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Determinants of the Construction of On-Site Sewage Treatment and Disposal System(OSTDS) in Florida Local Governments : Regarding Transaction Cost Theory

거래비용 이론과 개인하수처리시설 건설에 관한 연구 : 플로리다 지방정부를 중심으로

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목 차

I. Introduction

Currently, water resource management is an important consideration since its effects are enormous with respect to ecological and human settlement. One of the primary reasons for its importance is that water management embodies a new vision for regional sustainability(Gleick. 1998). The failure of water management, especially the preservation of clean water, causes regional conflicts, ecological and environmental degradation. Furthermore, with a viable water management system, governments can plan economic and residential development and provide further appropriate regulations to protect existing water resources.

In Florida, according to the Department of Environmental Protection, water resources are contained by "more than 7,700 lakes, 4,500 squares miles of estuaries and bays, throughout the state," and the government attempts to preserve clean water by appropriate water management, especially through wastewater management(DEP. 2010). With the aims of wastewater management(e.g., preserving clean water, protecting public health and the ecological environment, etc), county governments encourage the citizenry to install an On-Site Sewage Treatment and Disposal System(hereafter OSTDS) on their properties. In general, the purposes of OSTDS are to protect public health and to increase the cost effectiveness of cleaning domestic wastewater. The OSTDS is constructed at the suburban, newly developed area and rural area since the construction cost is relative low and geographic proximity of sewer services is efficient, comparing with any types of sewer facilities (CDC. 2009). Furthermore, as a decentralized system, the operation of an OSTDS emphasizes a individual-based maintenance operation and the owners have responsibility for their sewage facilities such as septic tanks. At this point, installation of an OSTDS is considered a competitive way to increase individual responsibility in the area of large lot size of property, rural and suburban closely connected in city and density area. Regarding these phenomena of OSTDS construction, it is important to investigate local contextual factor influencing the OSTDS construction as sewer system at the area of suburban or rural instead of the effects of geographical, regional and environmental characteristics.

Regarding the objectives of OSTDS, this research, more specifically, scrutinizes the research question regarding which local contextual factors influence the OSTDS construction. This question is inspired by two findings in the literature. First, regarding the characteristics of the nature of water, OSTDS can be related to a collective action problem in the context of common pool resources. The OSTDS as a part of decentralized sewer system is rooted in individual efforts to manage and control wastewater. But, when collective action has failed in water management of individual or private lots, the negative spillover is huge in neighborhood and causes environmental degradation. Thus, a high level of individual commitment is a primary focus.

Second, earlier research introduced several dimensions of wastewater management, but they were more likely to be related to site selections of sewage and drainage facilities and an engineering perspective with technologies for reducing environmental

degradation(Stander. 1966) rather than studying governmental policy choices among different types of sewer facilities. The OSTDS is based on local governmental sewer policy supports, and also since it relies on regional population growth, density, citizen participation, land zoning regulation, site and lot-size regulation and local ordinances, local governmental sewer policy choice can be determined by the local governmental and citizen willingness as much as geographic, environmental and regional status. Thus, this research attempts to find insightful factors influencing the OSTDS construction.

Based on the above two findings, the authors employ transaction cost theory for the theoretical foundation. Basically, transaction cost theory helps us to understand the cost and benefit mechanism in governmental policy choices and rational individual behaviors. Furthermore, according to a report from the Florida Department of Health(FDOH. 2008), in the situation of which the individual commitment and local governmental policy support are well operated and well integrated, OSTDS has a lower cost of construction, a lower level of environmental risk and an increasing proximity of facilities, and then the total social costs are smaller than any types of sewer facilities. Thus, using transaction cost theory the authors construct a theoretical framework and analyze local contextual factors affecting the OSTDS construction.

II. Literature Review of OSTDS and Local Government in Florida

In the United States, decentralized OSTDS is used by about 25% of the population and 33% of OSTDS is being developed(EPA. 2003). Even in Florida, 2.3 million OSTDS are used statewide and it serves about 31% of Florida's population(FDOH. 2008). OSTDS plays a significant role for wastewater cleaning. Specifically, the OSTDS has been characterized by its definition which is "managed individual onsite or cluster wastewater systems(commonly referred to as septic systems, private sewage systems, individual sewage treatment systems and onsite sewage disposal systems)(EPA. 2003: p5)." Rather than centralized public sewage systems in rural, suburban and newly developed or population growth area, the OSTDS focuses on decentralized systems and emphasizes individual responsibility. That is, OSTDS is presumably considered through voluntary participation among individual and local governmental preference and willingness. Each individual can use OSTDS construction in their region or property lots in terms of local governmental site regulation and sewer facilities standards.

Even though the OSTDS is a decentralized-voluntary system, it is regulated and complemented by several federal, state and local governmental requirements which are related to the National Pollutant Discharge Elimination System(NPDES) under the Clean Water Act(CWA) and the Underground Injection Control(UIC) program under the Safe Drinking Water ACT(SDWA)(EPA. 2003: pp7-8).

