implementing it for a few years and making necessary fine-tuning. This also explained why Taiwan environmental policies are strict, therefore it is necessary to aware of new policies launched ranked as the second least important factor in the implementation of Taiwan foundry environment with the power spectrum magnitude of about 0.89 from the survey results.

It is found that there is an age gap in the workforce received the power spectrum magnitude of about 1.13 from the survey results. The interviewees highlighted that foundry industry is not attracted by young age group. There are mainly relatively old people are currently working in the industry. There are also some young people working in the industry, mostly with low education background. The interviewees explained that the environment working in the foundry industry is very tough. Young people will not want to start with this industry unless no other industry can choose. Therefore, foundry industry may be disappear in the long term, noted by an interviewee.

Development of new casting techniques and transition of industrial type can significantly contribute to the future development of the foundry industry received the lowest power spectrum magnitude of about 0.88 from the survey results. The interviewees argued that the development of new casting techniques can provide a better opportunity for the industry to improve their own company business and their competitiveness around the world (Tsi, 2002); however, it can only be achieved in long term.

3.2 Difficulties and risks encountered in Mainland China foundry industry

From Table 2, it is found that inefficiency working performance commonly occurs in Mainland China ranked as the major factor affecting the implementation of the Mainland China foundry environment and received the power spectrum magnitude of about 1.24 from the survey results. Although labour cost in Mainland China is relatively low compared to other countries; it cannot directly lower the construction cost. As low productivity from Mainland China is commonly occurred which will require a large number of employees for ensuring quality products produced. Based on that, increase productivity of Mainland China workers is necessary. Therefore, proper staff training can increase productivity in Mainland China received the second highest power spectrum magnitude of about 1.24 from the survey results.

Tabla 2. Resultados de la encuesta sobre medioambiente de la fundición en China
Table 2. Survey results on Mainland China foundry environment

	Magnitud de energía spectral/ Power spectrum magnitude	Clasificación/ Ranking
Establecer filiales en China puede mantener intacta la cadena de abastecimiento./Establishing branches in Mainland China may keep the supply chain intact.	0.88	8
El bajo costo de mano de obra es un factor importante, por el cual las fundiciones taiwanesas establecen nuevas filiales en China./ Low labour cost is an important factor why Taiwanese foundry companies establish new branches in Mainland China.	1.05	5
La eficiencia de la fuerza laboral en China es menor que la de Taiwán./ Efficiency of the workforce in Mainland China is lower than in Taiwan.	1.10	4
Las fundiciones taiwanesas se adaptan a la sociedad China, más fácilmente que otros países inversionistas./The Taiwanese foundry is easier to adapt to the society of Mainland China than other foreign investors.	0.99	6
Las operaciones comerciales se pueden ver afectadas por serios problemas de corrupción en China./Business operations can be affected by serious corruption problems in Mainland China.	0.68	11
Generalmente existe un desarrollo ineficiente del trabajo en China./ Inefficiency working performance commonly occurs in Mainland China.	1.24	1
El gobierno chino no otorga tiempo suficiente para reaccionar antes de cambiar las políticas./The chinese government does not give enough time to react before changing policies.	1.21	3
Las comisiones y gastos bancarios son irracionalmente impuestos por el gobierno./Bank fees and charges are unreasonably imposed by the government.	0.76	9
La posición futura de las fundiciones en China puede reemplazar a Taiwán como principal país productor de maquinaria tradicional./ Future Mainland China position in the foundry industry can replace Taiwan as a main country producing traditional machines.	0.76	9
Un adecuado entrenamiento al personal puede incrementar la productividad en China./Proper staff training can increase productivity in Mainland China.	1.23	2
Una adecuada subcontratación puede aumentar la productividad en China./Proper outsourcings stem can increase productivity in Mainland China.	0.93	7

It is found that there is a very different observation on the results from Taiwan and Mainland China foundry environment. Government does not give enough time to react before changing policies received the third highest power spectrum magnitude of about 1.21 from the survey results. The interviewees highlighted that the Mainland China government formally changes or update the policies only within a short trail implementation period.

The industry may not have enough time to react or practice before the formal implementation, which cause them with heavy fines or even close of business for some small-sized companies.

Bank fees and charges are unreasonably imposed by the government received the power spectrum magnitudes of about 0.76 from the survey results. However, the companies still need to have a more careful cash flow and financial understanding of the company before the business start. As unpredictable bank fees and charges can significantly affect the financial situation in the companies.

From the survey results, it is found that business operations can be affected by serious corruption problems in Mainland China received the lowest power spectrum magnitude of about 0.68. The interviewees highlighted that although corruption is commonly occurred in Mainland China (Dong, 2006; Gori, 2006), the Mainland China businessman will not outlaw at the initial implementation. The government needs to enforce with strict legislation to protect the industry. The interviewees suggested that establishing an independent department to monitor and assess the corruption situation in Mainland China can improve the current situation. Necessary education should also be provided. The businessman will normally take extra care of the policies and regulations in related to their new business at the initial implementation period. However, corruption is one of their cultural behaviour which is hard to change within a short period of time.

Based on the above discussions and analysis, when Taiwanese businessmen are preparing to establish branches in the Mainland China foundry industry, they should: (1) have enough company cash flow for avoiding unnecessary problems or bankruptcies in the initial stage of business development and ensuring the establishment of a mature business environment, as dishonest cheques, unnecessary bank fees and charges, and penalties with the unfamiliar new environmental policies, may require additional resources; and (2) understand the difference environmental cultures between Taiwan and Mainland China, as working productivity and performance may be different from their expectations in Mainland China. Additional training and education may need to be planned in avoiding disappointment and thus affecting business expectation.

4. Conclusion

This paper examined the Taiwanese and Mainland China foundry industries. Telephone survey and structured interview were conducted. It was found that Dishonoured cheques cause serious problems between companies and customers, Accumulating profits is a good strategy to establish branches in Mainland China and The Taiwanese government gives time to react before formally changing environmental policies are the top three major difficulty and risk encountered for the Taiwanese foundry industry and Inefficiency working performance commonly occurs in Mainland China, Proper staff training can increase productivity in Mainland China and Government does not give enough time to react before changing policies for the Mainland China foundry industry.

From that, providing enough cash flow and understanding cultural differences between two countries were suggested and encouraged to be concerned for Taiwanese when establishing their business in Mainland China foundry industry.

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