



ASSET SPECIFICITY IN THE INDUSTRIAL WASTE MANAGEMENT INDUSTRY



Yeh, Wen-Chih^{1†} --- Tseng, Ming-hsun² --- Lee, Chun-Chang³

¹Department of Real Estate and Built Environment, National Taipei University, New Taipei City, Taiwan

²Associate Professor, Department of Real Estate and Built Environment, National Taipei University, New Taipei City, Taiwan

³Professor, Department of Real Estate Management, National Pingtung University, Taiwan

ABSTRACT

This study adopted a transaction cost perspective to examine the intra-organizational application of asset specificity in the industrial waste management industry and the potential tension it may cause to local and cross-strait organizations with respect to business operations. The industrial waste management industry faced considerable changes in the 1990s. While seemingly identical, the specific forms of asset specificity applied in the industry before and after the 1990s were actually very different, meaning that the operational flexibility of intra-organizational asset specificity could be explained by institutional changes. In addition to reduced transaction costs and skill development, specific access specificity was found to have an important and complex influence on the industry.

© 2016 AESS Publications. All Rights Reserved.

Keywords: Industrial waste management industry, Site specificity, Human asset specificity, Physical asset specificity, Specific access specificity, Transaction costs.

Received: 16 June 2016/ Revised: 9 August 2016/ Accepted: 1 September 2016/ Published: 10 September 2016

Contribution/ Originality

This study examined the actual application of asset specificity in the industrial waste management industry. Different types of domestic and cross-strait assets were specified one-by-one in the industry, including site, human, physical, relationship, and access specificity, and the industry's development and operations were analyzed.

1. INTRODUCTION

Before the 1990s, Taiwan was among the world's top five recyclers of scrap metal. The scope of industrial waste management organizations was small due to the prevalence of a home-based resource recycling system. With recent changes in the industrial environment and requirements, many new industrial waste management organizations have emerged. According to statistics provided by the Environmental Protection Administration (EPA), Executive Yuan, a total of 4072 organizations are engaged in industrial waste management in Taiwan, including 3892 waste disposal and 180 waste treatment enterprises (as of January 15, 2016). However, a little attention has been given to implementation and application of asset specificity in the industrial waste management industry. Asset specificity suggests a consistent vision of costs by buyer and seller and applies to specific transactions. In some cases, the importance of characteristics of both sides arises right when such a transaction begins. For example, when a buyer convinces a seller to invest in special physical assets which can effectively fulfill the buyer's needs, the seller is bound by such a

† Corresponding author
DOI: 10.18488/journal.2/2016.6.6/2.6.99.111
ISSN(e): 2223-1331/ISSN(p): 2226-5724
© 2016 AESS Publications. All Rights Reserved.

transaction, as well as the buyer for whom the cost of shifting purchase will be high [1]. Moreover, under the conditions of strong competition from international and domestic companies, industrial waste management organizations start investing specific human resources, equipment, and resources in order to attract customers who need waste disposal and recycling services and applying asset specificity in order to reduce transaction costs by increasing the internal operational flexibility.

In transaction cost theory, transaction cost is viewed as formed by differences in characteristics and management systems. The theory tries to explain the choices made by the both parties within a set of feasible organizations in order to minimize total transaction costs. Klein, et al. [2] suggested that the main role of specificity in transaction is the formation of specialized quasi rents by highly specific assets.

With regard to transaction cost theory, Williamson [3] maintained that asset specificity is important in describing transaction cost. In case of unspecialized assets, the market is efficient; semi-specific assets result in the emergence of bilateral market contracts; for highly specific assets, an intra-organizational model is required.

In addition to physical assets, specific transactions may also involve investments into human resources, e.g. professional training. Such transactions bring benefits in case of long-term and stable buyer-seller relations [1]. Agreement parties can considerably reduce communication costs and establish mutual trust by using relationship specificity to enable regular transactions. Thus, relationship-related specificity places an emphasis on trust and mutual adaptability [1]. Firms often integrate into industry clusters in order to reduce transaction costs. Site specificity develops when firms concentrate in one location and share equipment, technology, and human resources for the sake of cost reduction [4]. After applying physical, human, relationship, and site asset specificity to operations, firms must return to solving the issues regarding marketing channel expansion and profit earning. This requires the addition of specific access specificity into operations. Profits can be effectively gained after all types of assets are specified. Normally, much competition arises during transactions. However, bilateral monopolies can develop between buyers and sellers who use specified transactions due to a fixed structure of contract provisions regarding transaction costs and asset transfers. When investing equipment and financial resources into the disposal of a single source of waste, industrial waste management organizations cannot transfer the costs for equipment (physical), site, and human assets to the disposal of another waste source because these assets are fixed. For this reason, cleaning and disposal enterprises use highly specified assets.

This study examined the actual application of asset specificity in the industrial waste management industry. Different types of domestic and cross-strait assets were specified one-by-one in the industry, including site, human, physical, relationship, and access specificity, and the industry's development and operations were analyzed. Chapter 1 provides an introduction, background information about transaction cost, asset specificity, and franchising, and literature review to sort characteristics and operational modes of asset specificity. Chapter 2 introduces the time dimension of the issue and analyzes domestic and cross-strait operational modes of asset specificity in the industrial waste management industry before and after the 1990s using in-depth interviews and the perspective of institutional change. Chapter 3 uses analysis results to assess existing industrial development policies and recycling systems. Finally, the conclusion chapter reflects on the industry's potential development and countermeasures and provides suggestions.

