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# What advances information sharing for sustainability performance management? Empirical evidence from U.S. local governments

Angela Y.S. Park*

*Department of Political Science, Kansas State University, 802 Mid Campus Dr. South 101D Calvin Hall, Manhattan, KS 66506 USA*

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ABSTRACT

The broad nature of sustainability goals encompassing environmental, social, and economic well-being necessitates multiple departments' collaboration on integrating key informational resources. However, research finds that, in most cases, information sharing is still an exception rather than a norm and points to the importance of institutional force in shaping and advancing the practice. This research investigates the extent to which city departments are making efforts to integrate their knowledge and information in managing sustainability performance and what institutional conditions may advance such efforts. An analysis of 443 U.S. cities and towns from a recent survey on local sustainability performance management informs us that specific institutional mechanisms matter. Especially those directly tied to information-sharing, such as incentives for sharing, a quality information system, and a flexible structure permitting work autonomy, are significantly linked to an increased level of information sharing, while performance rewards are unlikely to be helpful in that regard. Culture is found not particularly significant. Culture as a multidimensional concept and the subsequent challenges in deconstructing and operationalizing its dimensions are discussed.

## Introduction

In the U.S., much of sustainability and climate protection efforts are led by cities. Yet, the triple bottom line approach to sustainability that widely spans environmental, economic, and social dimensions raise a unique challenge for many city governments. Its cross-cutting nature means that the implementation of many sustainability programs is likely to exist beyond the sole purview of a single department and thus requires close coordination between various city departments (Park, Krause, and Hawkins 2021). The key to successful collaboration is sharing information about individual departments' activities and performance, transcending departmental boundaries.[1] Prolific research exists to shed light on the critical role information-sharing plays in managing public programs. This is particularly so in the fields where up-to-date information is essential for program performance or multiple actors must engage in delivering a program, such as homeland security and disaster management.

While substantial research has been conducted on information exchange in interagency contexts, research also observes that it is equally important and challenging to integrate information even within a single organization (Drake, Steckler, and Koch 2004; Hatala and Lutta 2009; Yang and Maxwell 2011), such as in the case of local sustainability management. Individual departments are expected to access and exchange necessary information for achieving cohesive sustainability efforts, yet little is known about information sharing dynamics for managing sustainability programs among city governments. Understanding how, if at all, city departments are able to access and share the necessary information for managing sustainability programs is critical because it requires deliberate and concerted efforts to integrate information across organizational silos. Research reports that in most cases, information resources are still diffused across the boundaries of individual departments (Chen and Hsieh 2015; Cress, Kimmerle, and Hesse 2006; Jian and Jeffres 2006). There are several reasons for this, such as sensitivity to disclosing performance information and impediments rising from different processes, rules, and norms embedded in individual units. (Weber and Khademian 2008; Willem and Buelens 2007; Zhang, Dawes, and Sarkis 2005). Meshing insights from these public management research, information science, and urban sustainability, this research thus investigates inter-departmental information sharing behavior within city departments in management sustainability and how an organizational environment can be designed to enable individuals to share information for advancing city-wide collective sustainability goals.

* Corresponding author
*E-mail address:* angelapark@ksu.edu

[1] Ambiguity exists as to what information means or should mean; some scholars note that knowledge is, by definition, more inclusive than information, as it involves a certain level of subjective interpretation and internalization processes; others find little practical utility in distinguishing between the two concepts (Wang and Noe 2010). This research follows the latter approach.

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This research proceeds as follows: First, it briefly describes the increasing need for information sharing in the public sector, especially in the context of local sustainability. It then reviews some of the major discussions on how information sharing is expected to improve organizational performance, yet why it still remains an exception rather than the norm among many public organizations. Particular challenges facing local governments in integrating informational resources are identified along with key institutional conditions that enable organizations to overcome these challenges. The paper develops and tests a series of hypotheses using Structural Equation Modeling (SEM) and presents several tables and graphics to help interpret the results. The paper concludes with a discussion on policy implications and suggestions for future research.

## Literature Review

### *Cross-cutting Sustainability Goals and Collaboration Needs*

Information sharing, over the years, arose as one of the most critical determinants of organizational performance (Kim and Lee 2006; Liebowitz and Beckman 1998; Yang and Maxwell 2011). This is even more so in sustainability management, given its complex and cross-cutting nature (Janowski 2016). Many sustainability policies are ambitious in that they attempt to capture the triple bottom line (TBL) approach. TBL represents the challenging task of balancing between competing objectives of 3Es (economy, ecology, and equity) or 3Ps (profit, planet, and people) (Tumlin 2012, 7). TBL also means that implementing most sustainability initiatives lies beyond the purview of a single individual department. Green infrastructure management offers a good example (U.S. EPA 2017). Among the most cost-effective ways that municipalities can build green infrastructure is using parklands. Incorporating local park features into green infrastructure plans has the potential to produce several benefits across environmental, economic, and social dimensions. Examples include effective stormwater management, improved public health benefits, and cost savings in gray infrastructure maintenance and repairs. Given its potential of creating triple bottom line benefits, it requires multiple departments responsible for different functions and services within the city to design and implement the policy (Krause and Hawkins 2021; Krause, Hawkins, and Park 2019). Apart from the usual key players, such as public works, parks, and planning departments, it is also desirable to include transportation departments that can help identify underutilized open space at interchanges for drainage. Or neighborhood services/community development departments can investigate the potential of using under-performing parks in disadvantaged neighborhoods, thereby achieving community revitalization and health improvement, as well as environmental benefits. The sustainability office, if established, would play a central role in coordinating and supporting the inter-departmental engagement. Thus, ICMA (2014), after a series of case studies on local governments' sustainability management, concludes that "in local governments that are truly pursuing a holistic approach, sustainability activities are dispersed throughout a number of departments."