The Department of Environmental Protection (EPA. 2002) requires rules such as: "1) the estimated volume of domestic sewage to be processed should not exceed 10,000 gallons per day, 2) the estimated volume of commercial sewage to be processed should

not exceed 5,000 gallons per day, and 3) type of cleaning wastewater(e.g., Gray water and Black water; (1) Gray water - residential wastewater from the bathtub, shower, lavatory, laundry and sink, except kitchen sink waste and (2) Black water – part of domestic sewage carried off by toilets, urinals and kitchen drains)." This application is authorized by county level of government and Florida DEP authority based on the facts and salient applications about individual property and geographic drainage area (DOH Charter 64E-6). In sum, decentralized OSTDS is used for cleaning domestic water and preservation. More than that, OSTDS helps to protect public health, to increase individual control and maintenance of water quality and to increase cost-effectiveness.

But, there are positive and negative sides of OSTDS. The Florida Department of Health(FDOH. 2008) provide general comparisons between sewer and OSTDS from basic idea of two different construction as a de facto. Following Table 1 shows general idea and comparison in terms of cost and benefit.

Based on above general comparison between sewer

Table 1 _ Comparison of Sewer and OSTDS

Issue	OSTDS	Centralized Sewer Facility
Cost	•Generally low cost for passive system; $ 3,000 to $ 6,000 for standard 3 bedroom single family residence. Nitrogen reduction: $ 10,000 to $15,000.	•High up front cost for construction of treatment facility and connection lines. Connection costs for family residence range from $2,500 to $20,000.
Maintenance & Monitoring	•Homeowner responsible for monitoring and reporting problems. Minimum maintenance required.	•Minimize homeowner responsibility. Homeowner not responsible for maintenance but pays monthly service charge based on usage.
Water Recharge	•Provides for recharge on individual lots.	•Takes effluent away from area to central location and disposal site.
Failures	•Failures may be undetected but limited to small amount (300 –400 gallons per day). Failures generally isolated and limited to one specific area.	•Monitored 24/7. Spills can be very large (1000–100,000) but monitored and reported. Line leaks may be undetected. Failures affect multiple homes and can potentially contaminate large areas.
Treatment	•Technology currently limited to advanced secondary treatment. Significant increase in cost and requires ongoing maintenance and oversight.	•Advanced wastewater treatment.
Funding	•Individual owner pays full cost, few funding options available.	•More funding options; both loan and grant programs.
Upgrades Development	•Upgrades less costly but impacts individual owners. •Limits development options for site. Takes up physical space on site as well as requiring setbacks to wells and surface water and future modifications. •Limits on flow and type of waste. Using cluster systems provides additional options for development	•Upgrades costly but impact all owners over shorter time frame. •Opens areas to development. Few limitations on lot size. Few limits on lot flow or type of waste. Requires land area for spray field.

and OSTDS, four significant facts are characterized; 1) cost-effectiveness, 2) cost of environmental and water degradation, 3) technological treatment and financial support and 4) maintenance and monitoring. Regarding the cost-effectiveness perspective, the initial construction cost of OSTDS is smaller and water recharge is more efficient than the sewer facility. Individualized investment and the proximity of a sewage facility can provide cost savings to a governmental budget and easily recharge and refine domestic wastewater. Furthermore, since the OSTDS treats, if a failure of cleaning water takes place in individual lots the effect of environmental and water degradation is smaller than the failure of the sewer facility. That is environmental risks and costs are much smaller.

However, there are weaknesses to the OSTDS. Since the OSTDS is based on individual monitoring and maintenance, a high level of individual commitment as a perspective of self-regulating is necessary. Likewise, since the OSTDS is based on individual funds and investment, it is difficult to improve the treatment technology to the some extent. Moreover, since OSTDS is not constructed on a governmentally regularized site but constructed on an individual site, the individual cannot easily develop the OSTDS site because government regulates the setback and physical space.

Even though there are risks of negative externality and difficult maintenance, the local governments attempt to gradually provide the services of OSTDS, and continue to approve/ enforce OSTDS construction. That is, it may be influential study about which factors influence the local OSTDS construction in terms of increasing efficiency and achieving water preservation, controlling for physical, environmental and geographical characteristics.

III. Research Design

In this study, the authors focus on 1) local politics (i.e., type of county governmental form and election type of commissioners) correlating with political transactions, 2) the formal rule structure(i.e., mandatory requirement for inspection), and 3) the number of OSTDS contractors and white population correlating with decreasing uncertainty of commitment and information flow. The following table 2 shows the theoretical framework to investigate the OSTDS construction.