2. ASSET SPECIFICITY THEORIES

2.1. Asset Specificity in Transaction Cost Economics

Transaction cost economics has long been used in different fields to explain the analysis of the interpersonal and inter-organizational interaction issues conducted by economic organizations that pursue a certain goal [5]. Transactions of different types form different governance structures. Asset specificity is a product of innovations in industry and the market and an important factor and characteristic of transactions studied by transaction cost economics [1].

Specificity of resources is a key element of a transaction which leads to fundamental transformation of transaction nature [6, 7] after which it is difficult for firms to change counterparties and, as a result, a long-term sustainable and comprehensive partnership is developed to maintain asset specificity [8]. There is a large number of resource suppliers who enter into transactions of two types, competitive and monopolistic. By increasing asset specificity, durability of human and physical assets can be supported. Firms obtaining specified assets during inter-party competition may effectively turn to bilateral supply to maintain the efficiency of asset specificity. Bilateral dependency resulting from asset specificity gives prominence to its function and increases the willingness of both parties to invest specified assets. This leads to lock-in transactions and enables companies to switch from free market transactions to vertical integration [7].

2.2. Asset Specificity in Different Transactions

Asset specificity is an important element of transaction cost [9]. Asset specificity suggests the inability to change counterparties in a specific transaction without damage to productivity [10]. Specified assets can be used only in specific transactions [7]. According to Williamson [11] by specifying assets, a partner can show cordial relationship and strengthen mutual trust between parties. Asset specificity is an important concept in transaction cost structure because it increases the efficiency of customer-supplier transactions and creates supplier dependence Ganesan [12]. Williamson [1] stated that the opportunity cost of using specified assets for particular purposes is low. However, specificity of different types of assets requires different operational modes. Williamson [1] distinguished between the following types of asset specificity.

(1) Site asset specificity

Firms conducting continuous production may consider using resources from a certain location in order to reduce inventory and transportation costs. Such site-specific investments are not easy to be transferred without increasing associated costs. Thus, transaction partners must maintain their relationship over a long term. A breach contract by one party causes considerable loss to the other party.

(2) Physical asset specificity

Physical asset specificity refers to portable asset investments into specific products or production processes, including design specifications, dies, and services. Normally, such assets are used for specific purposes and have limited transferability.

(3) Human asset specificity

Human asset specificity refers to professional skills acquired through learning by doing which cannot be transferred to other jobs. These intangible assets include special knowledge and experience gained through learning by doing.

Considering the characteristics of the industrial waste management industry, specific access specificity and relationship access specificity are also included.

(1) Specific access specificity

According to the theory of distribution channels, channels perform production functions related to distribution. They serve as intermediaries between manufacturers and consumers and create value for them, thus, developing an efficient mechanism for profit maximization in market transactions [13]. New institutional economics views channels as the main source of transaction costs, suggesting that the actions of channel members must all be controlled and ordered so that to ensure a fair profit gained by manufacturers [14]. Distribution channels are an extension of manufacturers. Manufacturers can maintain good relationships with channel members by introducing legal restrictions and economic incentives for asset-specific investments, collaterals, and sales promotions through negotiations and contracts [15].

(2) Relationship access specificity

In theory, relationship access specificity has both positive and negative effects on transaction relations [16]. With regard to its positive impact, relationship access specificity increases transaction efficiency [1]. By introducing relationship access specificity, a party makes a commitment [11] or pledge [17] to the relationship, thus, ensuring a good faith and guarantee in relations with the other party and increasing the effectiveness of cooperation between the organizations [18]. Improved relations and mutual trust lead to better outcomes of knowledge transfer between organizations and increased effectiveness of cooperation [19]. The negative impact of relationship access specificity includes hold-up problems [20] in which case the investing party is constrained by the transaction relations and held up by the other party, being unable to have a free and fair agreement or change the transaction partner [21].

2.3. Operations under Governmental Regulations: Concessions

A government and a company may enter into a concession contract in which the government agrees to the grant of concession rights to the company. In such a business arrangement, the grantor's (business) reputation, innovation ability, technical know-how, and competence are combined with the grantee's strength, diligence, and investments for product/service supply and sales [22, 23]. Being able to effectively integrate tangible and intangible assets from different owners, concession is often applied in Taiwan and other countries to reduce operating costs by giving professional operators a right to perform certain business operations and increase business profits through royalties and license fees; this allows to achieve the most effective integration of business resources [24]. Concession contracts are usually made long-term in order to reduce operational risk and related concerns. However, in this case, it is impossible to capture rapidly emerging market opportunities [24].

In an investigation of concession management methods in airports, Pashkin [25] proposed the following five models:

- (1) Direct operation: A company directly participates in business operations and fully controls and plans concession operations.
- (2) Standard leasing approach - direct lease: A company leases commercial space/facilities to concessionaires. Each operator enters into a lessee-lessor relationship with the company and must develop, finance, and manage concession facilities.
- (3) Developer approach: A company enters into an agreement with developers who are responsible for improving and maintaining the company's retail space and capital equipment, provide related financing and management, and perform all operations.
- (4) Fee management contracts: A company enters into an agreement with one or several domestic companies who are responsible for operating concessions.
- (5) Master concessionaire (operator) approach: A large part of space and operations related to a certain product (e.g. food and beverage, duty-free, etc.) are granted to the principal concessionaire.

