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Public perception and attitude towards chemical industry park in Dalian, Bohai Rim

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ABSTRACT

Recent decade has witnessed accelerating expansion of chemical industry and increasing conflicts between the local citizens, governmental authorities and project developers, especially in some coastal and port cities in China. Development and transformation of chemical industrial parks has been adopted as a national initiative recently. However, there is a paucity of research examining public perspectives on chemical industrial parks and their risks. Aiming to understand public perception, attitude, and response and the factors underlying the support/acceptance of chemical industry park, this paper investigated 418 residents neighboring to two chemical industrial parks, Dalian in Bohai Rim through face-to-face questionnaire survey. The results showed the knowledge of the respondents on the chemical industrial parks development was very limited. The respondents had complex perceptions on the environmental impacts, risks control, social-economic benefits, and problem awareness. The current levels of information disclosure and public participation were very low. The central governmental official (44.3%) was the most trustworthy group by the respondents. Only 5.5% and 23.2% of the respondents supported the construction of a new CIP nearby and far away their homes, whilst 13% thought new CIP project as acceptable. The spearman correlation analysis results showed a strong NIMBY effect (Not In My Backyard). Factor analysis results demonstrated five latent factors: knowledge, benefit, information, trust, and participation. Multiple linear regression analysis indicated how socio-demographic differences and five latent factors might impact on the support/acceptance of the chemical industrial parks. Education level, trust, information, and participation were significant predictors of public support/acceptance level. This study contributes to our limited knowledge and understanding of public sentiments to the chemical industry parks in China.

1. Introduction

In the 21st century, the Chinese social development is not only characterized by chemical industry expansion and its technical as well as environmental threats, but also by emerging civil society and public awareness of these challenges (He et al., 2011, 2012a,b). With over 25,000 large scale chemical companies and recorded usage of 45,000 types of chemicals, China is the world's largest manufacturer and the second largest consumer of chemicals (MEP, 2013). Our previous study showed that the removal of small and medium chemical factories to industrial park was a solution for prevention and control of environmental pollution (He et al., 2014). The (chemical) industrial park policy has also become a central important component in the Chinese concept of a Circular Economy in the 1990s, aiming to reconcile rapid industrialization with the social-environmental sustainability. The first Shanghai Chemical Industrial Park of China started to construct in 1996. In November 2015, the Ministry of Industry and Information Technology (MIIT) issued a relocation and reconstruction plan of high-risk hazardous chemicals producers in densely populated areas, followed by a Guideline to standardize future development of chemical industrial parks (CIPs) in China, in order to prevent new industrial sites from being established in environmentally sensitive areas. Now, three petrochemical industry clusters formed in the Yangtze River Delta,

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the Pearl River Delta, and the Bohai Sea region. By the end of 2015, 502 major CIPs were built across China, in which over 15 thousand chemical enterprises were set up and operated.

It is widely accepted that CIPs will be essential in realizing sustainable development goals through fostering economic development and enhancing environmental performance (Festel and Würmseher, 2013). China's CIPs policy tried to deal with some challenges and risks of chemical industry emerged: 1) poor industrial structure and product portfolio due to large amount of small scale facilities with backward technologies; 2) prominent contradiction between industry and urban development characterized by the centralized distribution of chemical plants along rivers and coasts and being close to densely populated areas; 3) large amount of materials and energy consumption, high environmental and safety impacts and risks; 4) public oppositions to new chemical projects and frequent conflicts; and 5) imperfect and ineffective environmental and chemical risk management system (Fan and Lu, 2009; Jiang, 2016; He et al., 2014; Tong et al., 2012; Wang, 2016; Zhou et al., 2012). Using GIS mapping technology and the latest available data on 33,625 chemical facilities in China, Greenpeace (2016a,b) survey showed that the majority of chemical facilities were concentrated in the densely populated east and central regions. More than half (63.4%) of these companies were alongside rivers (within 2 km of a major river) in areas where water protection was particularly critical (Xu and Zhang, 2015). In recent decades, accidents with harmful substances and hazardous chemicals have become major problems in China (He et al., 2011, 2014). According to Greenpeace (2016a,b), there were a monthly average of 29 chemical accidents in China from January to August 2016.

