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Public sector voluntary initiatives: the adoption of the environmental management system by public waste water treatment facilities in the United States

Wan-Ling Huang[a]*, Eric W. Welch[b] and Elizabeth A. Corley[c]

[a]*Department of Public Administration, Tamkang University, No.151, Yingzhuan Rd., Tamsui Dist., New Taipei City 25137, Taiwan (R.O.C.);* [b]*Science, Technology and Environment Policy Lab, Department of Public Administration, University of Illinois at Chicago, 412 South Peoria, Chicago, IL 60607, USA;* [c]*School of Public Affairs, Arizona State University, 411 N. Central Avenue, Phoenix, AZ 85004, USA*

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This study examines the determinants of Environment Management System (EMS) adoption by public wastewater treatment facilities in the US. Based on the literature, it considers the range of regulatory, market and political influences on EMS adoption. The paper also incorporates prior work on publicness theory to articulate possible sectoral differences related to voluntary policy adoption. Hypotheses are tested using ordered logistic regression on data from a national survey of public wastewater treatment facilities in the US. Findings indicate that public wastewater treatment facilities that perceive stricter environmental regulation and greater attention from environmental groups and the public are more likely to voluntarily adopt an EMS. In addition, facilities reporting a higher degree of publicness are more likely to adopt in response to politician demands and when they apply greater amounts of biosolids to land. The findings carry implications for policy makers who aim to encourage public sector voluntary initiatives.

Keywords: voluntary environmental agreement; public sector voluntary initiative; environment management system; publicness

1. Introduction

Recent US environmental policy has evolved from a regulatory context that favoured defined, legally binding instruments towards one that prefers more collaborative arrangements and flexible instruments (Percival 1997). The hierarchical-adversarial perspective of the 1970s shifted to a socio-political governance framework that recognised increasingly complex problems and structural interdependencies (Fiorino 2006). Current environmental policies emphasise co-ordination among regulatory agencies, regulated entities and other stakeholders to preemptively address environmental problems through *ex-ante* arrangements (Howlett 2000). One of these new policy tools, voluntary environmental agreements (VEAs), is regarded as a manifestation of the new socio-political governance framework (Karamanos 2001).

VEAs are defined as "agreements among the corporate, government and nonprofit sectors not required by legislation that aim to improve environmental quality or natural resource utilization" (Long and Arnold 1995, 6). From the perspective of government, the use of VEAs instead of command and control regulation could reduce administration

*Corresponding author. Eamil: whuang24@mail.tku.edu.tw

and enforcement costs, and they side step complex legislative battles (Baggott 1986). From the firm perspective, the benefits accrued from VEA adoption must offset the cost incurred. The costs are often high in both public and private sectors. Turk (2009) found that adoption of the ISO 14000 Environmental Management System (EMS),[1] which is considered to be a type of VEAs, requires high initial set-up costs. Others have shown that government entities spent $1441 on average per employee to adopt an EMS - three times the average costs incurred by private organisations (Darnall and Edwards Jr. 2006). The benefits range widely and have been identified in the literature to include regulatory easing, market returns, pollution reduction and cost saving on material inputs, etc. (Florida, Atlas, and Cline 2001; Innes and Sam 2008; Zhang, Bi, and Liu 2009; Darnall, Potoski, and Prakash 2010).

The majority of prior research focuses on the effect of voluntary environmental initiatives on private sector organisations. The work has a relatively consistent set of determinants of voluntary policy adoption and effectiveness related mainly to regulatory and market incentives (Khanna and Damon 1999; Delmas and Terlaak 2001; Khanna 2001; Grolleau, Mzoughi, and Thomas 2007; Innes and Sam 2008; Nishitani 2009; Zhang, Bi, and Liu 2009; Psomas, Fotopoulos, and Kafetzopoulos 2011). However, few studies pay attention to the voluntary behaviour of public sector organisations. Due to the well-recognised distinctions between public and private organisations (Rainey, Backoff, and Levine 1976; Rainey and Chun 2005), we question whether the determinants identified in the private sector research will have similar effects on public agencies, where political influence is often more significant and economic implications of voluntary action are less obvious. Taken together, this study aims to investigate the extent to which regulatory, market and political influences determine the adoption of voluntary EMS by government-owned wastewater treatment facilities. Given that government-owned organisations may operate like private firms when they are more involved in the market for services, we further examine the degree to which the public nature (or publicness) of government-owned organisations helps explain their different responses to political influence on voluntary environmental behaviour.

Data used in this study comes from a 2007 national survey on environmental practices completed by 126 government-owned sewage and wastewater treatment facilities in the US, approximately 37% of which had adopted the National Biosolids Partnership (NBP) comprehensive voluntary EMS for biosolids at the time of the survey. This study advances existing literature on environmental voluntarism by showing that public voluntary initiatives are mainly driven by regulatory and political factors but are relatively insensitive to market considerations. Our findings also show that among government-owned wastewater treatment facilities, those reporting a higher level of publicness are more likely to respond to political attention on environmental issues through EMS adoption compared to those with a lower degree of publicness.

In the next section, we review relevant research on environmental voluntarism of private firms, which sheds light on the determinants of voluntary initiatives by public sector organisations. Based on the literature on public-private distinctions, we then contrast the primary assumptions of the existing private sector literature with the fundamental institutional and contextual differences that exist with the public sector. The data source, measures and methods, and results sections are presented in sequence, and the implications of our findings for theory and management are discussed in the conclusions.

2. Literature review and hypotheses

Voluntary policy approaches to promote environmental quality often rely upon working partnerships among governments, business, and other societal groups to solve problems, making the active participation of all parties a key element of the success of voluntary programs (Harrison 2001). Voluntary environmental policy research has increased understanding about the antecedents to voluntary activities, particularly for private sector organisations. These factors include regulatory pressure (Grolleau, Mzoughi, and Thomas 2007; Innes and Sam, 2008), green marketing or investment (Anton, Deltas, and Khanna, 2004; Darnall, Potoski, and Prakash 2010), pollution reduction (Florida, Atlas, and Cline 2001; Videras and Alberini 2000) and cost saving on material and energy inputs (Kollman and Prakash 2002; Zhang, Bi, and Liu 2009). Some authors have investigated the experiences and consequences of voluntary environmental activities undertaken by local government authorities (Noren and Malmborg 2004; Emilsson and Hjelm 2005; Lozano and Valles 2007; Botta, Comoglio, and Petrosillo 2013; Petrosillo *et al.* 2012), but most of those studies do little to explain why public sector organisations act voluntarily or if public voluntary action is somehow different than private voluntary action.