Table 2_Theoretical Framework

Theoretical Factor	Theoretical Mechanism
Political Transaction • Commission−Manager Form of Government • By District Election of Commission	Political Transaction • Manner of Policy Efficiency • Not−In−My−Back−Yard Politics
Commitment and Information Flow • Mandatory Requirement(Formal Rule) • Number of Contractors • White Population	Commitment and Information Flow • Increasing Commitment • Increasing Information Flow • Increasing Commitment

1. Local Politics in Transaction Cost

Transaction cost theory derives from an economic perspective using mechanism of exchange among economic actors. Transaction cost economics was developed by Coase(1937), Williamson(1981) and North(1990), and it was applied to organizational behavior and economics. The main theorem in transaction cost is that each transaction may produce costs and benefits, and the transition is made by individually calculated benefits regarding basic assumptions of bounded rationality and opportunistic behavior. Transaction cost economics is useful to explain the uncertainty of various contracting practices. More specifically, transaction cost economics was based on the production cost in the economic market until the 1930s. However, since the public sector's organizational activities are various and involve many actors contracted or planned, the transaction cost perspective is emphasized by encompassing the contracting process with negotiation and bargaining, uncertainty of commitment and information flow. Williamson(1985) concretized the analysis and dimensions of the contracting processes and relationship the producing efficient planning of the future performance of tasks. More recently, transaction cost theory is cited in the field of public policy.

Within the perspective of governance and governmental policy choice, transaction cost theory produces a lens through which to view political behaviors and then political behaviors with the transaction cost are re-addressed as transaction cost politics(Kwon et al. 2010). According to transaction cost politics, the mechanism of 'political efficiency' and 'political exchange' offers a core standpoint to analyze political behavior and governmental action and explores dynamic political negotiation and bargaining processes in policy decision making. Political behavior and action are correlated with political complexity which explains the political exchange between political gains and risks behind constitutional contracts for which elected politicians have responsibility and accountability. That is, the above statements are based on theoretical argument that legislative and executive institutions can provide responsible public policy while "the structure of executive branch institutions has different incentives about policy outcome(Lubell et al. 2005: p714)."

Regarding transaction cost politics, the OSTDS construction has several characteristics related to political transactions. First, the type of county government is important. Since the OSTDS has to be approved by each county government, the priorities of county governments determine whether they approve the OSTDS or not. County government consists of three types of governmental form – commission form, mayor-commission form(form of elected executive) and commission-manager form (Smith. 2007). Rather than commission form and elected executive form of government which emphasize political responsiveness and political exchange and efficiency, the commission-manager form of government emphasizes governmental policy efficiency and professional administration(Renner. 2001; Teske and Schneider. 1994). The county manager, separated by political influences, has a strong willingness to provide administrative efficiency

and is protected by political corruption and much influence(Lineberry and Fowler. 1967). Also, the professional manager has a long-term view when policies are being implementing. Within the perspective of governmental costs and environmental degradation costs, since the OSTDS is based on individual investment, governments can save a budget on constructing alternative sewer facilities. Moreover, the extent of environmental and water degradation when the failure of maintenance at the OSTDS takes place is smaller than with a certain types of sewer system. That is, the risks of environmental contamination and costs of maintenance can be small with OSTDS.

Hypotheses 1: The commission-manager form of county government is more likely to construct the OSTDS than other types of governmental form.

Second, the election type of county commissioner is an appropriate wayto address political transactions. In transaction cost politics, elected officials have a willingness to exchange their political influence and political gains(i.e., political incentives – re-election, political careers, etc). This means that elected officials occupy positions that can support or oppose certain public service policies depending on calculated political gains(Kwon et al. 2010). Also, according to Yoo and Park(2010) in the study, 'Understanding of Local Politics and Affordable Housing in terms of Political Market Theory,' they addressed the different effects of elected officials in light of different types of elections in local jurisdictions. Rather than electing officials by an at-large election(i.e., elected officials are elected by a whole geographic region), electing officials through a by-district election(i.e., elected officials are elected by a divided geographic region) create more of a willingness to respond to regional needs and have a 'Not-In-My-Back-Yard-Politics' (Yoo and Park. 2010; Clingermayer and Feiock. 2001). In sum, the officials elected through by-district elections are more likely to be constrained by regional- and district-based voters than other types of elections (Hajnal and Trounstine. 2010). Depending on the type of election, sewer facilities can be NIMBY facilities which can negatively affect neighborhood property values and environmental concerns. According to Bollens(1992), local governments face much opposition to constructing certain kinds of waste facilities since the dominant cognition in local communities is negative and the public plays a key role for not-in-my-back-yard-politics. That is, officials elected in by-district elections are more likely to choose the OSTDS options rather than utilizing other types of sewer facilities.

Hypothesis 2: The by-district type of election for county commissioners is more likely to construct the OSTDS than other types of elections.

2. Uncertainty of Commitment and Information Flow in Transaction Cost

Regarding transaction cost, in the OSTDS, since the individual/ community has a huge responsibility for water cleaning, monitoring and maintaining, the community's commitment is a significant dimension. According to Miller(2005), there is a difficulty

obtaining credible commitment and information asymmetry among stake-holders. He focused on the goal disparity and different incentives between the principal and the agents. If credible commitment is not involved, negative externality spreads out over a wide range of the community and fails to sum up collective efforts.

