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Rural electrification and development in South Korea

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ABSTRACT

In fifteen years, South Korea went from providing only 12% of rural households with electricity to providing 98% of rural households with electricity for lighting and productive uses. This paper provides an analysis of rural electrification and development in South Korea from 1965 to 1979 and finds that rural electrification contributed to a significant increase in rural household income levels and improved the quality of life in villages substantially. At the same time, rural electrification did not benefit the poorest quartile of rural households, increased economic and social inequality, led to a significant increase in household debt, and accelerated migration to urban areas. Central to the South Korean electrification experience was a top-down and a bottom-up approach that balanced local control and participation with central government control. This approach was crucial in overcoming many of the issues that continue to be found today in both grid-based and off-grid approaches to electrification.

Introduction

Over 1.2 billion individuals in the world today do not have access to electricity and live in difficult and burdensome conditions, particularly in rural areas (World Bank, 2014). Access to reliable electricity for both lighting and productive uses, however, has the potential to improve rural incomes and the quality of life in rural areas. Although the linkages between rural electrification and development have been recognized since at least the 19th century (Spencer, 1897), it is in the last few years that rural electrification has encouragingly emerged at the forefront of development (see, for example, UN, 2012). In order to help provide reliable electricity to today's developing countries, it is important to look at historical examples of rural electrification where, despite different economic, political, social, technological and temporal contexts, there are likely to be general lessons that may help inform policy.

This paper provides a detailed summary and analysis of South Korea's broadly successful rural electrification and development efforts from 1965 to 1979. Beginning with a government commitment to improving the economic productivity and quality of life of rural households through the Rural Electrification Promotion Act (1965) and implementation through the Five-year Electrification Plan (1965–1969) and the Long-term Rural Electrification Project Scheme (1970–1979), the Korean case was characterized by a novel top-down and bottom-up approach that balanced local control and participation with central government control. Specifically, strong central leadership through the government and the harnessing of rural community participation in rural electrification and development allowed for South Korea to achieve economically sustainable rural electrification through the state-owned utility, Korea Electric Power Corporation (KEPCO), as well as to overcome information asymmetries, rural apathy and opposition to electricity, and ensure that rural electrification translated into economic and quality of life improvements for rural households through complementary investment. Despite this success, the South Korean experience presents a cautionary lesson to today's developing countries by highlighting how: the poorest quartile of rural households benefited the least from rural electrification and often became heavily indebted; villages witnessed notable increases in income and social inequality; and migration to urban areas accelerated, particularly among the younger members of wealthier households.

Rural electrification and development

A survey of the literature suggests that rural electrification is necessary to improve economic productivity and improve the quality of rural life (Kirubi et al., 2009; Kaygusuz, 2011; Sovacool, 2012). Broadly speaking, economic activity in rural villages can be disaggregated into agriculture and a catch-all category of non-agricultural activity: mainly, rural industries (World Bank, 2008). Without a reliable and adequate electricity supply, rural households engaged in agriculture and rural industry are characterized by low productivity and growth prospects, and low incomes (Cabraal et al., 2005).

Specifically, rural households engaged in agriculture often require electricity to generate the motive power required for modern farm machinery and irrigation systems. Without electricity, rural households are unable to achieve the benefits of agricultural modernization that include, among others: improvements in yield, cropping intensities and overall area, dependability, cost efficiency and productivity, as well as

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decreased labor and time costs (Guruswamy, 2011; Kaygusuz, 2011). Electricity is also crucial in increasing the value added captured by farmers through being able to store their crops suitably and by allowing for information on market conditions to be incorporated in decision-making through information and communication technology (ICT) (Sovacool, 2012). Indirectly, access to electricity may impact agricultural productivity through health due to, for example, reducing the impact of indoor air pollution from biomass energy sources or kerosene lamps (Clancy and Skutsch, 2002).