The literature on public-private distinctions demonstrates that public sector organisations typically operate in an environment where political control and public scrutiny dominate, while market exigencies often play a less powerful role because most public services are not sold in a market but rather priced through taxation (Rainey, Backoff, and Levine 1976; Rainey and Chun 2005). Given that public organisations are fundamentally embedded within a political context, it is not surprising that public sector organisations have been found to respond to green demands from political entities, environmental groups and local communities (Bekkering and McCallum 1999; Emilsson and Hjelm 2002; Daddi *et al.* 2011). By contrast, the costs and benefits calculations that fundamentally drive environmental voluntary behaviour of private firms may fail to fully explain public voluntary initiatives because the viability and effectiveness of public sector organisations is less determined by market dynamics and competition. Nevertheless, both private firms and public organisations are constrained by legal frameworks and are responsible for adapting their behaviour to satisfy regulation (Bekkering and McCallum 1999).

Although public and private organisations are typically distinguished on the basis of ownership, some authors argue that all organisations are more or less public depending on the extent to which their resources and fundamental organisational activities, as well as outputs, are related to government (Bozeman 1984, 1987; Bozeman and Bretschneider 1994). Some organisations may be owned by government while a significant portion of their activities are contracted out to privately-owned organisations. Alternatively, like public enterprises, they may be operated as a form of business organisation and be financially self-supporting. Accordingly, government-owned organisations may vary based on the degree of publicness, which can be defined as "organizational attachment to public sector values such as due process, accountability, and welfare provision" (Antonsen and Jørgensen 1997, 337). To clarify how the public nature of an organisation influences voluntary environmental initiatives, this paper further addresses how the degree of publicness held by government-owned wastewater treatment facilities affects their sensitivity to political influences.

The next section first discusses the influence of regulatory, market and political factors on public voluntary initiatives. It then hypothesises how publicness influences the response to political factors by government-owned organisations.

2.1. Regulatory influence

Numerous studies have shown that level of regulatory pressure is an important factor for explaining adoption of voluntary initiatives by private firms (Khanna and Damon 1999; Welch, Mazur, and Bretschneider 2000; Winter and May, 2001; Clemens and Douglas 2006; Grolleau, Mzoughi, and Thomas 2007; Khanna *et al.* 2007; Uchida and Ferraro 2007; Innes and Sam 2008). Several rationales have been put forward to justify what have been relatively consistent empirical findings: polluters volunteer as a strategic means of addressing costs associated with regulation. By demonstrating to regulators and other key stakeholders their commitment to improve environmental performance, they may hope to reduce current regulatory pressure (Welch and Hibiki 2003; Delmas and Montes-Sancho 2010), preempt expected future government regulation (Segerson and Miceli 1998; Delmas and Terlaak 2001) or shift regulatory pressures to other firms (Maxwell, Lyon, and Hackett 2000; Potoski and Prakash 2005; Grolleau, Mzoughi, and Thomas 2007).

Given that both public and private organisations are subject to environmental policy, we expect that regulatory demands will also influence public wastewater treatment facilities' participation in voluntary environmental programmes. Similar to private firms, public facilities are accountable to environmental law and regulation. Compliance may require high investment in pollution-abatement equipment, operation and maintenance outlays, and development of capacity to understand and address regulatory demands (Gray 1987; Berman and Bui 2001; Hampton 2005). Public facilities may undertake voluntary initiatives as a means of demonstrating commitment to environmental goals and satisfying regulatory authorities. As with private firms, such a strategy may result in relieving existing regulatory pressure, shifting regulatory pressure to other facilities, or preempting expected regulatory demands. This discussion leads to the hypothesis:

> H1: Public wastewater treatment facilities that perceive higher regulatory pressure will be more likely to adopt a voluntary environmental programme.

2.2. Market influence

A majority of the literature has also reported that enhancement of market competitiveness is a critical explanatory variable for voluntary initiatives by private firms (Studer, Welford, and Hills, 2006; Psomas, Fotopoulos, and Kafetzopoulos 2011). Given that one of primary goals of private firms is to maximise profit, firms will be willing to adopt voluntary environmental programmes if they believe that such action will reduce operation costs through innovative waste-reduction solutions, energy savings and technical assistance (Fryxell and Szeto 2002; Kollman and Prakash 2002; Zhang, Bi, and Liu 2009). Stenzel (2000) posited that effective implementation of an EMS may lead to decreased internal costs by increasing recycling and reuse of materials, and reducing waste, toxic chemical use and energy use. Delmas and Terlaak (2001) contended that voluntary programmes would assist firms in developing innovative environmental solutions that can improve their industrial performance and provide competitive advantages. Khanna (2001) also pointed out that firms may benefit from participating in voluntary programmes by receiving information about new waste-reducing technologies or low interest financing.

In addition, the adoption of voluntary environmental programmes by private firms may be a response to demand from 'green' customers and investors (Khanna and

Damon 1999; Welch and Hibiki 2003). Given that public awareness concerning environmental protection has increased, environmental friendliness of products and processes has become a more important element of business competitiveness. In order to improve the profile and image of the organisation and its outputs and activities, firms are willing to invest more in environmental activities that satisfy customers and investors who are concerned about environmental protection (Arora and Cason 1996; Khanna and Damon 1999; Stenzel 2000; Delmas and Terlaak 2001; Anton, Deltas, and Khanna 2004; Zutshi and Sohal, 2004; Nishitani, 2009; Darnall, Potoski, and Prakash 2010).

However, economic factors may have less impact on the voluntary activity of public organisations because demands and resources are allocated through the budgetary process rather than through market exchange structures (Rainey, Backoff and Levine 1976; Rainey and Chun 2005). It is more important for public organisations to follow purchasing and procurement rules and to ensure spending within budget. As Demsetz (1967) and Alchian and Demsetz (1973) posited, because the ownership of public sector organisations belongs to everyone rather than individuals or groups, public sector organisations have weak incentives to monitor efficiency of organisations and to increase organisational profits. For these reasons, we argue that economic considerations may not influence public wastewater treatment facility propensity to volunteer.