However, mandatory rules can resolve the commitment problems in the contracting process by the formal rule-structure and enforce the actual agreement with written contracts. The formal rules are prohibitive and shared agreement about policy objectives among stake-holders. That is rules can enforce the implementation of high commitment. Moreover, North(1990: p6) stressed that formal rules can reduce behavioral uncertainty through strong requirements and enforcement of policies. This means that institutional enforcement can reduce opportunistic behavior and uncertainty of a community's commitment and internalize individual identities into the collective process(McCabe and Feiock. 2005). Within the mandatory requirement of the OSTDS inspection for 5 consecutive years, county governments can increase the capacity the monitoring operation of the OSTDS on individual and private lots, and then the mandatory requirement can increase individual performance and commitment even though OSTDS is based on voluntary participation.

Hypothesis 3: County governments which have mandatorily requirement of inspection are more likely to construct the OSTDS.

OSTDS construction means that local governments have contracted individually or privately to providing septic system facilities, private sewage systems, individual sewage treatment systems and onsite sewage disposal systems. In Florida, the municipalities or the individual are concerned about finding appropriate contractor to supply high level of maintenance capacity and advanced water cleaning skills. Even though local governments provide many licensed contractors, the selection of OSTDS contractors is obviously a serious matter when the municipalities or individual cannot fully understand or recognize contractors who are capable of working with the advanced technology. That is, in this contracting process, individuals and local governments are not in a position to compare contractors since they have limited information about them.

Regarding theoretical circumstance, Kenis and Knoke(2002) addressed an actor density to explain how information sharing and flowing occur. This actor density refers to the number of actors and when there are many actors involved, this provides many routes for information sharing and flow. Moreover, Feiock et al.(2007) argued that contracting and sector choices are determined by the number of external providers for certain public services, and then the number of external providers may contribute to this information to show their potential and capabilities. Thus, municipalities and individuals can easily find access to what they seek and have many options for choosing the best contractors for their property lots.

Hypothesis 4: County governments which have many licensed contractors are more likely to construct the OSTDS.

Furthermore, in terms of the social capital perspective, homogeneity in community is an important dimension to address transaction costs. In general, community heterogeneity results in diverse preferences(Feiock et al. 2007: p77). But, in community homogeneity, both commitment and information flow are less costly. Within the governmental perspective, public officials can reduce certain costs for collecting public opinions and easily reach integrated policy goals. Within social capital literature, information flow is an important function of community integration, and therefore information flow is easy in a homeogenous community since a homogeneous community is more likely to have similar preferences and a collective coalition(Lepelley and Valognes. 2003). This mechanism can be found in the popular concept of social capital as "a means of enforcing norms of behavior among individual or corporate actors and thus acts as constraints, as well as resources(Walker et al. 1997: p111)." Thus, based on the above statement about social capital and commitment in homogeneous communities, the white population may be considered as predictor influencing the OSTDS construction. Since the OSTDS is related to decentralized-voluntary participation and environmental water policy, the white population is more likely to adopt the OSTDS. Many scholars use the white population and their effect on environmental concerns, because of their strong preference for pro-environmental policies and protection of their property values base on their willingness to self-organize and self-regulate. For example, within the literature about growth management, land use and water management, the socio-economic status(i.e., race, education, poverty, and income) are cited to measure the effect of community willingness about environmental policy adoption or the performance of water management in community. Lee and Feiock(2011), in their study of 'The Role of Local Governments in Open Space', argue that the size of white population can be most likely to bring the adoption of pro-environmental policy, increase environmental entities and preserve the environmental public goods. Within land use regulation and zoning literature, the white population can be a lobbyist for environmental protection in the watershed management and an opponent for growth oriented development(Lubell et al. 2005; Clark and Gaile. 1989; Gray and Lowery. 1996). Thus, the white populations have a high probability of securing their environment and providing a self-regulated OSTDS system.

Hypothesis 5: County governments which have a high percentage of white population are more likely to construct the OSTDS.

3. Data and Method

For this study, three published data sources are employed as follows: 1) the 2000 and 2010 U.S. Census[1)] for collecting demographic status data(i.e., population, land area, white population, median income and population density), 2) the municipal code

1) The demographic status retrieved by http://www.census.gov/. [2011.1.22].

Table 3_ Testing Assumptions

Testing	Null Hypothesis(Ho)	Statistical Results
Pesaran'CD Test	Cross-Sectional Independence	Confirmed Dependence
Wald Test	Homoskedascity	Confirmed Heteroskedasity
A Lagram-Multiplier Test	No First-Order Autocorrelation	No First-Order Autocorrelation

corporation[2] for collecting county politics data(i.e., type of county governmental form and type of election) and 3) Florida Department of Health[3] for collecting OSTDS, mandatory requirement and contractors data.