This study discusses concessions in the industrial waste management industry in Taiwan and China which normally follows the direct operation approach described above. In China, industrial waste disposal and utilization can be realized only after a relevant concession is granted by the local government.

3. OPERATION OF SPECIFIED ASSETS IN THE INDUSTRIAL WASTE MANAGEMENT INDUSTRY

The development of manufacturing has long been the cornerstone of economic growth. The developmental course of the industrial waste management industry has become an important universal issue. In Taiwan, it grew from numerous and scattered home-based manufacturers suffering from technological lag into a large industry distributed over northern, central, southern, and eastern Taiwan and its outlying islands. Recent technology specialization and advancements in knowledge have spurred the developments in industrial waste management and utilization [26]. When a firm's technology and management reach a certain level, it tries to increase the efficiency of transactions and establish long-term partnerships by introducing preferential benefits to attract new customers and applying asset

specificity to increase the partner's willingness to maintain a long-term relationship [27]. However, there is a wide variety of industrial waste sources and their characteristics determine the way by which asset specificity is operated. The EPA divided general industrial waste into six main categories, namely, industrial, medical, construction, agricultural, educational, and defense waste; certain types of industrial waste are related to telecommunications, building, etc.¹ Currently, 58 items of industrial waste can be reused, including scrap metal (3C products, copper plates, wires, cables, scrap iron, scrap copper, scrap aluminum, etc.), waste paper, coal ash waste wood, waste glass, waste oil, waste vehicles, used batteries, etc [29].

In the early 1960s, a large percentage of scrap metal was imported.² Establishment of the Hsinchu Science and Industrial Park in the 1980s and the Southern Taiwan Science Park in 1995 brought Taiwan's manufacturing industry onto the world stage. On January 1, 1993, the "Industrial Waste Import, Export, Transit and Transshipment Management Measures" were enacted. Later that year, the "Prohibition of the Import of Scrap Metal" was implemented,³ which brought radical changes to the industrial waste management industry in Taiwan. Organizations split into two types, those that continued to dispose reusable industrial waste inside Taiwan and those that started moving their businesses to neighboring China (mainly to Nanhai District of Guangdong Province) as they had been disposing imported industrial waste [31]. This study examined operation of asset specificity in the industry before and after the 1990s.

3.1. Operation of Asset Specificity in the Industrial Waste Management Industry Before 1990

Before 1990, the living conditions in Taiwan were poor and many villagers seeking to cover family expenses joined the scrap metal recycling industry which had a lower barrier to entry and specialized in recycling old and waste products collected from common people. After 1960, larger manufacturers began to disassemble and process products imported from abroad (the US and Japan) [32]. The Waste Disposal Act was enacted in 1974 which introduced official regulations for waste collection and disposal in Taiwan. The Environmental Protection Bureau (EPA, Executive Yuan) was established in 1982 and served as a prototype for official environmental protection organization and system. This study examined the industry development of that period in terms of site asset, relationship access, and specific access specificity.

(1) Site asset specificity: Outcomes of governmental assistance

In the 1970s, Huifa, King Hwa Lung, Sunder, and Da Kong enterprises organized the Imported Scrap Metal Collection and Distribution Center out of the container yard used for cement production near Bo'ai Road in Kaohsiung City. Transportation method used for such imported scrap iron and other metal was bulk freighters. By 1980, the four companies collectively demanded the government to allow import by cargo containers.⁴ On September 13, 1983, the Environmental Protection Bureau and Industrial Development Bureau, Ministry of Economic Affairs, held a meeting to discuss establishment of Scrap Metal Special Zones in Daliao District of Kaohsiung City (Dafa Industrial Park) and Wanli Industrial Park in Tainan City where many companies were concentrated. That time was marked by a flourishing of the industrial waste management industry in Taiwan.

The growing amount of imported scrap metal was disposed of by open air incineration or treated using acid etching, which resulted in dioxin emissions, considered the "poison of the century," and cases of green oysters caused

1 Subcategories of six main types of general industrial waste are related to telecommunications, cleaning and disposal, gas fuel supply, and other industries [28].

2 At that time, Taiwan's manufacturing relied mainly on light industry, while heavy industry had a secondary role. Due to the lack of natural resources in Taiwan, they were imported from abroad. The main sources of waste goods were the US and Japan.

3 The import of scrap metal was prohibited because of inability to control pollution caused by established specialized zones and violation of land and water use regulations by sewage treatment and acid etching plants in Taiwan. However, the government did not prohibit all operations of these plants but only the import of waste wires and cables, while considering their processing capacity [30].

4 Source: <http://www.thinkingtaiwan.com/content/1415> (accessed February 25, 2016)

by environmental and soil pollution. Therefore, in 1993, the government prohibited the import of scrap metal, which was followed by periodic rises and falls in the industrial waste management industry. Many companies located in the Scrap Metal Special Zone in Tainan's Wanli Industrial Park that were dependent on the import experienced declines. The Scrap Metal Special Zone in Kaohsiung's Dafa Industrial Park continued to operate by refocusing its business and has been a home for 80% of Taiwanese organizations working with basic metals and metal products [33].