The key to successful interdepartmental collaboration is to integrate information diffused across individual departments (Fredrik et al. 2017; Gil-Garcia et al. 2019). In a governance structure where programs are implemented and delivered through a web of multiple policy actors, the program performance often depends on the expertise and informational resources of not one but multiple departments within the municipality. The importance of data sharing is also highlighted in a series of case studies on Local Government, Social Equity, and Sustainability Communities, released by ICMA (2014). Andrea Plevek, the executive director of Community and Economic Development in Washtenaw County, Michigan, explains:

"[t]here is a lot of data out there, but they only provide a slice of the picture. They don't tell you how they connect. If systems don't talk to each other and data are not shareable, then they're not that helpful. It is more important to be able to integrate data at a local level and focus on what is most important."

### *Performance Implications of Information Sharing*

The benefits of intra-organizational information-sharing can manifest in several ways, including streamlining processes, reducing duplications and work errors, and improving social-emotional outcomes of organizational members (Jarvenpaa and Staples 2001; Willem and Buelens 2007). While several explanations are offered about how information sharing enhances organizational performance, one chief benefit is its contribution to organizational learning. Organizational learning refers to an organization's ability to develop, disseminate, and apply knowledge, information, and evidence to program management and evaluation (Moynihan and Landuyt 2009). It is the key concept underpinning several modern public management reforms, such as total quality management, performance budgeting, and evidence-based program management (Barrados and Mayne, 2003; Ho, 2005; Moynihan & Landuyt, 2009; Richards and Duxbury 2015). When information and knowledge cross over individual and departmental boundaries, it is expected to provide a critical base for a broader knowledge network through which an organization can collectively learn and innovate and, thus, improve its performance (Henttonen, Kianto, and Ritala 2016; Kim and Lee 2006; Richards and Duxbury 2015; Silvi and Cuganesan 2006).

The needs for organizational learning through information sharing are particularly significant for the public sector, whose performance largely depends on the degree to which it can develop and manage collective knowledge. Public organizations are "knowledge-intensive" organizations (Luen and Al-Hawamdeh 2001; Henttonen, Kianto, and Ritala 2016; Huang 2014). All public organizations carry out knowledge-based activities, to varying degrees, either by directly offering knowledge to key stakeholders, including elected officials and the public, or indirectly providing programs and services devised by knowledge workers, e.g., policy analysts and scientists (Willem and Buelens 2007). Sustainability programs can be technical in nature, too (Park, Krause, and Feiock 2019; Wang et al. 2012). For example, according to the recent evaluation report by the Department of Energy, an important variable that determined the success of energy efficiency and renewable energy development in the U.S local communities was the availability of technical assistance. (DNV GL 2015). Therefore, the performance of sustainability programs, in large part, will depend on the degree to which an organization can systematically integrate informational and experiential resources held by individuals or individual departments across personal and structural boundaries (Melville 2010).

Information-sharing can also generate long-term benefits relating to human and social capital management. When information sharing occurs through in-person contacts, it has the potential to create a positive climate where a sense of cohesion and reciprocity is cultivated through repeated interactions and transparent organizational culture is fostered (Mesmer-Magnus and DeChurch 2009). And such social-capital benefits are particularly valued in implementing sustainability programs that widely span the job responsibilities of multiple departments, thus placing a heavy emphasis on collaborative behaviors among participants (Park, Krause, and Hawkins 2021). Through integrating information, local governments can ensure that their individual departments' activities and goals align with their municipal-wide sustainability goals and achieve a collective and cohesive vision.

### *Challenges and Obstacles to Information Sharing*

As much as information sharing is appreciated as fundamental to effective policy and program coordination, it requires arduous and concerted efforts among individual departments. The collection of data and information involves processes that are not merely technical but also behavioral and psychological. It entails the task of creating a collaborative culture where departments contribute their inputs, e.g., performance

records, to the system and communicate with a wider community. This can be challenging given the current emphasis on performance-driven management in the public sector, which may cause a heightened level of sensitivity and resistance to disclose performance information, especially when not mandated. Sustainability is a good example. Research notes that the mandated requirements for performance reporting on sustainability programs tend to be underdeveloped in the public sector and often require voluntary and motivational factors in sustaining the practice (Chai 2009; Park and Krause 2021; Volkery et al. 2006). Such reliance on motivation is less likely to provide steady and effective efforts in systematically bringing departments to exchange information. A midwestern city administrator involved in sustainability performance management echoes this point: departments do not share data despite the open government policy requirement, and there is a variety of "legitimate" reasons for the lack of cooperation, such as "privacy concerns." (personal interview, 2017)