H2: Economic incentives will not significantly affect the likelihood of the adoption of a voluntary environmental programme by public wastewater treatment facilities.

2.3. Political influence

Public organisations are agents working for public principals to pursue the common interests in a democratic system (Bovens 2005). The political and administrative system in the US is designed to help ensure that public entities are under the control of citizens or their representatives. Because decision making in public sector organisations is subject to involvement of elected officials, political appointments and other social groups (Rainey, Backoff and Levine 1976; Rainey and Chun 2005), participation in voluntary environmental programmes by public wastewater treatment facilities is likely to be affected by political attention on environmental quality (Bekkering and McCallum 1999; Lozano and Valles 2007). Political attention can be defined as awareness and interest of major political actors in particular problem or issue areas, which often comes along with the adoption of some type of political actions for problem solving. Elected officials may press public facilities to go along with their desires for greater environment action and environmental interest groups and local residents may apply pressure on policy or individual polluters (Forsyth *et al.* 2004; Mahoney 2007; Story and Forsyth 2008). Emilsson and Hjelm (2002) reported that citizens' demands and political decisions are significant explanations of the adoption of EMSs by Swedish local authorities. Daddi *et al.* (2011) also indicated that one of the main reasons that the City of Marrakech in Morocco adopts the ISO 14001 is to enhance the City's image with their electorate. Based on this discussion, we hypothesise:

H3: Public wastewater treatment facilities that perceive a higher degree of political attention towards environmental protection will be more likely to adopt a voluntary environmental programme.

2.4. The level of publicness

Although ownership is commonly used to distinguish between public and private organisations, some authors recognise the difficulty in applying a typology of organisations based on formal legal status (Dahl and Lindblom 1953; Wamsley and Zald 1973; Bozeman 1984, 1987). Dahl and Lindblom (1953) recognised that all organisations may be characterised based on varying degrees of economic process and political process. Similarly, Wamsley and Zald (1973) presented four types of organisations based on whether they are owned by governments or individual(s) (political dimension) and whether they are mainly funded via taxes or market transaction (economic dimension). Bozeman's (1984, 1987) dimensional model expanded Wamsley and Zald's (1973) two-category distinction by locating organisational publicness in a continuum between the influence of political authority and market authority. He contended that all organisations are public to a different degree, depending upon the extent to which organisations are subject to control of external political authorities.

Several studies have sought to apply the dimensional model of publicness to better capture organisational characteristics in ways that extend beyond legal status. Emmert and Crow (1988) empirically tested the dimensional model using a sample of 250 R&D laboratories with mixed ownership and found that two dimensions of publicness effectively discriminate among the organisational types: the level of government influence on organisational resources and the level of government influence on organisational goal-setting processes. Bozeman and Kingsley (1998) found that perceived risk culture does not vary on the basis of ownership but is negatively related to the degree to which organisations are influenced by elected government officials. The higher the level of political control that managers face, the lower the level of risk culture perceived. Bozeman and Bretschneider (1994), who contrasted the dimensional approach with the ownership approach, found that three types of government influence – determination of organisational resources, organisational agenda-setting and communications with external government actors – help to explain the composition of organisation outputs and bureaucratic characteristics.

One way to capture the concept of publicness is to measure the extent to which organisations are involved in contracts with the private sector. In this study, government-owned wastewater treatment facilities vary substantially in the extent to which they contract out biosolids-related activities such as treatment chemical production, wastewater treatment, biosolids processing (e.g. dewatering/screening/grinding), storage, incineration, transport, land application and so on. Contracting-out services to other professional organisations provides a way of operationalising the publicness of wastewater treatment facilities because the more services and goods are provided through the market process (competitive biding among contractors), the less political authority is able to intervene. We thus anticipate that when organisations have lower publicness, as indicated by a comparatively higher level of contracting out of services, political attention will have less influence on adoption of voluntary initiatives, and vice versa. The following hypothesis is thus presented:

> H4: The level of publicness will moderate the effect of political attention on the adoption of a voluntary environmental programme.

3. Data, measures and method

Since the mid-1990s, the US Environmental Protection Agency (EPA) has actively promoted EMS initiatives such as the EMS pilot project for local governments and sector-

based EMS programmes in agribusiness, chemical manufacturing, and shipbuilding and ship repair. Within this context, the National Biosolids Partnership (NBP) was formed in 1997 by the EPA in collaboration with the National Association of Clean Water Agencies (NACWA) and Water Environment Federation (WEF). To advance environmentally sound biosolids management practices, the NBP developed a Biosolids Management Program (BMP) establishing comprehensive elements of an EMS that are tailored to the needs of the wastewater profession involved in biosolids production, disposal or final use.[2] As indicated in *BMP Elements/Requirements* published by the NBP in 2011, there are five sequential steps for developing and implementing a BMP: biosolids management policy, biosolids management planning, biosolids programme implementation, measurement and corrective action, and management review. Seventeen individual management elements associated with the five steps have been developed and each of which further contains a set of requirements that can be measured objectively. To achieve NBP platinum-level certification for implementation of the BMP, it calls for a completion of a third-party audit to verify that all requirements have been satisfied. Although many elements of the NBP's BMP are derived from ISO 14001, it is distinct from ISO 14001 by including best management practices specific to biosolids and elements designed to enhance public participation and communication, rather than concerning general aspects of environmental management.[3]

Even though there are numerous sector-based EMS programmes, we chose to study the wastewater profession for two reasons. First, previous research has been conducted to understand the EMS application in some arenas such as chemical releases (e.g. Arora and Cason 1996) or agrifood industries (e.g. Grolleau, Mzoughi, and Thomas 2007), but we know little about the wastewater sector. Second, NBP allows public access to a list of public wastewater facilities that have adopted the BMP programme, which enabled us to empirically investigate public voluntary initiatives.

3.1. Data source

The data used in this study come from a 2007 national survey on environmental management practices of biosolids products in the US. The purpose of this survey is to understand environmental practices of public sewage and wastewater treatment facilities and to investigate determinants as well as outcomes of voluntary adoption of biosolids-related EMS programmes by those facilities. The sample frame for the study was developed from two separate populations: all NBP adopted organisations and a random selection of non-adopted organisations. The survey was sent to the person who was in charge of biosolids management practice in each sampled facility.

