

Extended Abstract

Extended Abstract 2,000 words

Justice, Trust, and Customer Acceptance in Smart Meter Deployment: A Governance Perspective on Utility Modernization

Introduction

Across advanced economies, electric utilities are undergoing rapid digital transformation. The deployment of advanced metering infrastructure (AMI), commonly referred to as smart meters, represents one of the most visible and consequential components of this modernization agenda. In the United States, smart meter deployment has accelerated over the past decade, driven by regulatory mandates, grid resilience objectives, decarbonization strategies, and the increasing integration of distributed energy resources. Despite the technological maturity of AMI systems and the operational efficiencies they enable, customer resistance to smart meter implementation persists in multiple jurisdictions. Existing research addressing customer resistance has predominantly relied upon technology acceptance frameworks, including variations of the Technology Acceptance Model (TAM). While such models offer explanatory value in contexts where users actively choose to adopt new technologies, their application within regulated utility environments may be limited. Utility customers do not “opt in” to grid modernization in the same manner as consumers adopt commercial digital technologies. Moreover, many residential customers lack sufficient technical knowledge to meaningfully evaluate smart meter functionality. In such environments, acceptance may be shaped less by perceived technological usefulness and more by perceptions of fairness, transparency, and institutional credibility.

This study reframes smart meter deployment as a governance and trust challenge rather than a purely technological adoption issue. It examines how perceptions of informational justice and procedural justice influence trust in electric utilities and, in turn, shape customer acceptance of smart meter deployment. By situating AMI modernization within organizational justice and trust theory, this research contributes to a more institutionally grounded understanding of infrastructure transformation.

Theoretical Framework

The study integrates three complementary theoretical perspectives: Organizational Justice Theory, Trust Theory, and Consumer Socialization Theory.

Organizational Justice

Organizational Justice Theory, particularly as operationalized by Colquitt (2001), provides a structured framework for understanding how individuals evaluate fairness in institutional contexts. While originally developed within organizational settings, justice constructs have increasingly been applied to public governance and service delivery contexts.

This research focuses on two justice dimensions particularly relevant to regulated utility environments:

- **Informational Justice**, defined as the perceived adequacy, clarity, and honesty of explanations provided regarding decisions and policies.
- **Procedural Justice**, defined as the perceived fairness, neutrality, and consistency of decision-making processes, including opportunities for stakeholder voice.

Within the context of AMI deployment, informational justice reflects whether customers believe the utility has communicated transparently about meter functionality, data privacy, billing implications, and system benefits. Procedural justice reflects whether customers perceive deployment decisions as fair, impartial, and inclusive, even when direct choice is limited.

Justice perceptions are particularly salient in public-facing institutions operating under regulatory oversight. Where procedural legitimacy is questioned, trust erosion may occur irrespective of technological performance.

Trust Theory

Trust is conceptualized as a multidimensional construct grounded in McKnight et al.'s framework, encompassing perceptions of competence, integrity, and benevolence. In regulated infrastructure sectors, trust is foundational to institutional legitimacy. Customers must rely on utilities for essential services; asymmetries in information and power are inherent.

In this study, trust functions as a mediating mechanism between justice perceptions and customer acceptance. Informational and procedural justice are theorized to strengthen perceptions of institutional integrity and competence, thereby increasing trust. Trust, in turn, is expected to predict acceptance of smart meter deployment.

This mediation perspective aligns with governance literature suggesting that fairness perceptions influence institutional legitimacy through trust formation.

Consumer Socialization

Consumer Socialization Theory recognizes that individuals acquire knowledge, attitudes, and evaluative criteria through informational exposure and social learning processes. Many utility customers possess limited technical understanding of smart meter systems. As

such, they may rely heavily on institutional cues — including communication quality and perceived fairness — when forming judgments.

By incorporating consumer socialization, the study acknowledges that acceptance may not be driven by technological literacy but by interpretive frameworks shaped by institutional interaction.

Collectively, these theories support a justice–trust–acceptance model that is well suited to infrastructure transformation contexts characterized by low technological agency but high institutional dependency.