(2) Relationship access specificity: Focus on reputation and emotion⁵

Formerly, waste disposal and treatment organizations in Taiwan were mostly home-based businesses which passed their technologies from generation to generation and relied on word-of-mouth marketing. Relations between these companies were based on reputation and personal connections. Recent emergence of large-scale recycling organizations has put home-based firms into crisis, forcing them to invite professional managers to run their businesses. Trained young enterprise, financial planning, and industrial planning managers have changed the nature of business relationships from personal to contractual.

(3) Specific access specificity: Building leadership through possessing the waste sources

Before 1990, the manufacturing industry in Taiwan was in its infancy; therefore, a waste recycling system was not fully developed and most waste originated from abroad. Thus, leadership could be developed by focusing on domestic companies connected with waste sources located abroad.

3.2. Operation of Asset Specificity in the Industrial Waste Management Industry After 1990

(1) Site asset specificity: Industrial agglomeration and domestic/overseas division of labor due to institutional changes

Before 1960, living conditions in Taiwan were poor. Waste was mainly produced by common people and waste management businesses were home-based. The period after 1960 is associated with the concentration of larger companies which started assembling and processing imported scrap metal. Despite the presence of such organizational systems, most businesses remained to be home-based and dispersed. The implementation of environmental protection policies which allowed the government to start controlling the industry and the establishment of Scrap Metal Special Zones in Dafa Industrial Park and Wanli Industrial Park led to a tendency towards industrial agglomeration after 1990. The manufacturing industry in Taiwan rapidly developed between 1990-2002. In order to provide the industry with ample methods of industrial waste disposal, in 1993, the Ministry of Economic Affairs and EPA jointly signed the Guidelines Governing Counseling for Industrial Waste Removal and Disposal System and actively promoted the idea of joint removal and disposal of waste.⁶ This resulted in widespread emergence of waste treatment organizations over northern, middle, southern, and eastern Taiwan and outlying islands. However, due to environmental pollution issues and the prohibition on importing scrap metal, many organizations moved their business operations to neighboring China.

With the change of China's economy model from centrally planned to market-oriented in 1990, the Chinese government launched reforms on housing policies, which created a great demand on copper, aluminum, iron, and other metals. Due to the growing price of recycled metals, metal recycling attracted many investors. However, intervention of the State Council slowed down the industry's development. Control over non-ferrous metals belonged to government-run enterprises but insufficient supply of non-ferrous metals which was initially the reason for the government's intervention negatively affected infrastructure. Therefore, the government had no choice but allow private enterprises to address the lack of supply [34]. Due to a limited production of non-ferrous metals, much scrap metal from the US, Japan, Australia, Korea, Taiwan, etc. officially entered Chinese recycling market through Guangzhou, Shenzhen, Hainan, Foshan, Qingyuan, etc. At that time, Taiwanese industry broke into the Chinese

⁵ Based on summaries from interviewees A, B, C, G, H, and I (see Appendix 1).

⁶ Source: <http://proj.tgpf.org.tw/riw/page4-1-1.asp> (accessed March 24, 2016)

market, with Nanhai District of Guangdong Province being the main territory for export. At the peak of the industry, the percentage of Taiwanese companies reached 80%.⁷ With the joint efforts of cross-strait companies, the Taiwanese industry could close the technology-funding gap and gradually permeate local recycling markets.

(2) Physical asset specificity: Vertical integration and expansion of facility services⁸

In addition to innovations and R&D in the manufacturing process, machinery equipment is another aspect of the industrial waste management industry that needs to be developed. Due to the issues associated with equipment and dies, their development requires effort-consuming investments. In order to reduce the cost of the die use, many Taiwanese companies develop their equipment in China. According to the Solving the E-waste Problem Initiative (StEP) statistics reported by the United Nations Environment Programme (UNEP), 70% of the world's electronic waste was handled in China, as of 2013 [35]. Thus, equipment and die components for industrial waste recycling are easier and cheaper to develop in China than in Taiwan. According to EPA statistics (from January 1, 2010, to August 7, 2015), 36 Taiwanese companies obtained a permission to export to China.⁹ In addition, many companies established subsidiary companies in China, including Plus Metal Tech, Liwu, Kailun, and Cheng-Rong. As a result, machinery and related automatized facilities of Taiwanese parent companies is are manufactured in China through vertical integration and then assembled in Taiwan.

(3) Human asset specificity: Knowledge transfer, technology sharing, and R&D innovations¹⁰

A. Learning by doing, doing by learning

In earlier years, backyard furnaces were used in Taiwan for industrial waste disposal. With the growing diversity of industrial waste, companies must gain a deeper understanding of characteristics, processing, and decomposition of different products in order to maintain their competitiveness. Under these conditions, learning by doing and doing by learning are an important channel for entering the industry. People who are actors in this channel gradually retain the technology through oral dictation or implementation and acquire it through mutual learning and knowledge exchange with support from up- and down-stream and other companies.