To construct the NBP sample, we included all 194 public sewage and wastewater facilities that had adopted the National Biosolids Partnership (NBP) Biosolids Management Program (BMP) as of 2007 (when the survey was implemented). To construct the non-NBP sample, we randomly selected 400 non-NBP BMP facilities from the population of approximately 16,000 public wastewater treatment facilities in operation in the US, identified in the US Population Served and Flow Report. Given that most of the 16,000 facilities are small, our non-NBP BMP sample was selected from a stratified frame that reflected the size distribution of NBP BMP adopted organisations. After removing facilities for which we were unable to retrieve contact information and duplicates (having the same contactor as other facilities), the survey was administered to 404 of government-owned wastewater treatment facilities, 110 of which were NBP members and 294 were non-NBP members.

The survey was implemented online using Inquisite Software® from April 2007 to May 2007. The respondents were first invited to complete the survey via an email invitation and then three reminders followed. A written survey was later mailed to the people who were not reached by the previous email invitations due to invalid email addresses. Some people asked to be removed from the study (7 and 13 from the NBP and non-NBP sample, respectively) because their agencies were not involved in biosolids activities, because they were regulatory agencies rather than wastewater treatment facilities, or because the survey did not apply for some other reasons. In addition, a total of 15 of the NBP members and 17 of the non-NBP facilities were removed from the study because neither their emails were valid nor mailing addresses were available. The final response size was 126 completed surveys (46 NBP members and 80 non-NBP facilities). The response rate was 52% for the NBP BMP adopted facilities and 30% for non-NBP BMP adopted agencies, with an overall response rate of approximately 36%. Descriptive statistics and bivariate analysis for the variables used are presented in Table 1.

3.2. Measures and model

3.2.1. Dependent variable

The dependent variable examined in this study, *Level of EMS Adoption*, represents the extent to which public wastewater treatment facilities have established EMS programmes for the effective management of biosolids and wastewater. Sampled facilities were asked to indicate their organisation's involvement in the development of an Environmental Management System. Facilities that had not considered establishing an EMS, as well as those that considered establishing an EMS but decided not to establish one, are coded with the number one. Facilities that were currently considering establishment of an EMS are coded with the number two. Facilities that were in the process of establishing an EMS, as well as those that had established an EMS, are coded with the number three. Therefore, the variable *Level of EMS Adoption* ranges from 1 to 3 with a mean of 1.91. A higher value indicates a greater level of EMS adoption by public wastewater treatment facilities.

3.2.2. Independent variables

This study contains three groups of independent variables: the level of regulatory pressure, economic consideration and external political attention. The level of regulatory pressure is captured by *Regulatory Strictness*, which is measured as the sum of responses to a set of two questions that asked about how regulated land application restrictions and stringency of regulatory requirements had changed over the previous two years for an organisation (Cronbach's alpha = 0.79). This variable ranges from 5 to 10 with a mean of 6.41. A higher value indicates that environmental regulation was perceived as becoming stricter. The indicator for economic consideration is *Cost Change*, which is measured using a question that asked about the change of the use/disposal fee for class B biosolids in the previous two years. This variable ranges from 1 (decreased) to 3 (increased) with a mean of 2.5. A higher value indicates an increase in disposal costs.

The level of external political attention is presented by three variables: *Stakeholder Influence*, *Politician Demands* and *Land Application*. The three variables capture the importance of environmental groups and local communities, political and government

Table 1. Descriptive statistics.

	Variable	Obs	Mean	Std. Dev	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Level of EMS Adoption	125	1.91	0.89	1	3	1.00												
2	Regulatory Strictness	118	6.41	0.94	5	10	0.20	1.00											
3	Cost Change	123	2.50	0.53	1	3	−0.05	0.02	1.00										
4	Stakeholder Influence	119	9.29	2.28	3	12	0.20	0.02	−0.08	1.00									
5	Politician Demands	109	5.01	1.72	2	8	−0.08	0.10	−0.12	0.33	1.00								
6	Land Application	125	54.68	45.91	0	100	0.09	0.04	0.02	0.06	0.02	1.00							
7	Publicness	126	0.23	0.42	0	1	−0.16	−0.10	−0.15	−0.18	0.04	0.02	1.00						
8	Stakeholder Influence* Publicness	121	−0.16	0.99	−6.29	2.71	0.10	−0.01	0.08	0.45	0.08	0.02	−0.32	1.00					
9	Politician Demands* Publicness	119	0.02	0.75	−3.01	2.99	0.05	−0.03	−0.09	0.05	0.46	0.04	0.07	0.19	1.00				
10	Land Application* Publicness	126	0.43	23.16	−54.68	45.32	−0.01	−0.06	0.01	0.02	0.04	0.51	0.03	0.05	0.09	1.00			
11	Budget	124	3.16	1.03	1	5	0.27	0.05	0.13	0.18	0.02	−0.10	−0.22	0.04	−0.04	−0.10	1.00		
12	Pollution	123	157321.5	673526	0.008	4500000	−0.18	−0.08	0.11	0.02	−0.10	0.03	−0.04	0.01	0.04	0.07	−0.13	1	
13	Management System Use	126	1	1	0	3	0.10	0.09	0.09	−0.01	0.01	−0.13	−0.09	0.04	0.06	−0.06	0.05	−0.01	1
14	Facility Age	124	42	24	1	184	0.11	0.09	−0.05	0.22	0.14	0.05	−0.01	−0.08	−0.02	0.12	0.23	0.06	−0.03

entities, and the general public on public voluntary initiatives, respectively (Bekkering and McCallum 1999; Emilsson and Hjelm 2002; Daddi *et al.* 2011). *Stakeholder Influence* is measured as the sum of responses to a set of three questions that asked about the importance of individual local residents, environmental groups and organisations, and neighborhood/community groups and organisations on the environmental practices of an organisation (Cronbach's alpha = 0.84). This variable ranges from 3 to 12 with a mean of 9.29. A higher value suggests that the perceived influence of stakeholders on the environmental practices is more substantial. *Politician Demands* is measured using a set of two questions that asked respondents to indicate the importance of the following factors that motivated their organisations to reduce environmental impacts: (1) to satisfy local politician demands/interests; (2) to improve relationships with elected officials. This variable ranges from 2 to 8 with a mean of 5.01. A higher value implies higher perceived importance of political factors on organisations' environmental initiatives. Cronbach's alpha for this indicator is 0.90. *Land Application* is operationalised as the percentage of an organisation's biosolids that are used in land application. A larger percentage of biosolids used in land application implies higher rates of public attention received by a facility because the end product use of biosolids may be more likely to affect the local population where the biosolids are applied. In addition, the greater the reliance of an organisation on land application, the more it must respond to social demands for clean product. This variable ranges from 0 to 100 with a mean of 54.68.