Research Questions and Hypotheses

The study addresses the following central research question:

How do perceptions of informational justice and procedural justice influence trust in electric utilities, and how does trust subsequently affect customer acceptance of smart meter deployment?

The following hypotheses are proposed:

1. Informational justice will positively predict trust in the utility.
2. Procedural justice will positively predict trust in the utility.
3. Trust will positively predict acceptance of smart meter deployment.
4. Trust will mediate the relationship between justice perceptions and acceptance.
5. Customer knowledge level and demographic variables may moderate the strength of these relationships.

Methodology

The research employs a quantitative, cross-sectional survey design. Data will be collected from residential electric utility customers across investor-owned utilities, cooperatives, and municipal providers within the United States.

Instrumentation

Validated measurement scales adapted from established literature will be used:

- Informational and procedural justice scales derived from Colquitt's justice instrument.
- Trust scales grounded in McKnight's multidimensional framework.
- Custom-developed smart meter acceptance measures tailored to utility deployment contexts.

All items will utilize Likert-type response formats. The instrument will also collect demographic variables, including service region, utility type, prior exposure to smart meter information, and self-reported knowledge level.

Sample

The anticipated sample size ranges between 500 and 2,000 respondents to ensure sufficient statistical power for factor validation and structural modeling. Sampling will seek representation across diverse utility structures to enhance generalizability.

Data Analysis

Statistical analysis will proceed in multiple stages:

1. Exploratory Factor Analysis (EFA) to assess construct dimensionality.
2. Confirmatory Factor Analysis (CFA) to validate measurement models.
3. Reliability testing using Cronbach's alpha and composite reliability.
4. Structural Equation Modeling (SEM) to evaluate hypothesized relationships.
5. Mediation analysis to test trust as an intervening variable.
6. Moderation analysis to examine demographic and knowledge-based effects.

This methodological approach enables simultaneous evaluation of direct and indirect effects within the proposed governance framework.

Anticipated Findings

It is anticipated that both informational and procedural justice will significantly predict trust in electric utilities. Transparent communication, perceived honesty, and adequate explanation are expected to strengthen perceptions of institutional integrity. Similarly, perceptions of fairness, neutrality, and procedural consistency are expected to reinforce trust formation.

Trust is anticipated to significantly predict customer acceptance of smart meter deployment. Furthermore, mediation analysis is expected to demonstrate that justice perceptions influence acceptance primarily through trust. In other words, fairness perceptions alone may not directly translate into acceptance unless they generate institutional trust.

Customers reporting higher levels of prior knowledge may demonstrate stronger acceptance, suggesting that informational exposure moderates trust formation.

Contributions

Theoretical Contribution

This study extends Organizational Justice and Trust Theory into the context of regulated infrastructure modernization. While justice frameworks have been widely applied within organizational behavior, their application to utility governance and infrastructure deployment remains limited.

By integrating justice, trust, and consumer socialization within a structural model, this research contributes to a more institutionally grounded understanding of public-facing digital transformation.

Practical Contribution

For utility leaders, regulators, and policymakers, the findings are expected to offer evidence-based guidance on communication strategy and stakeholder engagement during modernization initiatives. The results may inform:

- Transparent communication frameworks.
- Deployment governance structures.
- Trust risk assessments during digital transitions.
- Stakeholder engagement models for future grid technologies.

In an era characterized by decarbonization pressures, digitalization, and increased scrutiny of public institutions, maintaining customer trust is essential to the legitimacy of infrastructure transformation.

Conclusion

Smart meter deployment represents more than a technical upgrade; it is a governance event that reshapes the relationship between utilities and customers. This research argues that acceptance of infrastructure modernization is fundamentally rooted in perceptions of fairness and institutional credibility.

By empirically testing a justice–trust–acceptance model within the U.S. utility context, this study advances understanding of how institutional processes influence public response to digital transformation. The findings are expected to demonstrate that sustainable modernization requires not only technological capability but also procedural legitimacy and trust-based governance.