To date, the traditional models of operations no longer fulfill the existing requirements. Although young people can gain professional knowledge through scheduled or non-scheduled classes provided by colleges and universities and the EPA, very few are able to apply it in practice. Only a small number of experienced operators are responsible for managing the technologies because young people are intimidated by the real environment which is not similar to operating technologies in a clean room and the large amount of industrial waste. Certainly, new industry-related information keeps appearing. However, technologies cannot always develop apace, which is a concern of the industry.

B. Mentoring system

When seeking sources of waste, technicians (account executives) in waste management companies must have excellent product inspection skills (knowledge and technology) to be qualified to perform subsequent waste treatment operations. Coating elements of any waste product are heterogeneous and copper/aluminum/iron contained in a product must be carefully considered before its purchase because errors in such estimation may affect the profit brought by the product. A mentoring system is an important method by which required knowledge and technologies can be learned.

C. R&D innovations

In Taiwan, R&D in the industrial waste management industry is governed by EPA policies. Most companies conduct R&D in cooperation with educational and research institutions. Applied R&D models include the following:

7 Source: http://ago.gcaa.org.tw/env_news/199804/87041604.htm (accessed April 10, 2016)

8 Based on summaries from interviewees A-1, B-1, C, and G

9 Source: <http://waste.epa.gov.tw/qry/ExpPerm.aspx> (accessed April 8, 2016)

10 Based on summaries from interviewees A, B, C, D, E, F, and G.

A. Governmental policies and talent development

The EPA's responsibilities include implementation of related policies, tracking and supervision of industrial waste sources, environmental monitoring and control, and waste import and export control. The EPA established Environmental Professionals Training Institute to provide training programs for environmental professionals, professional certification, and environmental protection certification to improve talent quality in the industry.

B. Technology R&D assistance from research institutions

The Metal Industries Research & Development Centre and Research Institute for Industrial Metals have long been cooperating with the industrial waste management industry. Companies and these institutions can discuss difficulties in the manufacturing process associated with limited environmental equipment and high costs. After the institutions conduct tests and make revisions, companies may proceed to production.

C. Interaction between companies and educational institutions

Talent acquisition is an important issue in the industry. Graduates are usually unwilling to enter the industry due to its certain characteristics (e.g. mental and physical strain, likely exposure to toxic substances during the manufacturing process, etc.), which has resulted in a talent shortage. For the sake of the industry's sustainable development, companies start interacting with academia and provide financial aid and equipment in exchange for R&D of innovative ideas and technologies.

D. Independent R&D

Companies can exchange new concepts and information via policy and academic meetings organized by the industry's trade association. Subsidiary companies located in China may provide their feedback regarding R&D innovations to parent companies.

(4) Relationship access specificity: Establishment of social and trans-boundary networks

In the industrial waste management industry, there is a close link between relationships and orders where the continuity of relationships can determine the continuity of business. This study presented relationship access specificity in the waste management companies from the perspective of the actor-network theory¹¹ and aimed to clarify specificity-related operation modes on the levels of actors, passage points, and objectives.

Operations and functions of different actors vary and so do the requirements for passage points. In their operations at passage points, actors seek to obtain maximum profit. However, not all of them can obtain profit because some are filtered out at passage points. Beset by the difficulties in obtaining resources or limitations from governmental policies, some companies shift focus to recycling other products, whereas companies with resources develop independently and hold leading positions. As a result, other companies are pushed to the periphery of relationship access specificity and can enter the industry only after being selected by major actors.

Four major actors can be distinguished, namely, (1) the government whose main function is to implement and control related policies and select companies through an application process and whose main objective is to achieve sustainable development of the industry; (2) waste treatment organizations conducting waste treatment and subsequent reuse of resources; (3) waste disposal organizations who resell products after their storage and transportation to gain profit; and (4) organizations providing cross-border cooperation and responsible for import and export of products recycled in Taiwan or abroad (Fig. 1).

¹¹ The actor-theory network theory suggests the presence of human and non-human characteristics in actors and emphasizes that action rather than structure is a core element in the analysis of network interaction [36].