The level of publicness is captured by the variable *Publicness*, which is measured using a question that asked respondents to indicate whether their organisations performed biosolids-related activities internally or contracted them out. This variable is coded 1 if a respondent's organisation performed all identified activities internally, indicating a high level of publicness holding the organisation. Otherwise, it is coded 0 if any of the identified activities were contracted out. Following Frazier, Tix, and Barron (2004), three interaction variables are constructed to present the moderating effect of the level of publicness on the relationship between political attention and EMS adoption. Those variables are measured as the product of *Publicness* and *Stakeholder Influence*, *Politician Demands* and *Land Application,* respectively. To alleviate the multicollinearity problem, we standardise *Stakeholder Influence*, *Politician Demands*, and *Land Application* by subtracting the means.

3.2.3. Control variables

Several variables are included in the model as controls, including *Budget*, *Pollution*, *Management System Use* and *Facility Age*. Given that the adoption of EMS programmes requires resources, public wastewater treatment facilities with a higher level of budget are expected to be more likely to establish programmes for the effective management of biosolids and wastewater (Sharma 2000). *Budget* is measured using a question that asked about the level of an organisation's current operating budget. This variable ranges from 1 (less than $500,000) to 5 (over $50 million) with a mean of 3.16. Previous research also indicates that organisations with a higher level of pollution are more likely to adopt voluntary environmental programmes in order to reduce negative impacts of pollution for which they are responsible (King and Lenox 2000; Anton, Deltas, and Khanna 2004). *Pollution* is measured using a question that asked on average how many million gallons a wastewater facility processed per day (MGD). This variable ranges from 0.008 to 4,500,000 with a mean of 157,321.5. In our regression models, the original data are divided by 2000 for the easier reporting and interpretation of results. Organisations with

experience in other process standards also tended to adopt voluntary programmes (Grolleau, Mzoughi, and Thomas 2007) because the experience might help reduce resources and time required for the adoption. *Management System Use* was measured using a count of following management practices implemented by an organisation: (1) Quality management system (e.g. ISO 9000); (2) Full-cost or activity based accounting; (3) Process or job control system; (4) Inventory or materials requirement planning; and (5) Other non-environmental related management practices. Previous research has shown that the likelihood of adopting an EMS programme also tends to increase with the age of an organisation (Khanna and Anton 2002). Therefore, we included the variable *Facility Age,* which is measured as the number of years that an organisation had operated wastewater treatment. The reliability of all multiple item variables and question details are presented in the Appendix.

The final empirical model can be expressed as:

*Level of EMS Adoption = f (Regulatory Strictness, Cost Change, Stakeholder Influence, Politician Demands, Land Application, Budget, Pollution, Management System Use, Facility Age, Publicness, Stakeholder Influence*Publicness, Politician Demands*Publicness, Land Application*Publicness)*

3.3. *Method*

The dependent variable, *Level of EMS Adoption*, is measured on an ordinal scale. Given that the discrete nature of data is likely to violate the normality assumption of the Ordinary Least Squares (OLS), the Ordinal Regression Model (ORM) may be more appropriate for model testing with ordinal variables (Long and Freese 2005). An observed variable with an ordinal scale presents an unobserved latent variable that is theoretically continuous, while there is no fixed distance between categories (Cameron and Trivedi 1998; Long and Freese 2005). This study thus employs the cumulative logit version of the ORM in which each outcome category at or below a given cutoff of the underlying latent variable is compared with other categories above the cutoff (Menard 2009). The equation can be expressed as:

$$\text{In } [\text{P}(Y \leq i)/\text{P}(Y > i)] = \theta_i - (\beta_{i1}\text{X}_1 + \beta_{i2}\text{X}_2 + \ldots + \beta_{ik}\text{X}_k)$$

where i is the categorical value of the dependent variable, k refers to the independent variables, and θ_i is some thread value of the underlying latent variables (Menard 2009). The fundamental assumption of this model is that determinants and the probability of moving from one thread value to the next cutoff are the same across all categorical values (Borooah 2001). Stata version 9 was used to estimate hypothesised models, and missing values were excluded from all analyses.

4. Results

Table 2 presents the results of the regression estimations for the level of EMS adoption. Model 1 shows impacts of variables of interest on EMS adoption; Model 2 adds *Publicness* and the interaction variables into the model to examine the degree to which the level of publicness moderates the influence of political attention on EMS adoption. It should be noted that the individual variables in the model including the interaction terms are conditional effects (effects when other independent variables are constant) rather than

Table 2. Estimation results for the model of EMS adoption.

	Model 1			Model 2		
	Coef.	**SE**	**OR**	**Coef.**	**SE**	**OR**
Regulatory Strictness	0.46	0.22*	1.59	0.57	0.24*	1.76
Cost Change	−0.60	0.48	0.55	−0.58	0.46	0.56
Stakeholder Influence	0.23	0.11*	1.26	0.27	0.12*	1.31
Politician Demands	−0.28	0.15†	0.75	−0.44	0.19*	0.64
Land Application	0.01	0.01*	1.01	0.01	0.01	1.01
Publicness				−0.13	0.71	0.88
Stakeholder Influence*Publicness				−0.81	0.63	0.45
Politician Demands*Publicness				0.90	0.42*	2.45
Land Application*Publicness				0.03	0.02†	1.03
Budget	0.54	0.27*	1.72	0.56	0.28*	1.75
Pollution	−0.002	0.001*	1.00	−0.002	0.001**	1.00
Management System Use	0.18	0.23	1.20	0.20	0.22	1.22
Facility Age	0.01	0.01	1.01	0.01	0.01	1.01
/cut1	4.47	2.07		3.90	2.24	
/cut2	5.55	2.10		5.07	2.30	
N of Observations	89			89		
Log Likelihood	−79.403			−75.369		
Pseudo R Squared	0.15			0.20		
Wald Chi2	28.68***			41.38***		

Note: †p<0.1; * p<0.05; ** p<0.01; *** P<0.001

main effects (Jaccard 2001). The main effects of political attention – *Stakeholder Influence*, *Political Demands* and *Land Application* – should be interpreted based on the model without interaction terms (Model 1). By comparing Model 2 with Model 1, the pseudo R-square of Model 2 has improved from 15% to 20%, meaning that the inclusion of the interaction terms improves the overall explanatory power of the model. The following paragraphs discuss the regression results in order of the hypotheses.

