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## Evaluating human resource management capacity for effective implementation of advanced metering infrastructure by electricity distribution companies in Pakistan

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## ABSTRACT

The Government of Pakistan, with technical and financial assistance from international development institutions, has begun to implement Advanced Metering Infrastructure (AMI) in its electricity distribution systems to address a growing electricity crisis in the country. Grounded in resource-based theory and firm-specific human capital logic, we argue that the success of this project will largely be determined by the Electricity Distribution Companies' (DISCOs) HRM capacity that includes both the effective development of AMI-specific human resource (HR) capabilities (knowledge, abilities, skills, attitudes, behaviors), and human resource management (HRM) strategy. Data concerning HR capabilities and the prevailing HRM strategy were collected through in-depth interviews with HRM professionals, project managers, and technical staff of DISCOs; and an online survey of 3400 electricity consumers. Findings reveal that the DISCOs have a short-term, functional, and technical understanding of AMI and may not be aware of the long-term social and economic implications of the project. Electricity consumer attitudes toward different aspects of AMI technology and the government's commitment to overcoming the energy crisis and implementing AMI are not sufficiently positive. The DISCOs understanding of the need for consumer engagement and AMI-specific HR capabilities and HRM strategy to realize the full benefits of AMI is limited. This lack of attention to project-specific HR capabilities and HRM strategy in the DISCOs, along with the absence of a consumer-engagement strategy, seem to be major barriers to the successful implementation of AMI and achievement of associated goals in Pakistan.

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### 1. Introduction

Pakistan's electricity crisis has crippled almost every segment of economy and society (GOP, 2013). Daily production of electricity in Pakistan is around 11,500 MW, whereas demand fluctuates between 15,000 and 20,000 MW, resulting in massive unannounced electricity load-shedding of up to 18 h per day. Pakistan has lost billions of rupees due to electricity theft, line losses, diminished productivity, and massive load-shedding (NEPRA, 2011). Industry experts attribute this to growing demand relative to available

supply and the overall mismanagement of the electricity production and distribution systems.

To address this crisis, the Government of Pakistan in collaboration with international development agencies introduced Advanced Metering Infrastructure (AMI) to equip electricity producers and distributors with advanced technologies to better manage and control electricity production and usage in the country. The United States Agency for International Development's (USAID) five-year power distribution program was established to reform Pakistan's power sector to help meet electricity demand. During the last two years, the Asian Development Bank (ADB) approved a total loan of \$4 billion for Pakistan to improve its energy conditions through the installation of smart meters, the privatization of DISCOs, and reduce the fiscal burden of electricity subsidization by the government (Rana, 2015). An exclusive \$990 million was allocated for AMI to help improve the operational and financial

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effectiveness of the DISCOs by enhancing customer services, mitigating line losses, and increasing sales revenues through the identification and reduction of illegal connections to the power grid. The loans were used to upgrade about 642 grid stations and enhance 5021 megavolt-amperes (MVA) of transformers capacity. These projects were implemented in coordination with the Ministry of Water and Power (MWP) and the National Electric Power Regulatory Authority (NEPRA) of Pakistan.

In 2010, an AMI pilot project in the form of Smart Meters has been implemented by the Pakistan Electric Power Company (PEPCO) in some parts of the country. The installation was undertaken by Lahore Electricity Supply Company (LESCO) in selected areas with an investment of 6.2 million rupees (Ullah, 2011). As per LESCO officials, this pilot testing after installation of new meters on 146 industrial, 48 domestic and 156 commercial connections resulted in substantial reduction of illegal consumption and theft that led to radical reduction in overall losses from 11% to 2.9% in Shadbagh and Shadman and from 13.2% to 4.4% in Delhi Gate. Based on these results, the project will be implemented nationwide.

Although the main emphasis of the AMI project is technical, the electricity crisis is also attributable to socio-economic, institutional, and cultural complexities beyond the technical challenges (Hagblade et al., 2007; Nakano and Managi, 2008). According to experts, the key challenge for this sector is governance, and any investment in the distribution infrastructure without addressing governance and regulatory issues will be futile (Kardar, 2015). Thus, whether the AMI project is successful or not reflects on the effectiveness of the funding agencies and implementing organizations (i.e. DISCOs) to address multifaceted and complex challenges. Understanding of these critical factors and the role of human resources and their management in this project will enhance the ability of funding agencies and implementing organizations to ensure desired outcomes. In addition, this will help them anticipate the future status of the project, diagnose problem areas, and prioritize attention and resources to ensure successful completion of AMI in other areas of Pakistan.