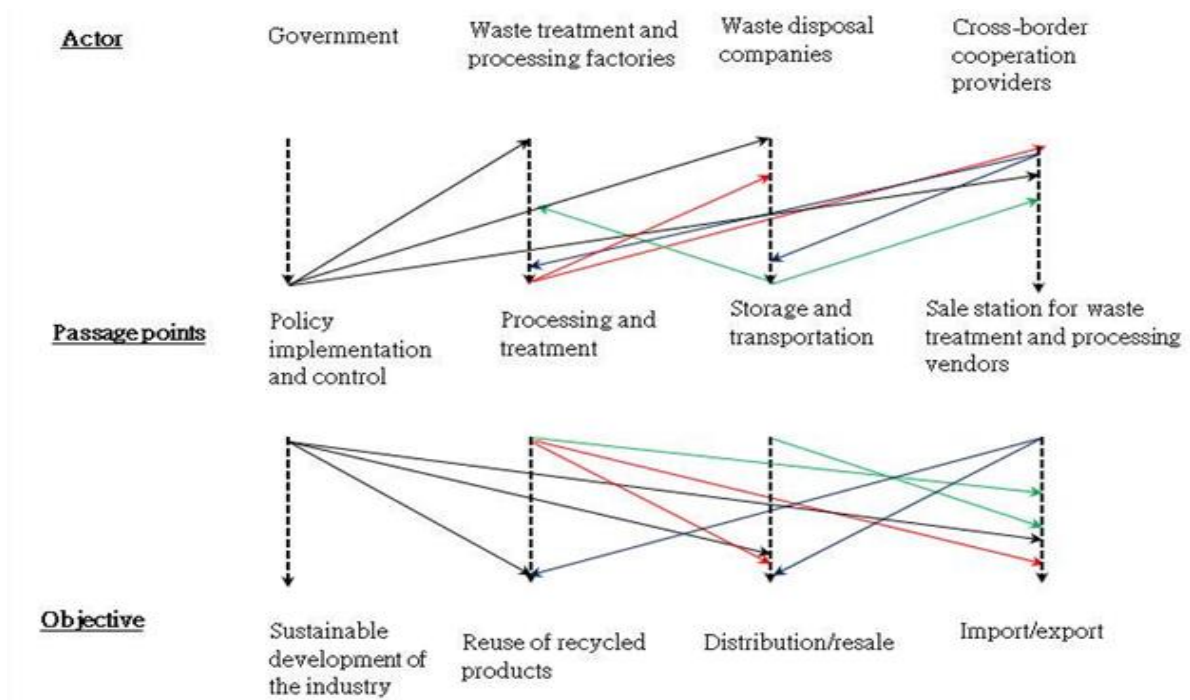


Figure-1. Relationship access specificity actors

Source: The author collected.

(5) Specific access specificity: Oligopolistic behavior under concession¹²

With regard to specificity related to distribution channels (specific access specificity), only those companies who hold licenses as sources of waste and recycled products have an access to the industry's main channels because they are normally considered as having passed a market test.

Domestic companies need to maintain partnership relations with manufacturers in order to have sources of products. Foreign companies are required to obtain a domestic license and be qualified to conduct import and export in their countries. Under total amount control, import and export operations are conducted for examined and approved types and amounts of waste and recycled products. Out of 4,000 waste treatment and disposal companies in Taiwan, only 46 are qualified to import products [37]¹³ which gives them an oligopolistic position in the market.

Analysis of distribution channels in the industrial waste management industry must be conducted from two perspectives, namely, waste materials and recycled products (Table 1). Domestic distribution of waste materials is based on free trading and usually follows the specific access specificity model. Personal relationships and negotiations remain important elements in operations in modern society. In the modern operational mechanism, with the popularization and growing consideration of knowledge of the law, relationships comes to prominence while contracts recede into the background. Large-scale manufacturers sell materials using agreements or competitive bidding. Three models can be distinguished with regard to overseas operations. First, domestic exporters are required to obtain a license from the EPA to be able to export and import. Second, in addition to a license from Taiwan, Taiwanese companies located in China must obtain official authenticated approvals from China and have the lot numbers approved on an annual basis to be able to perform business operations. This approval process includes the screening of the company and, most importantly, the effectiveness of control over the total amount of waste products. Finally, import and export operations in other countries can be performed after obtaining relevant licenses from both Taiwan and the country where the business is located.

12 Based on summaries from interviewees A-1, B-1, C, and G.

13 Source: <http://waste.epa.gov.tw/qry/ExpPerm.aspx> (accessed April 8, 2016)

With regard to distribution of recycled products, domestic companies operating under conditions of specific access specificity or vertical integration return them to domestic industries for cyclic utilization. Those who establish businesses or engage in strategic alliances overseas perform subsequent treatment operations themselves and those who do not have businesses or strategic alliances overseas perform such operations through (purchasing) agents.

Table-1. Specific access specificity in the industrial waste management industry

Product Channel model	Waste product distribution channel		Recycled product distribution channel	
	Domestic	Overseas	Domestic	Overseas
	Free trading/ relations (agreement/ competitive bidding)	1. Taiwan license (necessary condition for import/export) 2. China - special permission for oligopoly: annual audit of approvals and lot numbers 3. Other countries:	Up-stream companies (relationship access specificity)	1. China: Maternal (Taiwan) and filial (China) companies /alliances 2. Other countries: Currently there are no Taiwanese filial companies in other countries. Operations are performed through (purchasing) agents.

Source: The author collected.

4. CONCLUSIONS AND SUGGESTIONS

This study discussed specificity of site, physical, human resource, relationship, and access assets in the industrial waste management industry in Taiwan before and after 1990. Before the 1990s, site asset specificity was promoted by the government, while relationship access specificity was determined by reputation and affection. With regard to specific access specificity, access to the industry's main channels could be obtained through possessing waste/recycled product sources. After 1990, with the institutional changes and new governmental policies, cluster development was the main tendency with regard to site asset specificity. Physical asset specificity was characterized by vertical integration and expansion of services. Human asset specificity was an outcome of learning by doing, establishment of mentoring systems, and R&D innovations. Relationship access specificity was formed through social and cross-border networks. With regard to specific access specificity, leadership belonged to those companies who were entrusted by the government with oligopolistic rights through royalties. However, with changes in regulations and industrial policies in Taiwan, particularly revisions in the environmental regulations, most industrial waste was to be left for reuse in Taiwan (priority in managing industrial waste that was a valuable resource was given to Taiwan),¹⁴ excluding channels for overseas waste sources. To date, there continues a dispute over Taiwan having a priority in managing waste.¹⁵ However, under any condition, leadership over channels in the industry can be obtained through possessing domestic and overseas waste sources.