For an applicable method, the authors use mixed method for analysis. The reason for using mixed method is that dependent variable and independent variables are limited by certain time point. That is, the dependent variable, number of OSTDS construction, is observed by 2008 since the OSTDS construction after 2009 to 2010 is accumulative structure, not specified data. Furthermore, the first county government(Santa Rosa county government) started mandatory requirement of inspection in 2000 (FDOH. 2008). Thus, the panel data analysis is conducted between 2000 to 2008. And the predicted variable, the number of contractors, cannot be collected at multiple time points since published data only provided aggregated number of contractors in 2008 to 2009 year. Thus, based on one year proxy data of number of contractors and theoretically hypothesized predictors, one year cross-sectional analysis is conducted.

In the panel data analysis, except for the predictor of the number of contractors, the other predictors are measured. Specifically, the panel data is called as "longitudinal data or cross-sectional time series data where the same entities(panels) were observed at multiple time points(Princeton University[4]. 2010)." The predictors as shown above are constructed from 2000 to 2008 and they are observed at multiple time points from 2000 to 2008 for each variable. In selecting an analytical option in the panel data analysis, the authors made several assumption tests such as test of cross sectional independency, Wald test for group-wise heteroskedasticity and test of autocorrelation. The table 3 shows that the panel data constructed in research have problems as cross-sectional dependency and heteroskedasticity. Thus, the authors, to solve these analytical problems, select Linear regression, correlated panels corrected standard errors(PCSEs).

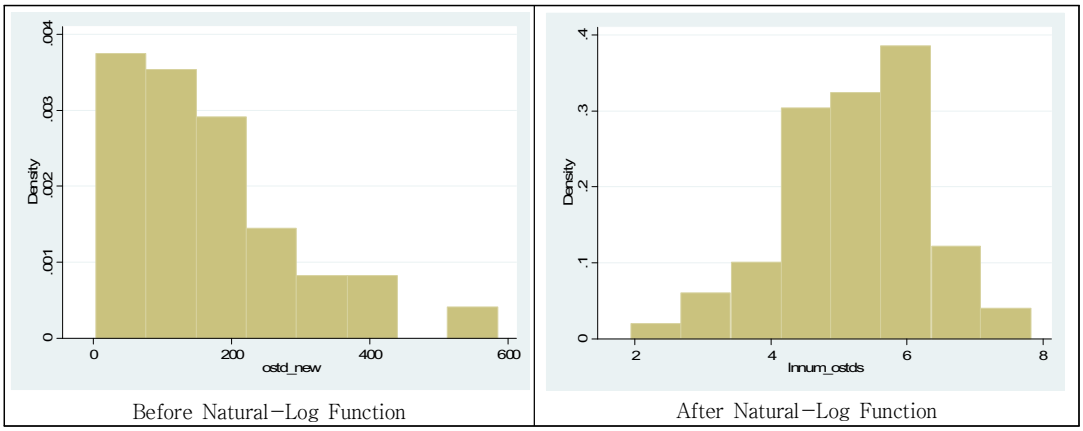
Based on the panel data, the authors create a 2008 year cross-sectional analysis, adding the number of contractors and controlling for the number of OSTDS approvals in 2007, but the cross-sectional analysis is measured by theoretically important predictors(i.e.,

2) County politics data retrieved by http://www.municode.com/library/ClientListing.aspx?stateID=9. [2011.1.22].

3) The OSTDS and contractors data retrieved by http://www.doh.state.fl.us/Environment/ostds/index.html. [2011.1.22].

4) STATA commands and knowledge about panel data analysis retrieved by http://dss.princeton.edu/usingdata/stata/analysis/panel.html. [2011.1.25].

Figure 1 _ OSTDS Distribution of Before and After the National-Log Function



Before Natural-Log Function | After Natural-Log Function

type of county government, election type, mandatory requirement, contractors and percentage of white population). Since here is a high probability of flawed coefficients because of small number of observations compared with the number of predictors, the authors provide two analytical methods: 1) results of multiple regression with the above five predictors and 2) two way scatter plot results to increase analytical validity between the OSTDS and contractors.

4. Measurement

The outcome variable(the approval of OSTDS construction) is constructed by the number of OSTDS constructions in each year. The unit of analysis is Florida county government. Additionally, the construction of OSTDS is neutralized by the natural-log value for satisfying normality assumptions. Tows OSTDS distribution before and after the natural log function.

For the independent variables, the authors measure five different predictors. The type of county governmental form is a dummy variable as if the county governmental form is a commissioner-manager form of government, it is coded as 1 and the others are coded as 0. Also, the type of election is a dummy variable as if the election for county commissioners consists of by-district it is coded as 1, but other elections types are coded as 0. The predictor of mandatory requirements for inspection is a dummy variable as if county government provides mandatory requirements for the OSTDS regulation, it is coded as 1 and the others are coded as 0. The white population is a continuous variable as percentage of the white in each county government. Finally the number of contractors is a continuous variable as the total number of contractors in the year 2008.