Hypothesis 1 states that regulatory pressure towards sound environment tends to increase the possibility of EMS adoption by public wastewater treatment facilities. According to Model 1, *Regulatory Strictness* is positively related to the level of EMS adoption ($p < 0.05$), indicating that public wastewater treatment facilities are more likely to voluntarily adopt EMS when environmental regulation is perceived to have become stricter during the two years prior to the survey. Specifically, for a one unit increase in perceived regulatory strictness, we would expect a 59% increase in the odds of being in a higher level of adoption.

Given that public organisations typically operate on the basis of government budget without a need to deal with market competition, hypothesis 2 posits that economic incentives will not remarkably induce voluntary initiatives of public wastewater treatment facilities. Model 1 shows that an increase in disposal fees during the two years prior to the survey is not significantly associated with EMS adoption by public facilities. This supports hypothesis 2.

We also hypothesised that political attention towards environmental soundness would play a considerable role in determining EMS adoption by public wastewater treatment facilities (H3). Our regression results partially support the third hypothesis about the influence of political attention, although the direction of the effects is not always positive. The level of political attention is captured by three variables – *Stakeholder Influence,*

Politician Demands and *Land Application* – that are connected to environmental groups, politicians and citizens, respectively. As shown in Model 1, *Stakeholder Influence* is positively associated with the level of EMS adoption ($p < 0.05$), meaning that public wastewater treatment facilities tend to voluntarily adopt an EMS when they face strong expectations from environmental and community groups to improve their environmental practices. A one unit increase in perceived attention from environmental groups leads to a 26% increase in the odds of being in a higher level of adoption. Likewise, *Land Application* is found to be a significant explanatory variable for EMS adoption by public wastewater facilities ($p < 0.05$). The higher percentage of an organisation's biosolids that are used in land application, the more likely the organisation is to voluntarily adopt EMS. This result is consistent with our hypothesis that public attention will induce environmental voluntary initiatives.

In contrast to our hypothesis, however, *Politician Demands* is negatively related to the level of EMS adoption (although the association is weak at $p < 0.1$). The finding indicates that as politicians' and elected officials' interest in environmental issues increases, public wastewater treatment facilities will be less likely to voluntarily adopt an EMS. Explored further below, this unexpected finding may reflect the fact that the impact of politician demands on the EMS adoption is moderated by the level of publicness holding government-owned facilities. Simply distinguishing wastewater facilities based on ownership may overlook the fact that government-owned facilities with various levels of publicness respond differently to politician demands.

Hypothesis 4 posits that the level of publicness for government-owned wastewater treatment facilities will moderate the effect of political attention on their EMS adoption. To test this hypothesis, our model further includes *Publicness* and three variables representing interactions between the level of publicness and political attention. As shown in Model 2 (Table 2), the interaction term of *Publicness* and *Politician Demands* is positively associated with EMS adoption ($p < 0.05$), indicating that politician demands tend to have stronger influence on facilities with a higher degree of publicness. Specifically, government-owned facilities performing biosolids-related activities internally are 2.45 times more likely to respond to politician demands on EMS adoption than those contracting out biosolids-related activities. Figure 1 further illustrates the form of the moderating effect of publicness on the politician demands-EMS adoption relation. It shows that government-owned wastewater treatment facilities, having a higher degree of publicness, are much more likely to adopt EMS compared to those having a low degree of publicness when facing great green demands from politicians. When facing fewer politician demands, the difference in EMS adoption between the groups with high and low publicness becomes less notable.

Moreover, the interaction term of *Publicness* and *Land Application* are also positively related to EMS adoption ($p < 0.1$). Government-owned facilities performing biosolids-related activities internally are 1.03 times more likely to respond to green demands from citizens on EMS adoption than those contracting out biosolids-related activities. As shown in Figure 2, government-owned wastewater treatment facilities having a higher degree of publicness are more likely to adopt EMS, particularly when a large percentage of biosolids produced by the facilities is applied to land and thus grabs citizens' attention to the importance of environmental management practices.

Estimation results for control variables are consistent across the two models. We find that the size of the organisational budget is positively associated with the level of EMS adoption by public wastewater facilities ($p < 0.05$), indicating that organisations with greater resources are more likely to adopt an EMS. Consistent with the public-private