Rural industries generally consist of small-and-medium enterprises focusing on retail, services, construction, processing and manufacturing (World Bank, 2008). For processing, manufacturing and construction industries, access to reliable electricity is necessary in order to provide adequate driveshaft or mechanical power. A lack of electricity also hinders rural industry through an inability to provide suitable lighting and to make use of ICT to obtain relevant market information, make more informed business decisions and integrate into more complex value chains (Cabraal et al., 2005; Flavin and Aeck, 2005; Casillas and Kammen, 2010). A further indirect impact is the potential for electricity, through providing lighting and enabling for ICT-based informal and formal learning, to improve the education and skill-levels of rural workers, and consequently increase the productivity of rural industry (Cecelski, 2000; Birol, 2007; Casillas and Kammen, 2010).

An often understated consequence of having no access to reliable electricity is the grinding nature of life that is pervasive in many rural villages (Zomers, 2003). Indeed, the impact of electricity can have a transformative impact on many villagers through: saving time and effort in collecting biomass; allowing for household appliances to take the role of normally labor and time consuming tasks; and providing public lighting at night so that people, primarily women, can enjoy social interaction without unnecessary fear of danger (Cecelski, 2000; Sovacool, 2012). The quality of life of rural households can also improve drastically through information and communication technology mediums that allow for information to be disseminated and for recreation (Johnson, 2001; Tenhunen, 2008).

Rural development in South Korea

The main unit of rural South Korea is the village. South Korean villages tend to consist of several hamlets that were consolidated at the end of the Koryo Dynasty (918–1392) or at the beginning of the Joseon Dynasty (1392–1897) for administrative purposes (Eikemeier, 1980). South Korean villages can broadly be classified into agricultural villages, situated on plains and relatively close to urban centers, and more remote mountain villages, which are located in the valleys of South Korea's many mountains (Kim, 2005). Historically, villages were viewed by the central government as an important source of tax revenue, usually in the form of agricultural and forestry products (Palais, 1996; Bae, 2004; van Gevelt, 2014). As a result, beyond interaction with the village leader to ensure appropriate taxation, the central government did not generally interfere with village affairs leading to the development of village-level solutions to social and economic issues (Brandt, 1971; Turner et al., 1993).

Japanese colonialism (1910–1945) and the Korean War (1950–1953) left South Korea in a desperately poor state. Regarding electricity, South Korea suffered from severe shortages during this period as the majority of electricity generating facilities were located in North Korea and the few facilities located in South Korea were severely damaged during the Korean War. It was not until General Park Chung Hee came to power through a coup in 1961 that the electricity shortage was addressed through directing funds from USAID towards new generation facilities, and that a tremendous improvement in the country's economic growth and living standards in urban areas was brought about through export-oriented industrial policy (Amsden, 1989; Song, 2003; Kim, 2011). Beginning in the early-to-mid 1960s, the Park government became acutely aware of the resultant spike in rural–urban inequality and its negative impact on the livelihoods of rural households (Park, 1997), national food supply (Baek et al., 2012), and his political support base (Brandt, 1980; Moore, 1985).

This led to a succession of rural development policies and, eventually, the Park government developed and implemented one of the most effective integrated rural development strategies of the 20th century: *saemaul undong* (the New Village Movement). *Saemaul undong* involved both top-down and bottom-up initiatives that, together with post-Korean War land reform, significant investment in human capital, and gradually improving terms of trade for the rural sector due to increasing urban demand for agricultural goods and agricultural subsidies, were able to provide the enabling conditions for rural households to improve their livelihoods (Brandt, 1980; Kwon, 2009; Reed, 2010; Baek et al., 2012).