Controlling for side effects, the authors select predictors which are total population, land area, amount of county property tax, median income, population density and total number of cities in the county. All six variables are continuous variable, and population is coded as total number of population with the function of natural log, land area is coded as square miles, property tax is coded as total amount of property tax revenue with the function of natural log,

Table 4 _ Descriptive Statistics

Predictors	N (PCSEs/2008)	Mean (PCSEs/2008)	St. Deviation (PCSEs/2008)
The OSTDS Construction (Natural Log Value)	602/67	5.613/5.214	1.141/1.076
Political Transaction			
•Commissioner−Manager Form	603/67	0.731/0.732	0.444/0.447
•By District Election	603/67	0.328/0.343	0.470/0.470
Commitment and Information			
•Mandatory Requirement	603/67	0.048/0.089	0.214/0.288
•Percentage of the White	603/67	0.824/0.818	0.093/0.093
•Number of Contractor	−/65	−/10.108	−/8.487
Control Variables			
Population(Natural Log Value)	603/−	11.448/−	1.477/−
Land Area(Square of Mile)	603/−	807.388/−	391.315/−
Property Tax(Natural Log Value)	536/−	17.138/−	1.699/−
Number of Cities	603/−	6.208/−	7.625/−
population Density	603/−	307.556/−	509.883/−
Median Income(Natural Log Value)	603/−	10.534/−	0.201/−
2007 OSTDS Construction	−/67	−/313.97	−/382.274

median income is coded as dollars of median income with the function of natural log and number of cities is coded as total number of cities involved in each county jurisdiction. The Table 4 shows descriptive statistics.

IV. Findings

Through the mixed method, several influential factors on the approval of OSTDS construction are provided in Table 5. Generally, within the panel data analysis, 536 counties years which imply 67 counties are multiplied by 9 years are observed and 68% explanatory power in this analytical model. Likewise, in the cross-sectional data analysis 65 counties are observed and 65% R-square is provided.

Regarding the panel data analysis, several predictors are statistically significant in terms of a theoretically hypothesized direction. The form of commissioner-manager type of government($p<0.01$), by-district base election($p<0.01$) and number of white population($p<0.01$) are positively associated with increasing the OSTDS construction. However, the mandatory requirement is not statistically significant. In control variables, population($p<0.01$) and land area(square/mile)($p<0.01$) are positively associated with and population density ($p<0.01$), county property revenue($p<0.01$) and number of cities ($p<0.01$) are negatively associated with the OSTDS construction.

For the cross-sectional analysis in 2008, the commissioner-manager type of county government ($p<0.05$) and number of contractors ($p<0.01$) are positively associated with the OSTDS approval. However, by district election, percentage of white and mandatory requirement are not statistically significance.

On the other hand, in contrasting to the panel data

Table 5_Results of PCSEs and Cross-Sectional Analysis

Predictors	PCSEs, 2000-2008		Cross-Section Data, 2008	
	Coef(Std, Err*)	P-Value	Coef(Std, Err**)	P-Value
Political Transaction				
- Commissioner-Manager	.239(.029)	0.000	.527(.234)	0.028
- By-District Election	.140(.033)	0.000	.009(.197)	0.963
Commitment and Information				
- Mandatory Requirement	-.087(.087)	0.313	-.006(.237)	0.979
- Percentage of White	2.54(.265)	0.000	.761(.943)	0.423
- Number of Contactors	-	-	.028(.010)	0.009
Control Variables				
- Population	1.128(.08)	0.000	-	-
- Land Area(Square/Mile)	.0002(.00004)	0.000	-	-
- County Property Revenue	-.359(.077)	0.000	-	-
- Number of Cities	-.022(.002)	0.000	-	-
- Median income	-.253(.154)	0.101	-	-
- Population density	-.001(.00002)	0.000	-	-
- 2007 OSTDS Approval	-	-	.001(.0005)	0.003
Observation(obs/groups)	536/67		65	
R-Square	0.68		0.65	
Wald Chi2(10)(Prob>chi2)	374055.38(0.000)		-	
Breusch-Pagan /Cook-Weisberg test	-		0.964	

note: * and ** indicates that all values of standard error are Panel Corrected and robust standard errors.

analysis, other predictors are not statistically significant. The authors expect that, even though the cross-sectional analysis is conducted by controlling for the OSTDS construction in 2007, the statistical model is limited to finding influential factors or small number of observations beyond the selected predictors. Thus, it may be difficult to define the significant factors in the number of form of government and contractor. To increase confidence about the statistical result and to attempt to find a correlation between contractors and the OSTDS approval, the authors conducted linear plots(i.e., scatter plots) to find a correlation. The