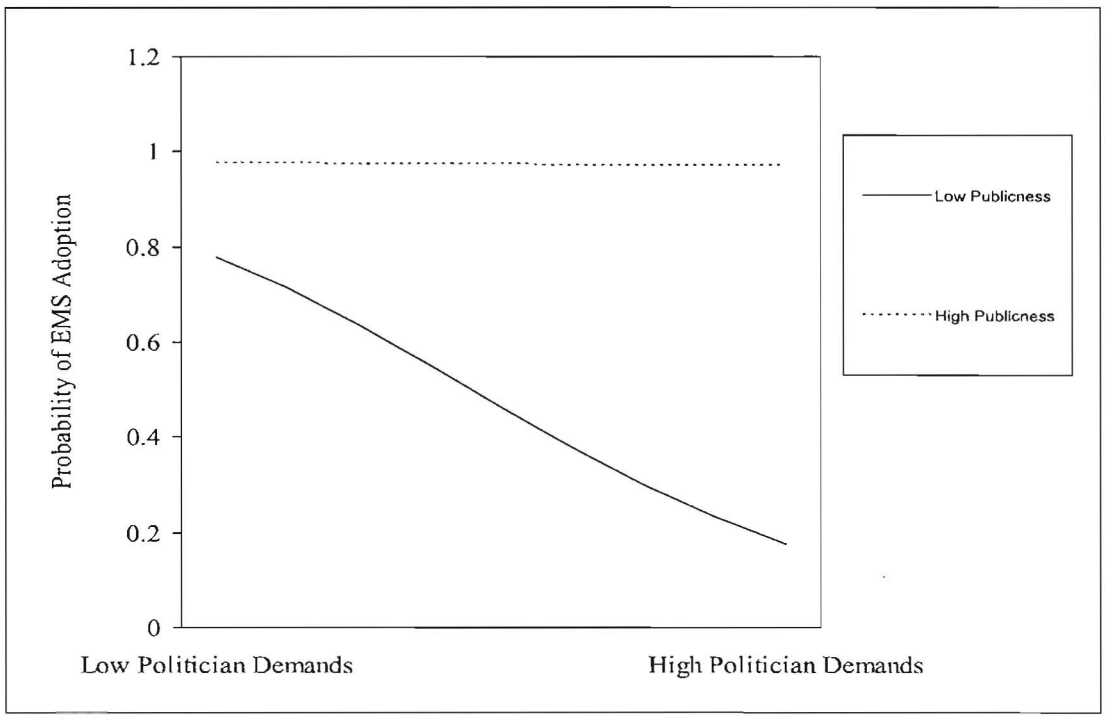

Figure 1. The moderating effect of publicness on the politician demands-EMS adoption relation.

distinction literature, cost savings or profit earnings are not major factors for public organisations when they decide to adopt an EMS, although a sufficient organisational budget seems to be a fundamental requirement for public wastewater facilities to consider adopting EMS. In contrast to our expectation, public wastewater treatment facilities that process a larger amount of sewage and wastewater are less likely to adopt

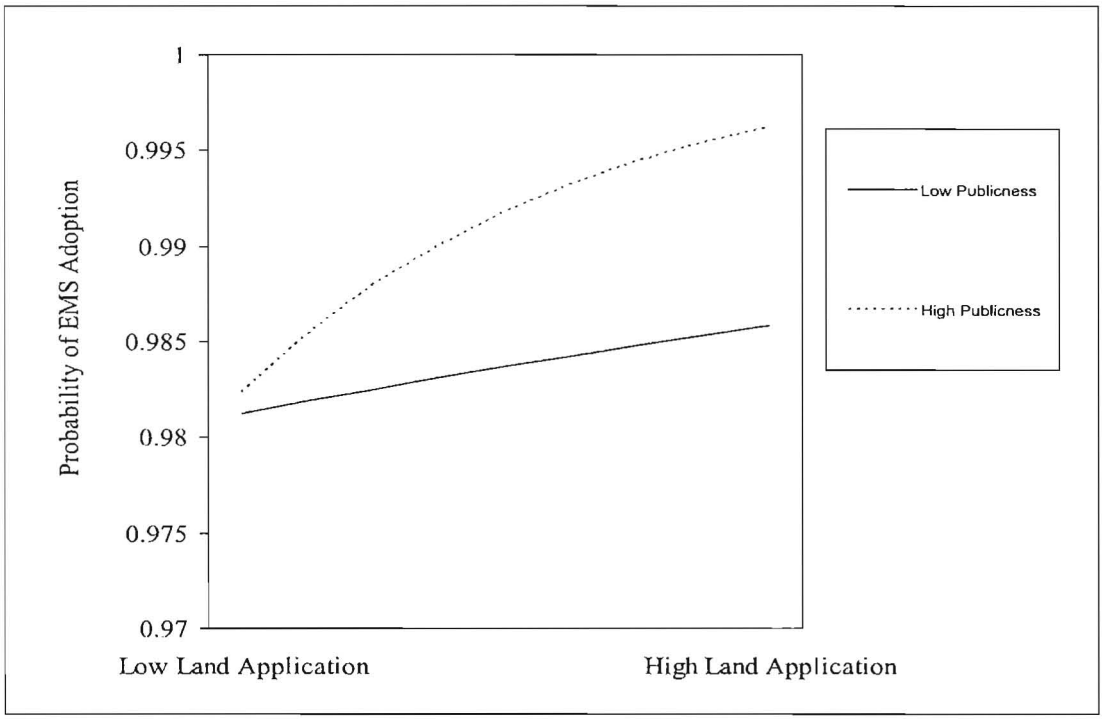

Figure 2. The moderating effect of publicness on land application-EMS adoption relation.

an EMS ($p < 0.05$). This is probably because public wastewater treatment facilities handling a high amount of sewage and wastewater tend to be large in scale and prefer maintaining the status quo rather than adopting new environmental initiatives (Downs 1967).

5. Discussion and conclusions

In this study, we have explored the relevant factors that induce voluntary initiatives by public wastewater treatment facilities. We recognise that the determinants of voluntary environmental behaviour for private firms (found in prior research) may not fully explain the adoption of voluntary initiatives by public organisations. We conclude that the adoption of public voluntary initiatives is primarily driven by regulatory pressure and political attention towards environmental soundness, rather than by economic considerations such as profit maximisation or cost reduction. Moreover, we explored how voluntary behaviour might vary across government-owned wastewater treatment facilities depending upon the level of publicness. We found that facilities that have a greater degree of publicness are more likely to be influenced by external political attention.

Overall, the findings provide evidence in favour of our regulatory and political attention hypotheses. Our analysis indicates that public wastewater treatment facilities perceiving a higher level of regulatory strictness tend to be more likely to adopt voluntary programmes. We speculate that this is due to the norms of administrative responsibility in which public employees follow rules established by elected representatives (Finer 1941), as well as the intention to reduce the regulatory burden on the organisation. Our analysis further shows that an increase in disposal fees seems to have no significant impact on EMS adoption; instead, public wastewater treatment facilities that experience a higher level of political attention from environmental groups and the public are more inclined to adopt an EMS. These findings support the literature on the public-private distinction, which argues that the decision making of public organisations is subject to political influence rather than market mechanisms (Wamsley and Zald 1973; Bozeman 1984, 1987).

In addition to the expected findings mentioned above, we also found that demands from politicians or elected officials negatively influence the level of EMS adoption by public wastewater treatment facilities, meaning that stronger politician demands towards environmental soundness may result in resistance to EMS adoption. Our explanation for this unexpected finding is that the public nature – or publicness – of wastewater treatment facilities may moderate the extent to which politician demands on green environment determine the EMS adoption. Among government-owned wastewater treatment facilities, those performing biosolids-related activities internally are more sensitive to politician interests in environmental issues than those contracting out the activities.

