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The centrality of electricity to ICT use in low-income countries



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ABSTRACT

A growing body of literature that extols the ability of information and communication technologies (ICTs) to enhance well-being in developing countries tends to focus on long run institutional and socio-economic changes as key to driving Internet uptake. The literature, however, too often ignores one factor in discussions of ICTs' importance and employment: electricity. Overlooking the centrality of electricity to any ICT for development (ICT4D) initiative has enormous consequences; countless initiatives have failed to consider the (in)ability to power the technology that is central to such development efforts. The present article seeks to address this gap by emphasizing the primacy of electricity in ICT4D initiatives. Utilizing a unique dataset that avoids issues associated with unreliably measured and inequitably distributed grid power, we examine the drivers of Internet adoption in low-income countries. We find robust evidence that increasing the distribution of electricity within under-served countries—and thereby making electricity available to a larger proportion of the population—significantly increases the number of Internet users. Arguably, improvements in infrastructure may bring about significant changes in Internet use, even in places where advancements in education and political representation remain elusive.

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I came to Uganda to run the technical side of a mobile phone company. Instead, I'm running the largest diesel fuel distribution company in the country—in order to run the mobile phone company. –Francis Kazinduki, CTO of MTN, Uganda

1. Introduction

Many believe that information and communication technologies (ICTs) have the potential to improve quality of life around the world. Recent times have seen the emergence of an entire body of scholarly literature devoted to defining, conceptualizing, debating, measuring, and addressing the use of ICTs in developing countries. Our contribution concerns an underemphasized factor impacting all technology use, particularly for less-developed locations: *lack of electricity*. Its presence is a prerequisite to ICT use, and its under-emphasis in the digital divide literature has significant consequences for the developing world: countless initiatives have failed to consider the ability to power the technology that is central to such development efforts (Hosman & Baikie, 2013).

Our intention, therefore, is to foreground electricity as a fundamental consideration in ICT for development. We use an innovative approach for measuring countries' electrical infrastructure using data on the distribution of night light as measured from space by satellite. This dataset provides both a measure of distribution (rather than quantity) of electricity used in developing countries, and includes off the grid power use in low-income countries where an electrical grid constitutes only a small proportion of the electric power available.

We use country fixed effects to distinguish within-country drivers of Internet adoption from cross-country differences. We believe that these within-country differences are more important for short-run within-country policy considerations.

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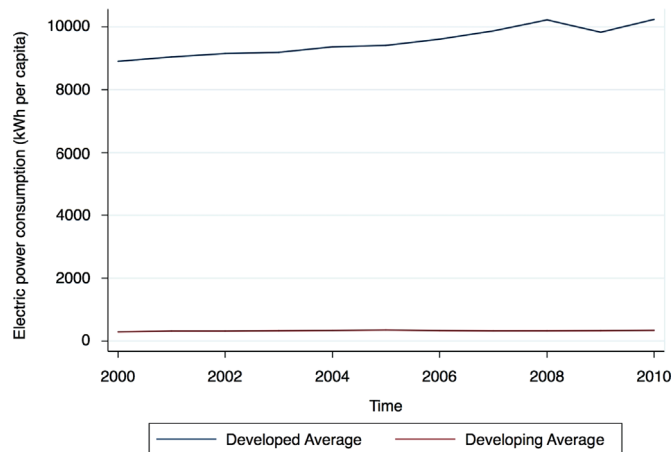


Fig. 1. Electricity consumption.

Moreover, this is one of the first papers on this topic to use dynamic panel data analysis, which allows us to model the S-shaped curves and dynamic processes that characterize technology adoption. In addition, the use of newer data, 2000–2010, offers novel insights into disparities in Internet adoption because it has been a period of change and divergence of Internet adoption in developing countries.

We find significant evidence that the distribution (i.e. availability), rather than the quantity of electricity, significantly increases within-country demand for the Internet. We posit that there is latent demand for the Internet within low-income countries, and that when electricity becomes available, more people will become Internet users.

In other words, using a dataset that more precisely measures the use of electricity in low-income countries, on and off grid, we find that greater numbers of people having access to electricity is a far better predictor of Internet uptake (the most commonly used dependent variable in the digital divide literature), than is the overall amount of electricity produced on a national level. Our policy recommendations follow from these findings.

2. Literature overview

In high-income countries, increased use of electricity enables the “new digital economy,” as well as improves individuals’ productivity and quality of life (Ebohon, 1996; Rosenberg, 1998). Very little has been written, however about increased access to electricity in developing countries and its parallel benefits in terms of information and communication technologies’ (ICT) adoption.

This issue should be pertinent to a variety of bodies of literature. For example, an entire body of literature has focused on economic, social, and quality of life differences—often called the digital divide—that exist between groups of people due to differing levels of access to, use of, or knowledge of, (ICT)—(for overviews, discussions, and/or critiques of this literature see DiMaggio, Hargittai, Celeste, and Shafer (2001), Howard (2007), Norris (2001), Vehovar, Sicherl, Husing, and Dolnicar (2006), and Warschauer (2004)). Much of the debate in this literature centers around a haves vs. have-nots dichotomy and a persistent focus on hardware provision rather than on the creation of the entire ICT ecosystem necessary for meaningful quality of life improvements to accrue (Di Maggio & Hargittai, 2001; Warschauer, 2002). Rather than engaging in this debate, this article seeks to draw attention to a crucial pre-requisite for all ICT use, the provision of energy.

A small but growing group of scholars, in the ICT for development field, acknowledges the importance of electricity in ICT4D (Heeks, 2008; Unwin, 2009). Heeks (2008) calls for innovation to address the scarcity of electricity in poor, rural areas. Still, such an assertion of electricity’s importance in this body of literature generally merits no more than a mention. In fact, in his seminal book on the subject, simply titled *ICT4D*, Tim Unwin boldly asserts, “Without electricity there can be no ICT4D” (2009:99). Yet the book’s entire discussion of energy and electricity vis-à-vis ICT4D takes place on one page, within a 386-page book. We make this point not as a reproof toward Unwin’s work in any way—quite the opposite. This article is in complete agreement with Unwin’s bold assertion, and it attempts to answer Heeks’ call for more innovative work in this area.

Data suggest that this oversight is not because electricity provision is a minor issue. The International Energy Agency (2010) estimates that 1.4 billion people, approximately 20% of the world’s population, live with no access to electricity, and one billion more (for a total of about one third of the global population) have access only to extremely unreliable electricity networks. The World Bank asserts that “no country in the world has succeeded in shaking loose from a subsistence economy without access to the services modern energy provides,” (1996) and annually publishes the *World Development Indicators*, which reports how much grid electricity is generated in each country. Fig. 1 uses World Bank data to illustrate the differences between grid electricity use in the developed (OECD) world and least developed countries.

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