Figure 2_Scatter Plots between Contractor and the OSTDS

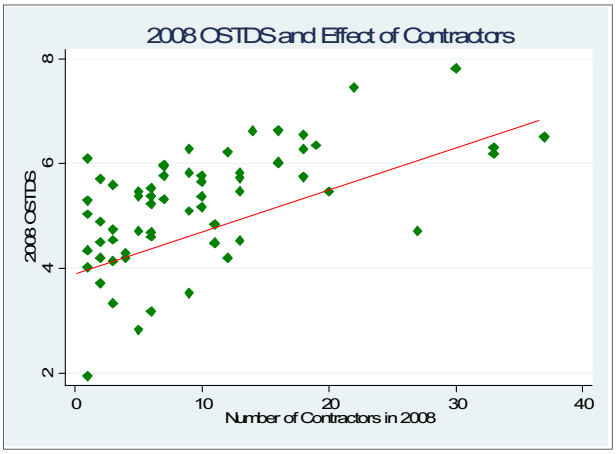


Figure 2 shows the scatter plots between them and then the authors find that a number of contractors are positively associated with the OSTDS construction.

V. Implications and Discussions

This research investigates the primary question of which factors influence the OSTDS construction in county government. OSTDS approval is mainly argued from the perspectives of governmental willingness and individual commitment. Based on the understanding of presumptions of high level of individual commitment and participation, local governmental policy support and interaction between local elected officials and citizen, the OSTDS can have an efficient mean of constructing sewage facilities to increase economic efficiency and reduce risk of environmental degradation. Furthermore, residents can welcome the OSTDS since certain sewer facilities have a negative cognition as a NIMBY facility, resulting in reducing neighborhoods' property values and increasing probability of an environmental degradation. Thus, these insights provide transaction cost approaches and then this theoretical framework helps us to explore the effects of political transactions, institutional regulation and community status.

Regarding transaction cost perspectives, political transaction is a salient factor when addressing OSTDS construction. The selected type of county governmental form and type of election imply that local governments which emphasize professional and administrative experts are positively correlated with policy efficiency rather than political efficiency. This means that the commissioner-manager form in county government is explained by the separation between politics and administration. Contrasted with other forms of county government(i.e., commissioner form and mayor-commissioner form), a manager can be less influenced by political factors, attempt to provide policies with long term plans, and consider the entire cost of a governmental budget and administration. Thus, administrative authority or a professional manner in county administration can create more policy efficiency with OSTDS. From the perspective of OSTDS policy efficiency, the district base elections for county commissioners can promote construction of OSTDS since the district- elected commissioners are more likely to interact with regional and electoral residents. As state government emphasizes county governmental participation to provide OSTDS construction, the commissioners can actively be involved in a policy campaign and induce citizen participation in the construction of OSTDS in terms of the benefits from OSTDS such as economic efficiency and governmental budget savings.

From the perspective of commitment and information flow in transaction costs, voluntary action and resources are very important. That is, even though mandatory requirements as institutional regulations are addressed as a theoretically significant factor, not in statistically, voluntary action in community and individuals are more important. The OSTDS construction is based on voluntary application by individuals and then county government allows the OSTDS construction on individual lots based on EPA and Department of Health ordinances. Thus, systematically, county government can provide mandatory regulation about OSTDS, but more importantly, voluntarily applied action in individuals has already high commitment to control and maintain the OSTDS.

With respect to commitment, white populations

are important. As a theoretical argument, white populations can have a willingness to engage in a pro-environment movement and be self-organizing and self-regulating. Furthermore, within the perspectives of social capital and a homogeneous community in accordance with information flow and community commitment costs, the large size of the white population is more likely to create a collective coalition and participation in OSTDS construction. Thus, since the construction of OSTDS is based on decentralized voluntary action from citizens, a community with a large white population is more likely to construct or engage in OSTDS construction.

The number of contractors helps to create fluent information and increase governmental and individual confidence in the selection of contractors. High density of service providers as contractor increases competition among them and then the competitive action provides detailed and important information to service receivers. Individuals can contract with providers in many ways and compare adequate providers more efficiently. That is, providers having more resources and capacities can be selected by individuals and the community, and then individuals and the community can have more resources. Therefore the number of contractors positively influences an increase the OSTDS.

To apply theoretical and empirical evidence to local governments in South Korea, there are important aspects to consider the administrative profession, institutional regulations, and pro-environmental behavior and action by citizens are more likely to promote the outcomes of OSTDS which create local governmental budget savings, economic efficiency, a low risk of environmental degradation and reduction of social conflicts at the sewer site as well as construction of certain types of sewer facilities. Furthermore, the district-elected officials are more likely to communicate with regional or geographical citizens, resulting in reduced conflicts between governmental policy and citizen preferences, and thereby promoting voluntary action and participation in goals such as governmental sewer policy and site selection, even OSTDS construction. Thus, with social phenomena such as population growth and new development in suburban area, local governments in South Korea may need to increase flexibility with respect to local sewer services and policy options to provide OSTDS construction integrated by local finance stability. They also may need to initiate environmental institutions and regulations, citizen participations, and interaction between governmental representatives and citizens.