Performance measurement inherently involves challenges associated with managing people. Research explains the "people factor" – changing their behavior – is the number one difficulty in information sharing, as it is a natural human tendency to feel guarded about personally-held information (Bock et al. 2005; Davenport, Eccles, and Prusak 1998; Jarvenpaa and Staples 2000). Information is often endowed with power and influence (Kolekofski Jr and Heminger 2003; Marks et al. 2008; Yang and Maxwell 2011). This is true for any organization, but particularly so for public agents who have been described as drawing their power or legitimacy from information and expertise they hold (Watkins-Hayes 2011; Whitford 2002). Information constitutes an important source of power for public agents and sharing information can cause the fear of losing or diminishing that power. Motivation for sharing information to improve organizational performance is also not clear for many public institutions. Public management research has long noted that efficiency is not necessarily the top priority for public sector organizations. Instead, reputation and legitimacy are just as important concerns as efficiency or other market values for defining performance (Carpenter and Krause 2012; Frumkin and Galaskiewicz 2004; Powell and DiMaggio 2012). In these circumstances, the rationale for information sharing on the grounds of performance improvement may not provide sufficient impetus or motivation for public agents. Thus, the problems of information hoarding can be particularly prevalent and persistent among public organizations, which leaves information-sharing an ambitious goal (Chen and Hsieh 2015; Wang and Noe 2010; Yang and Maxwell 2011).

## Hypotheses

### *Drivers of Information Sharing*

Challenges are inherent in integrating information in the public sector, and deliberate efforts are required to change people's perceptions toward information sharing. Extant research identifies multiple ways to institutionalize conditions that may help further this change (Grover and Davenport 2001; Willem and Buelens 2007). By taking advantage of the critical insights developed within this literature, this section outlines institutional conditions under which intra-organizational information sharing may increase when managing sustainability performance.

First, an *organizational culture* that emphasizes affiliation, mutuality, and collaboration is vital for sharing information. According to research, an organizational culture that emphasizes inter-dependence and affiliation can regulate information-sharing behavior by diminishing the sense of information ownership – a significant impediment to information sharing – and encouraging individuals to perceive sharing as a norm rather than an exception (Bock et al. 2005; Jian and Jeffres 2006; Tsai 2001). In contrast to rational-choice theorists who mostly depict human behavior as carefully calculated by utility-maximizing principles, sociological institutionalists explain people's actions are often shaped by the norms and values that the surrounding social climates define as appropriate. In this sense, culture can be a powerful tool to governing institutional behavior, as actors are interested in making judgments deemed not only efficient or effective but also legitimate and socially fit (Powell and DiMaggio 2012; Frumkin and Galaskiewicz 2004). Jarvenpaa and Staples (2000) explain that communicating the value of collective action within an organization can encourage employees to "rise above their self-interest rational impulses to consider the long-term impacts of their actions." Based on these discussions, the following hypothesis is developed:

H1: The level of interdepartmental information-sharing in sustainability performance management is positively related to the degree to which an organization emphasizes such values as affiliation and collaboration among employees.

If culture underscores the relational aspects of information sharing, formal *incentives* can increase information-sharing by tapping into an individual's rational self-interest. Research notes when individual contributions to creating collective knowledge are compensated through monetary and/or non-monetary measures, such as recognition, it can provide an important motivation (Jian and Jeffres 2006; Willem and Buelens 2007). Some argue extrinsic rewards have limited and sometimes perverse effects on individuals' attitudes. For example, while some find general performance-based rewards facilitate information sharing, many argue such general incentives incite competition, further leading to information hoarding or increasing ad-hoc sharing at best (Barua, Ravindran, and Whinston 2007; Zhang, Dawes, and Sarkis 2005). Thus, it can be crucial to provide incentives specifically tailored for the desired behavior. Based on these discussions, the following hypothesis is developed:

H2: The level of interdepartmental information-sharing in sustainability performance management is positively related to the incentives specifically tailored for information-sharing while negatively related to general performance-based rewards.

Several features of the *bureaucratic structure* are also known to be at odds with information-sharing. Within bureaucratic models, information flows are hindered by the structure that emphasizes functional divisions and the culture of hierarchy (Cress, Kimmerle, and Hesse 2006). Departmentalized and hierarchical structures, which were initially designed to define clear lines of responsibility and increase work efficiency, tend to create barriers to employee interactions (Park, Krause, and Hawkins 2021). For example, a centralized authority that limits work autonomy and lateral communication channels can hamper interdepartmental engagement (Kim and Lee 2006; Tsai 2001). Formalization that lowers flexibility can also interfere with the culture of sharing (Jarvenpaa and Staples 2001; Kim and Lee 2006; Willem and Buelens 2007). When departments have different rules and processes that their employees need to strictly follow, this can reinforce functional and structural boundaries between departments. It is important to understand if and how public agencies can encourage functionally-fragmented units to share performance information both within and across organizations. Therefore, it is hypothesized that:

H3: The level of interdepartmental information-sharing in sustainability performance management is negatively related to the level of organizational bureaucratization, characterized by formal and vertical structures.