Following increasing numbers of chemical pollution accidents and public complaints, chemical risk management has moved high on China's policy agendas (He et al., 2013a, 2014; Mol et al., 2011; Wang et al., 2005; Wang et al., 2012). Some regulations and policies on CIPs have been promulgated and implemented by the State Council and departments. Especially after the serious chemical explosion accident of Tianjin Port in August 2015, Opinions on Promoting the Orderly Development of Chemical Industrial Park (MIIT No.433, 2016) issued for accelerating the relocation of the hazardous chemical enterprises into CIPs. The 13th Five-Year Plans (2016–2020) at the national level and chemical, environmental and safety sectors gave the strong emphasis on relocating chemical plants into chemical parks. However, potential environmental risks will arise because many enterprises in the CIPs produce and use hazardous substances at the same time, in the centralized area, and with high intensity, especially in coastal and port cities. According to a Greenpeace report (2017) on Lianyungang CIP, Jiangsu Province, 61 of 226 chemicals found in air, soil and water samples taken around the park are chemicals with health or environmental hazards.

In past decade, the construction of chemical infrastructure leaded to conflicts between local communities on the one hand and the project implementation organization and higher-level authorities on the other, resulting in protests and the cancelation or postponement of the project (Liu et al., 2010; Qi et al., 2012; Tang and Tang, 2012). Since 2007, several cases of public opposition to Paraxylene (PX) projects have been reported in Xiamen, Pengzhou, Dalian, Ningbo, Kunming, and Maoming (He et al., 2014; Lee and Ho, 2017; Li et al., 2012; Liu, 2016a). Previous studies argued that many factors could affect public resistance or acceptance of infrastructure projects. These factors included public awareness of environmental issues, direct benefits, public perception of the environmental, economic and social risks, general knowledge, environmental costs, trust in the government and companies, information openness, and the involvement and participation of all concerned citizens (Beck and Kropp, 2007; Chen and Xu, 2014; De Marchi, 2003; He et al., 2012b, 2013b, 2016, 2017; Li et al., 2012; Slimak and Dietz, 2006). These factors are considered key to determining individual behavior or action as conceptualized in attitude-behavior models (Spaargaren, 2003), awareness and perception do matter (Carbone et al., 2006; Sjoberg, 2000; Slovic, 1987; Willis and DcKay, 2007). One of the greatest obstacles is the low level of public access to relevant information and decision-making (Mol et al., 2011; He et al., 2015; Zhang et al., 2016). Empirical evidence suggests that sufficient and reliable information and two-way communication would build citizen trust in governmental agencies, which could enhance public participation in and acceptance of programs and projects (Fiorino, 1990; Sun, 2015; Yuan et al., 2011).

As this shift requires substantially higher levels of public interaction and cooperation, the ultimate contribution of CIP relies heavily on societal sentiments. Hence, public attitudes and responses, including local residents' support and acceptance with respect to CIPs, need to be assessed to facilitate further chemical industrial developments through local, regional, and national policies. Previous research on public attitudes, acceptability and participation has largely focused on infrastructure projects and single chemical project and event (Grasa et al., 2002; Huang et al., 2013). There is a surprising paucity of research examining public perspectives on the petrochemical and chemical industrial parks and their risks that are envisaged in policy, academic, third sector and industry scenarios (e.g. Ding and Bao, 2017; Li and Zhao, 2011; Lu et al., 2010; Ma et al., 2015; Zhao, 2009). In a nutshell, the understanding as well as consideration of public concern, attitude, and response is undoubtedly a key for implementation of chemical industrial project, planning, and policy direction.

Overall, we are therefore interested in questions how the public perceive about chemical industrial parks, how well and why the chemical industry transition is supported and accepted. To this end, a face-to-face questionnaire survey was conducted in Dalian city, one of the port and coastal cities in Bohai Rim, China. This study contributes to our limited knowledge and understanding of public perception, attitude, and response to the chemical industry parks in China. The next section introduces the research methodology. Section 3, 4, 5, and 6 shows the results on public perception, attitude, information and participation. The final section 7 presents the discussions and conclusions.

2. Research questions and methodology

2.1. Research aim and questions

This research aims to investigate what attitudes and responses are to CIPs in the perspectives of local residents. To this end, four research questions are raised:

- Q1: How CIPs are perceived by local residents, including knowledge, environmental impacts/risks, economic and social benefits, and problem awareness?
- Q2: To what extent and how do local people access to information and participate in the planning and management process of CIPs? Who are the trust stakeholders and why?
- Q3: What are the attitudes of local residents towards various aspects of the current CIPs construction, decision-making, and management?
- Q4: What are the main factors driving local opposition/acceptance of CIP construction? In practice, to what extent of public perception, information sources, the public trust, and socio-demographic characteristics do play roles in the public attitude?