However, to apply the findings of this research to the case of sewer facilities similar with OSTDS in South Korea, the roles of the central government are different in South Korea and the state of Florida in the U.S. Whereas the central government in South Korea is more likely to directly control and manage the sewer facilities in low density and rural areas, Florida is more likely to delegate the authority for sewer facility construction and regulation since county governments try to reform governmental structures to provide public service provisions. This comparison of central government roles may more or less be related to local financial stability and aids or subsidies. That is, sewer facilities, similar to OSTDS, in South Korea could more likely be installed in the area of

water protection of the 'Four Big River Restoration Project'. Since the sewer facilities in this area can be subsidized by the 'Four River Water Management Fund,' the authority can be concentrated by the central government, and local governments may not consider the budgetary consistency and stability. On the other hand, in Florida, the state government emphasizes budgetary control and the action of county governments to create and manage sewer facilities. Hence, this financially different structure between South Korea and Florida in implementing sewer services and construction need to be re-considered for further study.

Lastly, this research has some limitations. First, panel data are measured by a short time period. Historically, the OSTDS was started in the 1960, but since the authors had limited data collection for the expected predictors, this research cannot analyze long term perspectives. Second, cross-sectional analysis cannot be generalized, but contractors are positively correlated with the OSTDS. Since small number of observations and many predictors can have high a probability risk of less reliability and validity, the results are less strong at the cross-sectional analysis. However, the authors believe that the linear plots(scatter plots) can add analytical points to increase the validity.

In sum, even though this research has some limitations, it advances literature on the study of the OSTDS and can be a first trial for transaction cost perspective about the OSTDS and sewage facilities. Political transaction, type of governmental form, election, community status, institutional regulations and number of service providers can be core predictors for studying NIMBY facilities or other alternatives for the OSTDS, and even for other policy service tools.

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Abstract

Determinants of the Construction of On-Site Sewage Treatment and Disposal System(OSTDS) in Florida Local Governments : Regarding Transaction Cost Theory

Keywords: On-Site Sewage Treatment and Disposal System, Transaction Cost, Political Transaction Cost and Commitment and Information Cost

This research investigates the significant question regarding which local contextual factors influence the construction of On-Site Sewage Treatment and Disposal System(OSTDS). Within the context of natural of water(common pool resources) and decentralized OSTDS, transaction cost theory is employed as a theoretical foundation. Based on theoretical and empirical evidences, the administrative profession, regional demographic status, local politics and number of service providers are positively associated with increasing the OSTDS construction. The importance of governmental policy support, citizen participation and voluntary action provide a credibility of the OSTDS operation and successfully promote economical and environmental outcome by the OSTDS. Furthermore, the local governments need to expand their efforts such as sewer policy flexibilities and interaction with citizen for increasing citizen commitment and reducing regional conflicts, resulting in well organized site selection or types of sewer facilities. Lastly, this research provides advance literature about the OSTDS in terms of social science approach with transaction cost theory.

거래비용 이론과 개인하수처리시설 건설에 관한 연구 : 플로리다 지방정부를 중심으로

주제어: 개인하수처리시설, 거래비용, 정치적 거래비용, 책무이행 및 정보비용

수자원 관리의 실패는 지역적 분쟁, 생태 및 환경적 오염을 유발시키므로 수자원 관리는 매우 중요한 고려사항이다. 본 연구에서는 수자원 관리 방식의 일종인 개인하수처리시설에 초점을 두고 있으며, 개인하수처리시설 건설에 어떠한 지역적 요소가 영향을 미치는지를 분석하는 데 있다. 본 연구는 거래비용의 이론적 근거를 활용하여 개인하수처리시설 입지 특성을 설명했으며, 이론적 그리고 실증적 분석결과는 다음과 같다. 첫째, 전문적 행정 관료의 특성을 지닌 정부구조, 지방정치인 특성, 지역적 인구구성 및 개인하수처리시설을 공급할 수 있는 업체 등이 개인하수처리시설 설치를 높이는 데 긍정적으로 영향을 미쳤다는 사실을 도출했다. 둘째, 정부 정책지원, 시민참여 및 자발적인 행동들이 개인하수처리시설 설치에 대한 신뢰성을 높일 수 있다는 사실을 발견했다. 본 연구결과의 시사점으로는 인구가 산재한 지역 및 새롭게 개발되는 근교지역에서는 개인하수처리시설이 공공하수처리시설보다 경제적 효율성이 높음을 제시했다. 또한 전반적인 하수처리시설 부지 선정 및 유형을 결정짓는 데 있어서 지방정부의 역할, 정부, 지방정치인 및 시민들의 상호작용이 중요한 시사점임을 밝혀냈다.