Institutional *capacity*, particularly relating to information management, is also an essential condition for sharing to occur. The rapid development of Information Technology (IT) was one of the major driving forces behind the movement toward information and knowledge integration. Therefore, it is vital to consider the extent to which organizations have the capacity, such as IT infrastructure and human resources, to collect quality information, as well as analyze and disseminate it (Alavi and Leidner, 2001; Kim and Lee 2006). This research studies information sharing dynamics in a specific context, i.e., sustainability performance management. Thus, besides the general IT and human capacity

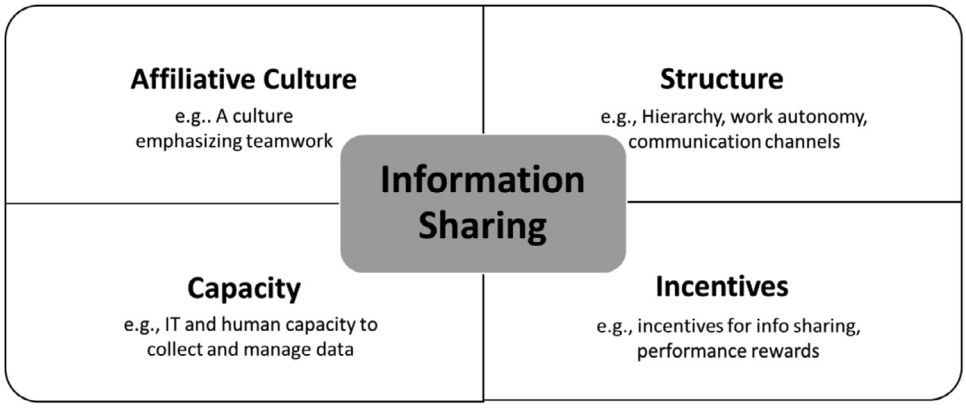


**Fig. 1.** Institutional Context for Information Sharing in Sustainability Performance Management

to manage data, a quality performance measurement system also makes a vital component of institutional capacity that enables organization-wide information sharing. If the performance measurement system underperforms and produces unreliable and largely irrelevant information for management, departments are unlikely to contribute to the system and use the information collected through the system. Therefore, it is hypothesized that:

H4: The level of interdepartmental information-sharing in sustainability performance management is positively related to the organizational capacity of collecting, analyzing, and managing data.

Fig. 1 visually summarizes key institutional conditions for successful information sharing to occur in sustainability performance management. This research empirically examines which of these organizational factors shape the likelihood that city departments will engage in information sharing when managing the performance of their sustainability initiatives. The following describes data and methodology.

## Data and Model

### *Data and Methodology*

Data comes from an original survey that was conducted from October 2018 to early January 2019. The survey was sent to local governments in U.S. cities with populations over 20,000 (n=1282).[2] A staff member primarily in charge of sustainability program management was identified through multiple rounds of web-search and in collaboration with the Urban Sustainability Directors Network (USDN). For a small portion of the sample (75 contacts), delivery of the survey failed despite multiple attempts. Excluding these, a total of 443 complete responses were received, a response rate of 37%. Among the responses collected through USDN, two cities had populations under 20,000 and, thus, were excluded from the analysis.

The key objective of this research is to identify institutional conditions that explain why some U.S. city governments share information for managing sustainability performance while others do not. Institutional conditions of primary interest are affiliative culture, bureaucratization, incentive system, and capacity. Here, special attention is required to potential endogeneity problems. Endogeneity is a fundamental problem to social science research where explanatory variables are correlated with the error term and can cause serious concerns about the validity and reliability of research findings (Bollen and Noble, 2011). Endogeneity may arise from several sources, such as selection bias, variable omission, simultaneous determination, and many more. In this study, it is likely to come from the existence of multiple equations. In a standard regression model, a single equation exists where a Dependent Variable (DV) is explained by a linear combination of Independent Variables (IVs) and their covariates. On the other hand, where multiple equations exist, the standard terms of IV and DV are less helpful in understanding the model because the DV in one equation might be an IV in another equation (Bollen and Noble, 2011). This can be written as the following:

$$y_1 = \alpha_1 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon_1 \quad (1)$$

$$y_2 = \alpha_2 + y_1 + \beta_3 x_1 + \beta_4 x_2 + \varepsilon_2 \quad (2)$$

where $y_1$ is both an endogenous variable explained by $x_1 and\ x_2$ in equation (1) and, at the same time, an exogenous variable explaining $y_2$ in equation (2). In these cases, error terms of each equation are correlated with one another, causing endogeneity problems and needing a special statistical methodology to address them.

This study potentially faces the same problem; while affiliative culture is treated as an IV here, it serves as a DV in many other studies. This is because culture is not a standalone phenomenon that is independent of institutional structure and mechanisms but a manifestation of a complex interplay among people, structure, and mechanisms. In this study, one can reasonably expect that some of the factors shaping information-sharing behaviors are also the key conditions for forming an affiliative culture. Lateral communication structure, flexibility, and the provision of different types of incentives all create an institutional context conducive to information-sharing, but they are also desirable conditions for creating an affiliative and collaborative culture. Therefore, several institutional factors this study theorizes as promoting information sharing behavior are also expected to positively influence the affiliative culture.

To address this issue, this research employs Structural Equation Modeling (SEM). SEM is marked by multiple equations and accounts for correlations between the endogenous variable equation and the outcome equation (Bollen and Noble, 2011; Christ et al. 2014). This research models latent constructs for both the DV and key IV (i.e., information sharing and culture). Both are abstract concepts that cannot be directly observed, as opposed to manifest variables, such as the presence of incentive or the count of staff members. Compared with other methodological choices (e.g., factor analysis), SEM is preferred as it takes into account various issues that can arise from fitting multiple latent variables, such as interactions, nonlinearity, and measurement error.[3] Within SEM, several variants exist. This research em-

[2] With some exceptions where cities are consolidated with their county governments, cities and towns in the U.S. are typically below the level of counties, which are in turn subordinate to state governments. The study sample only include incorporated cities and towns that have some degree of powers and authority delegated by the county and state governments.