Different industries address asset specificity differently. Most studies focus on examining enterprise behavior. Due to the lack of academic research on the issue discussed in this study, data were collected through interviews with companies. Currently, there are approximately 4000 waste treatment and disposal companies in Taiwan. However, due to time and financial limitations, in-depth interviews could be conducted only with a fraction. A comprehensive

¹⁴ According to the Article 3 of the "Industrial Waste Import, Export, Transit and Transshipment Management Measures," and Articles 3.2 and 11.2.3 in its draft from 2007, with regard to giving Taiwan a priority in managing waste, the waste needs to be exported in case it cannot obtain a domestic certificate for appropriate treatment and recycled use.

¹⁵ Source: Records of the public hearing on "Industrial Waste Import, Export, Transit and Transshipment Management Measures" draft amendments (2007). According to Peng Tien-fu, the regulation deprives exporters from their rights, does not accord with the current state of the waste management in Taiwan, violates free market principles and benefits only a certain number of domestic waste management providers.

analysis of all companies by future studies can provide a deeper and more accurate investigation of the empirical results in this field.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Contributors/Acknowledgement: All authors contributed equally to the conception and design of the study.

REFERENCES

- [1] O. E. Williamson, "Comparative economic organization: The analysis of discrete structural alternatives," *Administrative Science Quarterly*, vol. 36, pp. 269-296, 1991.
- [2] B. Klein, R. Crawford, and A. Alchain, "Vertical integration, appropriable rents and the competitive contracting process," *Journal of Law and Economics*, vol. 21, pp. 297-326, 1978.
- [3] O. E. Williamson, "The economics of organization: The transaction cost approach," *American Journal of Sociology*, vol. 87, pp. 548-577, 1981.
- [4] R. Martin and D. Sunley, "Deconstructing clusters: Chaotic concept or policy panacea?," *Journal of Economic Geography*, vol. 3, pp. 5-35, 2003.
- [5] R. Coase, "Durable goods monopolists," *Journal of Law and Economics*, vol. 15, pp. 143-150, 1972.
- [6] A. A. Dick and K. Basu, "Customer loyalty: Toward an integrated conceptual framework," *Journal of the Academy Marketing Science*, vol. 22, pp. 99-113, 1994.
- [7] O. E. Williamson, *The economic institutions of capitalism: Firms, markets, relational contracting*. New York: The Free Press, 1985.
- [8] L. Y. Wu, "Effect of specific asset investments on a company's spontaneous actions: Relationship benefits and quality," National Research Program, National Science Council, Executive Yuan, ROC. NSC 99-2410-H-004-015-MY3, 2013.
- [9] D. Mocnik, "Asset specificity and a firm's borrowing ability: An empirical analysis of manufacturing firms," *Journal of Economic Behavior & Organization*, vol. 45, pp. 69-81, 2001.
- [10] A. Buvik and O. Andersen, "The impact of vertical coordination on ex post transaction cost in domestic and international buyer-seller relationships," *Journal of International Marketing*, vol. 10, pp. 1-24, 2002.
- [11] O. E. Williamson, "Credible commitments: Using hostages to support exchange," *American Economic Review*, vol. 73, pp. 519-540, 1983.
- [12] S. Ganesan, "Determinants of long-term orientation in buyer-seller relationships," *Journal of Marketing ABI/INFORM Global*, vol. 58, pp. 1-19, 1994.
- [13] B. Mallen, "Functional spin-off: A key to anticipating change in distribution structure," *Journal of Marketing*, vol. 37, pp. 18-25, 1973.
- [14] C. A. Ingene and M. E. Perry, "Coordination and manufacturer profit maximization: The multiple retailer channel," *Journal of Retailing*, vol. 71, pp. 129-151, 1995.
- [15] J. B. Heide, "Interorganizational governance in marketing channels," *Journal of Marketing*, vol. 85, pp. 71-85, 1994.
- [16] A. I. Rokkan, J. B. Heide, and K. H. Wathne, "Specific investments in marketing relationships: Expropriation and bonding effects," *Journal of Marketing Research*, vol. 40, pp. 210-224, 2003.
- [17] E. Anderson and B. Weitz, "The use of pledges to build and sustain commitment in distribution channels," *Journal of Marketing Research*, vol. 29, pp. 18-34, 1992.
- [18] J. B. Heide and G. John, "Alliances in industrial purchasing: The determinants of joint action in buyer-seller relationships," *Journal of Marketing Research*, vol. 27, pp. 24-36, 1990.
- [19] M. Ghosh and G. John, "Governance value analysis and marketing strategy," *Journal of Marketing*, vol. 63, pp. 131-145, 1999.