Top-down rural development

By the late 1960s, Korean industry was sufficiently successful that the Park government was able to invest significantly in agriculture and rural infrastructure (Brandt, 1980). In agriculture, the Park government: strengthened agricultural extension services; undertook land reclamation projects to increase the area available for cultivation; launched a nation-wide reforestation campaign to, in part, deal with soil erosion and improve soil fertility; implemented an agricultural subsidy to further improve the terms of trade for agriculture; promoted the mechanization of agriculture; and developed and rapidly deployed high-yield rice and barley varieties. Additionally, the mandate of the national agricultural and forestry cooperatives were expanded to include the provision of affordable credit to rural households which, along with legislative changes, helped eliminate usurious loans in rural areas (Keim, 1974; Tak et al., 2007; Kwon, 2009; Reed, 2010; Douglass, 2013). Alongside agriculture, the Park government invested significantly in rural infrastructure. Table 1 details both the government's targets and the actual output for rural infrastructure. The targets set by the government were by all accounts ambitious and were surprisingly exceeded for the expansion and construction of village roads, small bridges, village centers and sewage systems. For the majority of infrastructure projects, villagers were expected to contribute their opinions, labor and, in some cases land, thereby creating a sense of community-ownership and management (Park, 1997).

The idea to mobilize rural villagers to contribute their efforts to rural infrastructure projects was brought about during a visit by President Park to the flood devastated *Gyeongsang* province in July 1969. During his visit, Park is reported to have been struck by how a small village, *Sindo ri* in *Cheongdo* county, North *Gyeongsang* province, recovered quickly from the floods and had at the same time decided at a village meeting to work together to improve the village infrastructure while repairing flood damage (Kim, 2004; Kim, 2011; Lee, 2011). Upon

Table 1
Rural infrastructure (1970–1979).
Source: Based on Choe (2005).

Type of infrastructure	Target	Output
Expansion of village roads (Km)	26,266	43,558
New village roads (Km)	49,167	61,797
Small bridges	76,749	79,513
Irrigation (Km)	21,282	13,622
Village centers	35,608	37,012
Warehouses	34,665	22,143
Housing improvements	544,000	225,000
Sewage systems (Km)	8654	15,559
Electrification (households)	2,834,000	2,777,500
Telephone lines	–	345,240
Saemaul factories	950	717
Reforestation (Ha)	744,354	347,153

recognizing the effectiveness of mobilizing and empowering villagers, the Park government put its effort behind an integrated rural development initiative that came to be known as *saemaul undong* or the New Village Movement. Officially launched in 1971, the aim of *saemaul undong* was to achieve economic and social improvement in rural areas through promoting three principles: diligence, self-help and cooperation (Brandt, 1979; Moore, 1985; Ha 2001; Kwon, 2009; Reed, 2010). *Saemaul undong* had three objectives: to improve the living environment and rural infrastructure; to generate income; and to build human capacity and foster attitudinal change (Park, 2009).

To achieve this, the Park government effectively mobilized and empowered rural communities through a variety of innovative policies (Kim et al., 2011). Firstly, villagers were responsible for providing their thoughts on rural infrastructure projects and community-level economic activities considered most beneficial to the village, as well as providing the non-specialist labor required for construction and installation of many rural infrastructure projects. Secondly, an incentive system that rewarded villages that demonstrated productive use of previously allocated materials and successful community-level economic activities with priority for future allocation of materials and specialist labor was adopted (Ban et al., 1980; Park, 1997; Baek et al., 2012). Specifically, villages were surveyed annually by local government officials and classified into three categories: basic villages, self-help villages and self-reliant villages. Materials and specialist labor was given to self-help and self-reliant villages (Kim, 2011). Basic villages were publicly announced to be "lazy" and were effectively shamed in their respective townships. This incentivized basic villages to contribute their own village funds to infrastructure projects and economic activities so as to be classified as a self-help village in the next round of surveys and funding (Kim, 2004; Lee, 2011).

Thirdly, the government reformed local levels of governance. As previously mentioned the historical relationship between local government and villagers was based largely on tax collection and mediated through the village leader. As a result, villagers perceived government officials as exploitative and viewed any government intervention in village affairs with distrust. To tackle this, the Park government introduced village technical leaders. So as not to directly compete with the traditional village leader, village technical leaders were effectively positioned as project managers who worked in conjunction with the village head. Furthermore, village technical leaders were technically volunteers receiving no payment, although non-pecuniary benefits were often awarded. A further unique point was the appointment of both a male and a female village technical leader. The inclusion of a female leader was seen by the Park government as necessary due to the mass-migration of men to urban areas and the increasing role of women in small-scale agriculture. This offered a small channel through which women could directly participate in the public sphere of a traditionally patriarchal society, and consequently led to numerous instances of positive social and economic change (Park, 2009; Kim et al., 2013). Additionally, the government arranged training sessions where successful 'model' villages were exemplified and visited by village technical leaders. This led to positive competition between villages and had the effect of further incentivizing the undertaking of ambitious rural infrastructure projects, sometimes at the villagers' own cost (Park, 1997). The village technical leaders responsible for 'model' villages were also invited to Presidential meetings to share their experiences with ministers and members of the cabinet in an attempt to both make city-based government officials aware of the rural situation and to help ensure cooperation and avoid overlap between various ministries involved in rural development (Kim, 2011).