[3] Factor score regression is an alternative but it also likely introduces bias. Plugging factor scores into an equation is commonly done yet it is also debated as it treats factor scores as exogenous without proper attention to measurement error and uncertainty inherent in factor scores, resulting in biased estimates

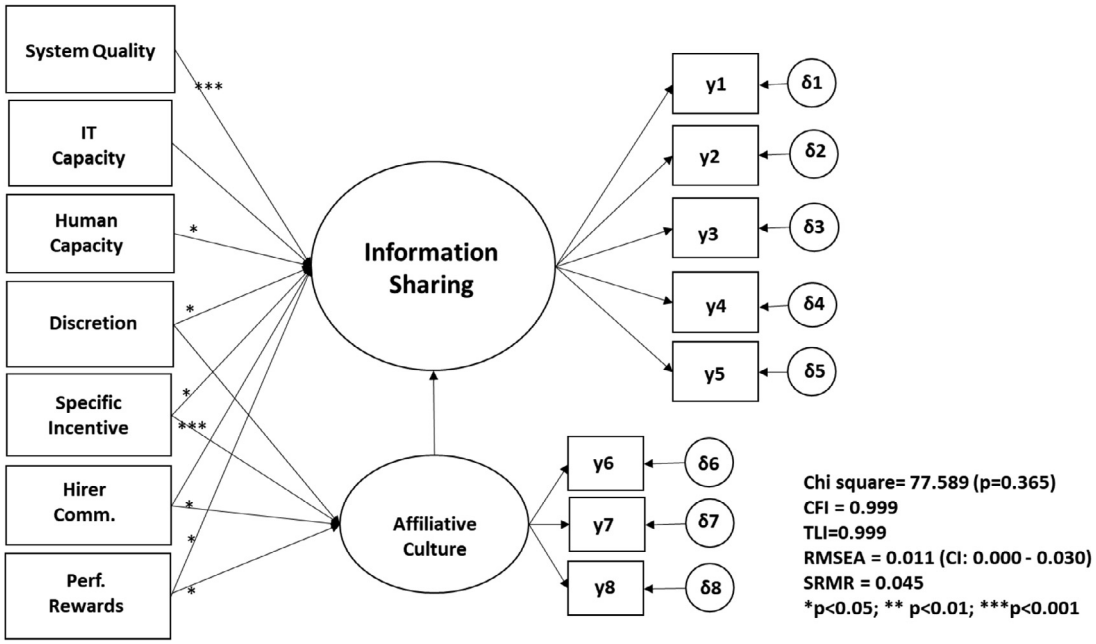


**Fig. 2.** MIMIC-SEM MODEL of Information Sharing

ploys Multiple-Indicator-Multiple-Cause (MIMIC). Unlike most SEM approaches, MIMIC-SEM allows simultaneous estimation of both formative and reflective constructs. In the former (formative), indicators cause the construct, while in the latter (reflective), indicators are explained by a latent construct as in conventional factor analysis. While the primary purpose of SEM is to measure reflective (latent) constructs and estimate the relationship between them, MIMIC integrates both formative and reflective models, thereby allowing one to understand the causes and consequences of a latent construct. This study theorizes that formative indicators are related to more than one construct (culture and information sharing), and thus MIMIC-SEM is useful in that regard. This point will be elaborated graphically in the next section.

*Variables*

Fig. 2 visually presents the model[4]. The model shows two latent constructs – information sharing and affiliative culture – and eight manifest (observed) variables. *Information sharing*, the DV in this study, was measured using five survey questions to capture the degree to which departments involved in sustainability implementation exchange information and performance data on sustainability activities. Another latent variable, an *affiliative culture,* represents how much an organization instills its employees with such values as collaboration and affiliation. It was captured using three questions. Capacity consists of the following three. *IT capacity and human capacity* reflects the extent to which a respondent perceives their organization to have a sufficient level of technological (e.g., integrated database) and human resources to manage data while *Measurement System quality* reflects the extent to which a performance measurement system displays key qualities constituting a well-developed performance measurement, such as accessibility, reliability, validity, and managerial relevancy (Park and Krause 2021). The degree of bureaucratization was captured using two questions: *communication structure* to see if communication tends to occur vertically through department heads or laterally among employees, and if employees have *work discretion* in managing sustainability programs. Lastly, the model includes two different types of incentives – one specifically for information sharing (named *specific incentive*) and *general rewards* for performance improvement. In addition, the survey respondent's personal attitude toward performance management was controlled to prevent potential bias from different motivational levels.

Table 1 offers a detailed description of variables used in this research, including survey questionnaires and response scales, and Table 2 provides summary statistics of each variable. The summary statistics (Table 2) show that the reported degree of information sharing is not high. While respondents indicated their partner departments are generally willing to share data (mean = 7.38 out of 10), the average scores are much lower when asked about specific actions, for example, how frequently they interact or have meetings to discuss data (mean=5.74 and 4.97 respectively). However, a considerable variation among the observations indicates that there may be distinctive institutional features that may enable some cities to develop greater information integration efforts than others.