- [20] S. M. Klein, "A management communication strategy for change," *Journal of Organizational Change Management*, vol. 9, pp. 32-46, 1996.
- [21] B. S. Wimmer and J. E. Garen, "Moral hazard, asset specificity, implicit bonding, and compensation: The case of franchising," *Economic Inquiry*, vol. 35, pp. 544-554, 1997.
- [22] R. Doganis, *The airport business*. London: Routledge: Chapman & Hall, Inc., 1992.
- [23] H. B. Kim and J. H. Shin, "A contextual investigation of the operation and management of airport concessions," *Tourism Management*, vol. 22, pp. 149-155, 2001.
- [24] Y. H. Chang and I. Chiang, "Operation and management of airport concessions for increasing non-aeronautical revenues," *Journal of Aviation Safety and Management*, vol. 3, pp. 23-53, 2016.
- [25] R. Pashkin, "Retail management structures and retail revenues in North American airports: Humboldt-Universitat zu Berlin School of Business and Economics", Berlin (August 20), 2010. Available: http://userpage.fuberlin.de/~jmueller/gaprojekt/downloads/released_dipl_theses/Management_structures.pdf, 2010.
- [26] L. K. Tsou, "Development trends of cross-strait industrial waste management and recycling. cross-strait environmental service exchange platform E-paper." Available <http://www.tesd.org.tw/enp/detail.php?ec=10&es=9&aid=233> [Accessed December 15, 2015], 2015.
- [27] Y. R. Chen, C. Yang, S. M. Hsu, and Y. D. Wang, "Entry mode choice in China's regional distribution markets: Institution vs. transaction costs perspectives," *Industrial Marketing Management*, vol. 38, pp. 702-713, 2009.
- [28] Environmental Protection Administration Executive Yuan, "Environmental white paper No. 62," 2006.
- [29] Y. W. Tseng, "Development and future prospects of industrial waste recycling industry in Taiwan," *Environmental Protection Newsletter*, vol. 24, pp. 1-13, 2014.
- [30] K. I. Taan, "Industrial development issues." Available <http://resource.lksh.ntpc.edu.tw/dyna/data/user/jinyulu/files/201206120545401.pdf> [Accessed December 21, 2015], 2012.
- [31] Commercial Times, "The second spring of scrap metal industry in China." Available http://ago.gcaa.org.tw/env_news/199804/87041604.htm. [Accessed April 10, 2016], 1998.
- [32] Liberty Times, "Years of killing, remembering gliding of the port, A13D." Available <http://tkhems.pixnet.net/blog/archives/200707>. [Accessed December 21, 2015], 2007.
- [33] Economic Development Bureau Kaohsiung City Government, "Note on investments attracted by Kaohsiung City. Industrial Technology Research Institute Professional Service Note, No. 9922," 2011.
- [34] F. L. Peng, B. Harald, and W. Jici, "Network dynamics and cluster evolution: Changing trajectories of the aluminium extrusion industry in Dali, China," *Journal of Economic Geography*, vol. 12, pp. 127-155, 2011.
- [35] J. H. Lin and Y. J. Lee, "Waste management policies in China. Cross-strait environmental service industry communication platform." Available http://www.tesd.org.tw/enp/topic_reports_seasons.php?siid=4&ec=8&es=49. [Accessed March 25, 2016], 2015.
- [36] J. Law, *Organising modernity*. Oxford: Blackwell, 1994.
- [37] Environmental Protection Administration Executive Yuan, Available: <http://waste1.epa.gov.tw//Grant/GS-UC60/OrvGrantData.aspx>. [Accessed December 21, 2015], 2016.

BIBLIOGRAPHY

- [2] Industrial Waste Clearance, "Treatment and recycling information net. The ministry of economic affairs industrial waste treatment and disposal policies and regulations." Available <http://proj.tgpf.org.tw/riw/page4-1-1.asp>. [Accessed March 24, 2016], n.d.

Appendix-1. List of interviewees

Code	Interviewee	Experience of output/input to Qingyuan	Characteristics	No. of interviews	Interview date	Location
A	Chairman of the board	23 years	Professional waste disposal, licensed waste treatment, designated processing factory	2	2016.01.21 2016.04.09	Office in Taiwan
A-1	Resident personnel in China	19 years	Professional waste disposal, licensed waste treatment, designated processing factory	1	2016.04.09	Office in Taiwan
B	General Manager	23 years	Professional licensed waste disposal, designated processing factory	2	2016.01.21 2016.04.09	Office in Taiwan
B-1	Resident personnel in China	18 years	Professional licensed waste disposal, designated processing factory	1	2016.4.10	Office in Taiwan
C	Director	20 years	Professional waste disposal, licensed waste treatment, designated processing factory	1	2016.04.10	Office in Taiwan
D	Chairman of the board	11 years	Professional licensed waste disposal	1	2016.03.26	Office in Taiwan
E	Director	10 years	Professional licensed waste disposal	1	2016.03.27	Office in Taiwan
F	Director	12 years	Professional licensed waste disposal	1	2016.03.18	Phone interview
G	Chairman of the board	19 years	Professional licensed waste treatment, designated processing factory	2	2016.01.21 2016.04.09	Office in Taiwan
H	High-ranking manager	6 years	Professional licensed waste disposal	1	2016.03.18	Phone interview
I	High-ranking manager	7 years	Professional licensed waste disposal	1	2016.3.18	Phone interview

Views and opinions expressed in this article are the views and opinions of the authors, Journal of Asian Scientific Research shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.