The appointment of village technical leaders provided a new and largely impartial two-way channel between villagers and local government: villagers were now able to communicate their needs and desires to the local government and the local government was now able to more effectively communicate and implement government policies, as well as provide technical advice on feasible community-level economic activities at the village-level (Kim et al., 2013; Sonn and Gimm, 2013). In the majority of villages, the perception of local government shifted from an exploitative agency to a rural development agency that would try to meet the needs and desires of villagers, although there are several reported instances of villagers refusing to participate and government coercion (Brandt, 1979, 1980; Goldsmith 1981; Kim, 2004).

Lastly, the impact of President Park's frequent visits to villages and his well-publicized speeches at village halls cannot be underestimated. With his humble rural upbringing, Park made it a point to emphasize rural development from his earliest writings. During his presidency, Park made frequent visits to villages and took part in traditional rural activities with villagers, including the drinking of humble rice wine. These activities were photographed and disseminated through newspapers. During these visits, Park cemented his identity as a 'man of the soil' and gave speeches at village halls to mobilize and empower rural communities (Kim, 2004; Kim, 2011; Lee, 2011). For example, in a speech in 1970, Park stressed the following:

> "Help yourselves to escape from poverty. Poverty cannot be overcome by placing responsibility on others, by blaming the government for lack of help, nor by believing you are fated to poverty. We cannot, the government, help those who do not want to help themselves. Everyone — farmers, local governments, and field hands, must cooperate together to build a new village".
>
> [Kim, 2011: 220]

Bottom-up rural development

At its heart, *saemaul undong* was a bottom-up rural development initiative. Although the movement was enabled by the government it was the villagers who took ownership of rural development (Park, 2009). For the first time, villagers were provided with the means to improve their living conditions through participating in infrastructure projects. Villagers were also eager and innovative in undertaking new economic activities, such as higher value-added agriculture and non-timber forest product cultivation, and starting or working in small-scale rural industries (Keim, 1974; Brandt, 1979, 1980; Ban et al., 1980). Furthermore, villagers were able to communicate their needs and socio-economic aspirations to local government effectively through the village technical leaders. As the majority of village technical leaders were intimately involved with village affairs and were respected members in their village communities, this ensured that many of the rural infrastructure projects undertaken during *saemaul undong* were largely selected, organized and implemented by the village community.

Rural electrification in South Korea

Providing reliable electricity for both lighting and productive uses was seen as a key prerequisite for rural development in South Korea. This is captured by Article 1 of the Rural Electrification Promotion Act (1965), which stated that the purpose of rural electrification was to improve the productivity and quality of life of rural households. Although rural electrification efforts continued through the 1980s and early 1990s to reach small villages situated on remote islands, this article focuses on two major efforts: the Five-year Electrification Plan (1965–1969) and the Long-term Rural Electrification Project Scheme (1970–1979).

The Five-year Electrification Plan (1965–1969)

The Five-year Electrification Plan was the first effort to implement the Rural Electrification Promotion Act (1965). The Act contained a relatively comprehensive and practical account of how construction of the facilities for rural electrification was to be funded (Articles 3, 5, 6, 7, 10,

11 and 12) and installed (Articles 2, 4, 8 and 9). In order to maximize the return on investment, existing 22.9 kV transmission lines were used as a distribution main so as to not have to spend scarce resources building 22/3.3 kV intermediary substations (Yim et al., 2012).