## Results

To estimate the structural relationships between key constructs, it is important to ensure the constructs are valid and reliable. Convergent validity is assessed by examining individual standardized factor loadings and obtaining the values of average variance extracted measures (AVE). A minimum of 0.5, and preferably 0.7, for factor loadings and a minimum of 0.5 for AVE are suggested, whereas 0.7 is recommended as a cut-off criterion for the construct reliability test (Hair et al., 2006). Table 3 presents standardized factor loadings (λ), showing how eight observed indicators measure each latent construct along with fit indices at the bottom. Both standardized factor loadings and AVE estimates satisfy the guidelines (0.70 - 0.84 for factor loadings and 0.60 - 0.68 for AVE), and all t-statistics for the loadings are statistically significant at 0.001 level. Construct reliability estimates are also well above the suggested cut-off point, with 0.87 for the information-sharing construct and 0.88

(Hoshino and Bentler 2011). This is particularly so when a factor is employed for the dependent variable, which is the case of this study. SEM serves similar purposes yet is a more powerful alternative to multivariate regressions with latent variables because of its ability to fit multiple latent variables and their relationships more effectively and efficiently.

[4] Covariance arrows between observed variables and a control variable are not graphed in Fig. 2 to improve readability.

**Table 1**
Variable Description

| Variable Name | Variable Description |
|---|---|
| ***Dependent Variable*** | |
| Information Sharing | A latent construct that captures the degree to which departments involved in sustainability policy implementation exchange information on sustainability activities and programs and data for performance management purposes. It was constructed using five questions that asked about the extent to which departments 1) often interact with each other to exchange information on programs relating to sustainability; 2) regularly use inter-departmental meetings to discuss performance data; 3) are willing to share data; 4) help each other with acquiring necessary data on sustainability programs; and 5) can easily access information relating to sustainability programs. All measured on a scale of 1-10 |
| ***Independent Variables*** | |
| *Latent Variables* | |
| Affiliative Culture | A latent construct that reflects how collaboration is valued and emphasized in an organization. Three questions that asked, on a scale of 1-10, about the extent to which the top management of a respondent's organization 1) emphasizes collaboration as an organizational objective; 2) encourages teamwork among staff; and 3) facilitates vertical collaboration by welcoming ideas initiated by employees. |
| *Manifest Variables* | |
| Measurement System Quality | An additive index that reflects the extent to which a performance measurement system displays key qualities that extant literature identifies as constituting a well-developed performance measurement system. Respondents were asked to rate, on a scale of 1-10, if performance metrics are 1) objective, requiring little subjective judgment and personal interpretation; 2) linked to sustainability goals; 3) not too difficult to use; and 4) produce information relevant for management. |
| IT and HR Capacity | Two additional variables to represent the construct, institutional capacity. Two questions asked the extent to which a respondent perceives, on a scale of 1-10, his/her organization to have a sufficient level of human and technological resources (e.g., integrated database) to analyze and manage data. |
| Communication Structure | One of two variables that capture bureaucratization. A question was asked to what extent departments communicate through the department heads for sustainability program management, on a scale of 1-10. |
| Work Discretion (Rigidity) | Another variable to capture bureaucratization. A question was asked to what extent departments enjoy discretion for sustainability program management rather than having to follow formal rules and written procedures. |
| Incentive for Information Sharing | A binary variable indicating if formal incentives to share data (e.g. recognition in a formal evaluation or rewards) are available (0=No, 1=Yes). |
| Incentives for Performance | A binary variable indicating if rewards are provided based on work performance (0=No, 1=Yes). |
| Personal Attitude | A control variable that indicates the degree to which a respondent thinks it is important to collect data on the progress of sustainability programs to achieve their city/town's sustainability goals (0=Unimportant, 1=Neutral, 2=Important, 3=Very important). |

**Table 2**
Variable Summary Statistics

| | N | Mean | Std Dev | Min | Max |
|---|---|---|---|---|---|
| *Information Sharing* | | | | | |
| Help obtain information | 394 | 6.068 | 2.314 | 1 | 10 |
| Willing to share data | 386 | 7.383 | 2.198 | 1 | 10 |
| Have meetings to discuss data | 365 | 4.967 | 2.498 | 1 | 10 |
| Often interact to exchange info | 378 | 5.753 | 2.403 | 1 | 10 |
| Can access data easily | 366 | 5.038 | 2.394 | 1 | 10 |
| *Affiliative Culture* | | | | | |
| Emphasizes teamwork | 421 | 8.009 | 1.948 | 1 | 10 |
| Open to bottom-up ideas | 424 | 7.5 | 1.979 | 1 | 10 |
| Collaboration as an org goal | 411 | 7.817 | 2.077 | 1 | 10 |
| *Incentive System* | | | | | |
| Specific incentives | 346 | .263 | .440 | 0 | 1 |
| General performance rewards | 409 | .207 | .406 | 0 | 1 |
| *Capacity* | | | | | |
| Measurement system quality | 390 | 5.456 | 1.882 | 1 | 10 |
| Human capacity | 387 | 4.020 | 2.226 | 1 | 10 |
| IT capacity | 389 | 4.727 | 2.397 | 1 | 10 |
| *Bureaucratization* | | | | | |
| Hierarchical communication | 395 | 6.091 | 2.225 | 1 | 10 |
| Work discretion | 385 | 5.584 | 2.130 | 1 | 10 |
| *Individual Attitude* | 435 | 3.335 | .670 | 1 | 4 |

for the affiliative culture construct. Strong evidence is found for both the validity and reliability of each construct.