## 2. Context of the study

While looking at the operational and strategic aims of AMI in Pakistan, as well as the structural context, we argue that the success of the AMI project will largely be determined by the Electricity Distribution Companies' (DISCOs) HRM capacity that includes effective development of AMI-specific human resource (HR) capabilities (knowledge, abilities, skills, attitudes, behaviors), and human resource management (HRM) strategy. However, the provision of these capabilities and an effective HRM strategy for AMI is central to the overall HRM capacity of Electricity Distribution Companies (DISCOs). The AMI project requires employees to demonstrate a specialized and unique set of project-specific capabilities (knowledge, abilities, skills, attitudes, and behaviors) and the organization to have an effective human resource management (HRM) strategy to develop and retain these capabilities to support AMI's successful implementation.

The resource-based theory (RBT) of the firm provides the theoretical rationale for the critical role of HR capabilities in successful AMI project implementation and goal achievement. RBT highlights the significance of firm-specific knowledge resources or specialized human capital for the sustainable achievement of any specific goal (Barney, 1991; Crook et al., 2011; Wang et al., 2009). An organization's ability to develop creative and innovative solutions largely depends on its members' information inputs, knowledge capabilities, and overall expertise (Hsu, 2008). Implementation of the AMI project requires unique and complex technical and social interventions; thus, project-specific knowledge is necessary to

operate and maintain customized technologies and initiate behavior changes by electricity consumers. This level of technological and behavioral change requires a high level of skills, human resources, and abilities in order to adapt to rapidly changing circumstances (Døving and Gooderham, 2008).

The development of AMI project-specific knowledge resources depends on the investment in specialized human capital considering the special needs, challenges, and context of the project. Development of specialized human capital requires investment by both the employees and employers along with integrated organizational practices to create an enabling environment that fosters expansion of this knowledge base (Benson, 2006). In the absence of any systematic approaches or management practices, employees may be reluctant to invest their time in gaining project-specific knowledge and skills and demonstrating required attitudes and behaviors (Kehoe and Wright, 2013). In addition, the employees' attitudes and behaviors have a strong correlation to project effectiveness (Liao and Chuang, 2007). Researchers have identified a group of behaviors, including team work, learning, knowledge sharing, and customer orientation, that enables organizations to excel under such exceptionally challenging circumstances (Ericksen and Dyer, 2005).

Drawing inferences from both the cognitive and behavioral perspective of firm-specific employees' knowledge and behaviors, we argue that the AMI project requires a unique set of project-specific human resource capabilities for learning and adapting to new technologies, adopting new organizational structures and processes, engaging customers, and demonstrating service-oriented behaviors during implementation. Porter (1980) suggests that an organization's ability to undertake socially complex and diversified activities in a more effective way largely depends upon its human resource capabilities. Other scholars have asserted that knowledgeable and skilled human resources are crucial if emerging economies are to innovate and succeed through social networks, knowledge spillovers, and service orientation (Acquaah, 2007; Cabello-Medina et al., 2011).

According to official documents and communications of donor agencies, government officials, and representatives of the DISCOs, the following activities have been identified as critical to AMI project success:

1. Engaging in strategic planning, engineering, safety, communications, and customer service;
2. Learning the new technology, equipment, and best practices for improving metering, meter reading, billing, revenue collection, back office functions, automation, and operations;
3. Developing technical skills concerning the replacement of traditional with advanced meters; reading, installation of efficient transformers, and replacement of open wires with aerial bundled cables;
4. Increasing planning and engineering (PandE) capability to develop new PandE centers, geographic information system (GIS) mapping, and new system analysis tools;
5. Establishing new state-of-the-art power distribution control centers in every DISCO;
6. Taking a census to identify the location of illegal connections and erroneously billed legal connections;
7. Adopting the "Protection from Harassment in the Workplace Act" in DISCOs to improve working conditions for female staff; and
8. Employing proper safety techniques for front line-workers.

Although all of these activities require a specific set of employee capabilities, little attention seems to be paid by both funding and implementing organizations to support the necessary development

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