Several limitations of the study need to be noted. First, the small sample size may limit our ability to generalise the findings. Second, our models may face some endogeneity problems. For example, it can be argued that voluntary initiatives may reversely influence regulatory pressures and the level of political attention from stakeholders, politicians and the public. This is a common problem for all cross-sectional survey data, and the lack of longitudinal data precludes our ability to test the causal relationship expected here. Third, while the survey respondent was the person in charge of biosolids management at each facility, that person's point of view may not accurately represent the entire organisation.

Despite these limitations, this study contributes to the literature in several ways. First, it advances the literature on environmental voluntarism by indicating that voluntary

initiatives of public and private organisations may be induced by a different set of factors. We concluded that the decision making of public organisations (for voluntary initiatives) is primarily determined by regulatory and political factors rather than market mechanisms. For policy makers seeking to encourage public voluntary initiatives, it is clear that regulatory, stakeholder and public influence play an important role. To affect voluntary behaviour, regulators could increase oversight and monitoring, implement larger and more frequent fines, or carry out other forms of compliance-enhancing activity. In addition, regulatory agencies could increase the transparency of pollution outputs (e.g. effluent amounts) or pollution violations in ways that enhance rather than limit stakeholder and public knowledge about an organisation's environmental activities. In addition to calling public attention to land application of biosolids, which is perceived to have considerable influence on public health, environmental information disclosure is also a possible way of attracting stakeholder organisations and the general public. Second, this study supports the literature on public-private distinction by showing that the level of organisational publicness may help to explain some environmental decisions made by government-owned wastewater treatment facilities. For organisations owned by government but contracting out their business, voluntary initiatives may be less driven by environmental pressure from politicians and the public. Political actors should recognise that level of publicness will affect the extent to which organisations respond to political pressure. The overall effect of political pressure on the voluntary adoption of an EMS is negative, but the negative effects are attenuated if the organisation is publicly owned and operated.

Since our analysis is conducted in the wastewater profession specifically, the findings only provide some evidence of the hypothesised relationships among variables of interest, and there should be caution when generalising our findings to other arenas. Therefore, future research that investigates public environmental voluntarism in multiple, different arenas will be important for the development of the literature on this topic. Moreover, future studies may consider collecting data on voluntary initiatives across public and private sectors and empirically comparing whether voluntary activities by organisations with different levels of publicness are determined by different factors.

Notes

1. The US Environmental Protection Agency (EPA) defines an Environmental Management System as "a set of processes and practices that enable an organisation to reduce its environmental impacts and increase its operating efficiency". Accordingly, EMS does not set up requirements for environmental performance but rather provides a framework that helps to establish a more effective system to manage environmental aspects. The ISO 14000 series standards, developed by the International Standards Organisation, is the widely recognised EMS framework. Among the ISO 14000 family, ISO 14001 specifies requirements with guidance for EMS use and ISO 14004 complements ISO14001 by offering general guidelines on principles, systems and support techniques (ISO, 2009). An organisation that has met these requirements can become ISO 14001 certified. Other standards present requirements and direction for the use of additional environmental tools such as life-cycle assessment (ISO 14040, 14044), environmental auditing and performance evaluation (ISO 14031), and environmental labelling (ISO 14020, 14021, 14024, 14025) (ISO, 2009). The adoption of ISO 14000 EMS is voluntary. Costs to the adopting firms are substantial, while benefits include provision of visible environmental branding that may have positive market effects. Other EMS systems exist including the Eco-Management and Audit Scheme (EMAS) prepared by the European Union.
2. Biosolids are the nutrient-rich organic materials resulting from the treatment of domestic sewage at a wastewater treatment facility; through biosolids management, solid residue from

wastewater treatment is processed to reduce or eliminate pathogens and minimise odours, forming a safe, beneficial agricultural product (NBP 2007).

3. http://www.wef.org/Biosolids/page.aspx?id = 7554

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Appendix

Table A1. The construct of variables and reliability.

Variable	Questions
Level of EMS adoption	Please check the box next to the statement that best describes your organisation's involvement in the development of an Environmental Management System (EMS): 1. We have not considered establishing an EMS, or We considered establishing an EMS, but decided not to establish one. 2. We are currently considering establishment of an EMS. 3. We are in the process of establishing an EMS, or We have established an EMS.
Regulatory strictness (Cronbach's $\alpha = 0.79$)	How have the following changed over the past two years for your organisation? (1: improved significantly; 5: worsened significantly) • Regulated land application restrictions • Stringency of regulatory requirements
Cost change	How has the use/disposal fee for class B biosolids changed over the last two years? 1. Decreased 2. Stayed the same 3. Increased
Stakeholder influence (Cronbach's $\alpha = 0.84$)	How important do you consider the influence of the following groups or organisations on the environmental practices of your organisation? (1: not important; 4: substantially important) • Individual local residents • Environmental groups and organisations • Neighbourhood/community groups and organisations

Table A1. (*Continued*)

Variable	Questions
Politician demands (Cronbach's $\alpha = 0.90$)	How important were the following motivating your organisation to reduce environmental impacts? (1: not important; 4: extremely important) • to satisfy local politician demands/interests • improve relationships with elected officials
Land application	The percentage of your organisation's biosolids that are used in land application.
Publicness	Please indicate which biosolid-related activities your organisation performs internally and which are contracted out: treatment chemical production, wastewater pre-treatment, wastewater treatment, biosolids processing (e.g. dewatering/screening/grinding), storage, landfill, incineration, transport, land application (Class B), compost (Class A), drying
Stakeholder influence *Publicness	Product of Publicness and Stakeholder Influence
Politician Demands *Publicness	Product of Publicness and Politician Demands
Land Application *Publicness	Product of Publicness and Land Application
Budget	What is the level of your organisation's current operating budget? 1. Less than $500,000 2. $500,000 to $999,999 3. $1 million to $9,999,999 4. $10 million to $50 million 5. Over $50 million
Pollution	On average, how many million gallons per day (MGD) does your facility (s) process? (In our regression models, the original data is divided by 2000 for the convenience of result interpretation)
Management system use	Has your organisation implemented any of the following management practices? • Quality management system (e.g. ISO 9000) • Full-cost or activity based accounting • Process or job control system • Inventory or materials requirement planning • Other non-environmental related management practices
Facility age	What is the approximate age of your wastewater operation? (years)