Moving on to the structural component, the model presents information-sharing and affiliative culture as both formative and reflective, where arrows are drawn simultaneously from observed exogenous indicators to the latent variables and from the latent variables to observed indicators. While the former (formative) brings causal assumptions between the exogenous and latent variables, the latter (reflective) captures each underlying construct. All but capacity variables are related to culture, as each of them is theoretically relevant for shaping the affiliative culture that emphasizes collaboration; e.g., formal incentives for information sharing are also likely to support collaborative culture, while the opposite relationship is expected with rigidity, hierarchical communication structure, and performance rewards.

The bottom of figure 2 shows fit indices. Model Chi-Square statistic is a traditional measure for evaluating the overall fit of a structural model, and insignificance indicates a good model. Chi-Square for the model is highly insignificant. Other fit indices also yield strong evidence for a good model fit, all exceeding recommended cut-off points: RMSEA==0.01 (good fit < 0.08); RMSEA CI = 0.00-0.03 (good fit =0.03–0.08); SRMR = 0.05 < (good fit < 0.08); CFI = 0.99 (good fit > 0.90);

**Table 3**
Standardized Loadings of Latent Variables

| Indicators | Information Sharing | Affiliative Culture |
|---|---|---|
| City/town departments involved in implementing sustainability programs… | | |
| Help each other with acquiring necessary data on sustainability programs | 0.82 | |
| Often interact with each other to exchange information on sustainability programs | 0.76 | |
| Regularly use inter-departmental meetings to discuss data | 0.76 | |
| Are willing to share data | 0.7 | |
| Can easily access information relating to sustainability programs | 0.81 | |
| The top management in my organization… Encourage teamwork among staff | | 0.83 |
| Are open to new ideas initiated by employees | | 0.81 |
| Emphasize cooperation as an organizational objective members | | 0.84 |
| Composite Reliability (CR) (>.7) | 0.88 | 0.87 |
| Average Variance Extracted (AVE) (>.5) | 0.60 | 0.68 |

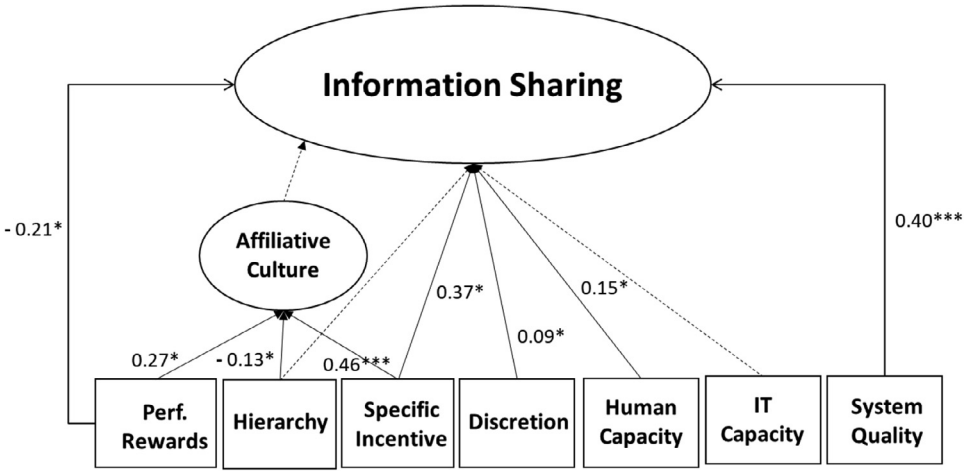


**Fig. 3.** MIMIC-SEM: Institutional Context for Information Sharing

and TLI = 0.99 (good fit > 0.95).[5] Taken together, these indicate the theorized model effectively explains the variations of observed data. In other words, hypothesized relationships among variables closely match patterns observed in actual data, yielding strong evidence for the model.

## Discussion

Results from the analysis show some interesting patterns. While several variables exert direct influence on information sharing, a non-trivial number of variables are also interrelated with affiliative culture. To enhance readability, figure 3 rearranges the graphic with solid lines representing significant paths and dashed lines showing insignificant paths. Several features of institutional context are found important for understanding the variations in information-sharing behaviors of local governments. First, different types of incentives an organization offers show interesting dynamics, as each forms a significant path to information-sharing in opposite ways. Consistent with extant research, results indicate information-sharing is more likely when such behaviors are recognized through formal incentives. However, it is less likely when general rewards for performance are in place. This supports the claims that rewards targeting general performance improvement can cause heightened competition among staff and encourage them to hoard information for personal benefits (Barua, Ravindran, and Whinston 2007; Zhang, Dawes, and Sarkis 2005).

On the other hand, formal incentives and performance rewards are linked not only to information sharing but also to affiliative culture. Interestingly, the performance rewards variable is positively linked to affiliative culture, raising some interesting points for discussion. The positive path between performance rewards and affiliative culture indicates the sample organizations that offer performance rewards also tend to emphasize collaboration. It could be that local governments' discourses on collaboration are situated within or parallel with the discourses on organizational performance, whereby collaboration is emphasized for performance improvement. This is likely given the multiple public-sector reform movements that have emerged in the modern era. Over the past century, we have seen shifting governing principles from professional elitism (the orthodox period) to market-like entrepreneurship (New Public Management) to collaborative governance (New Public Governance). All these reforms come with a set of distinctive ideas and values that do not always align with one another, resulting in "reform tensions" where multiple ideas coexist but conflict (Ingrams, Piotrowski, and Berliner 2020). This has likely driven public institutions to develop a culture that simultaneously emphasizes several concepts with contradictory effects on bureaucratic behavior. For example, city governments could encourage collaboration among team members on the one hand while rewarding high performers on the other, which inevitably involves some degree of competition. In this context, the contrasting relationships that performance rewards form with affiliative culture and information-sharing (positive for the former and negative for the latter) may explain why culture is insignificant; collaborative culture combined with the provision of performance incentives could send a mixed message, negating the positive role collaborative culture can play for facilitating information-sharing.

Capacity variables also show some interesting dynamics. While the quality of the measurement system shows strong significance, both statistically and economically, general IT infrastructure remains insignificant. Instead, the human capacity to manage data is found to be positively linked to the increased level of information sharing. The result is consistent with other research findings highlighting the importance of human capacity, especially relating to technical expertise and knowledge professionals hold in managing such innovative practices as sustainability and performance management (Cho, Kim and Park 2021; Wang et al. 2012; Wellstead and Stedman 2011). Overall, information-sharing is more likely in organizations where better performance metrics are available and sufficient staff members to carry out data analyses are present. The view on major features of bureaucracy as interfering with information-sharing efforts is supported partly by the mixed findings. While having work discretion rather than having to rigidly follow formal rules and procedures is found to be necessary, hierarchical communication structure remains largely irrelevant for explaining information-sharing , although it has an expected sign. Hierarchical communication, however, forms a significant and negative relationship with affiliative culture, indicating that vertical communication structure (e.g., primarily through department heads) is likely unhelpful in creating a culture that communicates the values of affiliation and information-sharing.

In all, results indicate that institutional support is critical in promoting information-sharing in sustainability performance management. Simply communicating the values of sharing without proper supporting mechanisms is not likely to be effective. In particular, incentives for sharing and system quality display substantially large standardized coefficients when compared with other institutional variables. In other words, information-sharing is most likely when there are such targeted efforts as recognizing sharing behaviors and establishing quality metrics that produce reliable, valid, and practically relevant information. The strong evidence for their economic and statistical significance emphasizes the importance of a proper support system directly tied to in-

[5] Abbreviations: Root Mean Square Error of Approximation (RMSEA); Standardized Root Mean Square Residual (SRMR); Comparative Fit Index (CFI); Tucker-Lewis Index (TLI).

formation collection and dissemination. On the other hand, the results also highlight the importance of soft aspects of management for shaping institutional behavior. The fact that departments in the study sample behave differently depending on the incentive types and work flexibility granted to them indicates the importance of the people factor, as suggested by other research. Establishing proper technical infrastructure alone does not automatically lead to sharing unless people perceive sharing as a desirable and legitimate action– either rationally or socially (Jarvenpaa and Staples 2000; Orlikowski 1993).

## Conclusion

The intersecting policy dimensions under the 3E sustainability means city departments tasked with managing local sustainability need to pull informational resources together to accomplish cohesive city-wide goals. And such needs for information sharing arise not only for successful policy implementation but continue through the stages of measuring and managing program performance. This is because the quality of performance management systems rests on the rich and continuous inflows of information about organizational activities across different functions and divisions. This research thus examined the institutional dynamics of information-sharing in local sustainability performance management.

Investigation of U.S.municipalities' engagement in information-sharing reveals some interesting relationships that exist not only between key institutional variables and information sharing but also among institutional variables themselves. In all, the results find that supporting institutional mechanisms directly tied to information-sharing, such as incentives and a quality system to generate information, are important for understanding how city departments engage in collective knowledge building for performance improvement. A flexible structure that permits work autonomy in program implementation is also significantly linked to an increased level of information-sharing, while performance rewards are likely harmful in that regard. On the other hand, the non-significance of culture and its positive relationship with performance rewards variables proposes an opportunity for future research. Culture is often found to be critical in shaping organizational behavior and bringing about desirable changes. It has received significant research attention, as evident in various terms designed to tap into different dimensions of culture, such as affiliative, result-driven, developmental, and innovative culture. The multidimensionality of culture and the potential interrelationships among the dimensions, as discussed in the previous section, raise challenges in deconstructing it and operationalizing its dimensions. It also raises a question about the utility of examining one dimension of organizational culture in isolation of other dimensions. These questions remain open for future research.

This research advances the understanding of an institutional approach to information-sharing, yet its focus on institutional analysis also has limitations. Research explains that information-sharing is shaped by factors of three layers: structure and institutional context (the outer layer) that shapes inter-personal dynamics (the middle layer), which in turn affects individual belief systems (the inner layer) (Yang and Maxwell 2011). Since modeling a full set of relevant variables is not viable, this research examined the factors of the outer layer that broadly impacts all other factors. Nonetheless, individual-level variables, such as information ownership, can be important and should be considered for future analysis since whether to exchange information or not is, in the end, a personal, individual decision.

With the rise of the governance era and consequent needs for effective cross-boundary coordination, the need for sharing information and integrating knowledge is growing rapidly. Research efforts are underway to meet these needs, and this research extends these efforts to create an integrated knowledge base for better-performing public institutions.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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