Financing

Unlike the majority of rural infrastructure initiatives undertaken during *saemaul undong*, rural electrification was not financed directly by the government. Instead, Article 3 of the Rural Electrification Promotion Act (1965) enlisted the state-owned Korea Electric Power Corporation (KEPCO) and rural consumers to raise sufficient funds. Specifically, KEPCO was tasked with financing the distribution infrastructure through reinvestment of KEPCO's own profits from urban electricity provision services[1] and from foreign loans (see Table 2). Over the duration of the Five-year Electrification Plan and the following Long-term Rural Electrification Project Scheme, KEPCO was successful in securing government-backed loans from the Asian Development Bank, the Agency for International Development, the Korea Development Bank, and the Italian and Japanese governments. In addition to the monthly electricity fee payable to KEPCO, end-users were tasked with financing the internal wiring costs involved in electrification. As the cost of internal wiring far exceeded what the average rural household could afford to pay, the Rural Electrification Promotion Act (1965) made a provision for low-interest government loans to end-users. Loans were initially designed with a repayment period of 19 years, with installments being included in the monthly electricity fee levied by KEPCO. It was quickly recognized that monthly repayment burdens were too high on the average rural household. The repayment timeframe was consequently amended twice in March 1967 and in May 1968. The final amendment specified that loans were to be repaid over 35 years (Yim et al., 2012).

Implementation

The Ministry of Commerce served as the hub for implementing rural electrification. Specifically, both local governments and KEPCO reported directly to the ministry allowing for central planning and coordination of budgets and project plans. After the Ministry allocated each local government's budget, local governments were mandated with selecting which villages would be electrified first. Selection was supposed to be undertaken according to a criteria disseminated by the Ministry to ensure maximum return-on-investment. The criteria mandated that selected villages be: located in an area where distribution did not require transmission and substation facilities to be built, and populated by rural households with sufficient electricity demand and able to afford monthly electricity fees to allow KEPCO to make at least normal profit in the medium to long run. This effectively excluded smaller and poorer villages, as well as the more remotely located mountain villages. After villages were selected by the local government, KEPCO surveyed the village and drafted construction plans. These plans were reviewed by the local government and, when approved, KEPCO undertook construction immediately. Internal wiring – paid for by end-users – was installed by independent private contractors hired by individual end-users (Ban et al., 1980; Park, 1997; Yim et al., 2012).

Issues

A number of issues affected the effectiveness of the Five-year Electrification Plan. Firstly, local governments tended to loosely follow or, in some cases, completely ignore the criteria for village selection mandated by the Ministry of Commerce. This resulted in projects that were more expensive than budgeted and significant construction delays. Secondly, many independent private contractors were unlicensed. This led to poor workmanship and a negative effect on the quality of electricity. Rural electrification was hindered by household perceptions and lack of information. For example, many rural households either thought that the entire construction cost was paid for by the government or did not know about the need to repay a loan for internal wiring until after installation. Many rural households distrusted the local government and thought that electrification would only benefit more wealthy households (Brandt, 1979; Yim et al., 2012). Furthermore, Pak and Gamble (1975) found that some of the more elderly villagers refused electrification on the grounds that it would destroy village morals. Another significant issue that arose during the Five-year Electrification Plan was a shortage of electrical generation capacity (Kim, 2011).

The Long-term Rural Electrification Project Scheme (1970–1979)

The issues that hindered the effectiveness of the Five-year Electrification Plan were largely addressed and overcome during the revamped Long-term Rural Electrification Project Scheme. To tackle the problem of selecting villages, KEPCO trained and deployed 11,510 surveyors to undertake an extensive survey of all villages in 1970–1971 that lasted seven months and the Ministry of Commerce improved its ability to coordinate rural electrification by establishing a task force agency. Selection of villages was now based on KEPCO's surveys and broadened to include more remote mountain villages. This, however, involved a significant increase in investment due to the need for KEPCO to expand transmission and substation facilities. Furthermore, as the number of households being electrified increased rapidly, the government required a loan from the International Bank of Reconstruction and Development to help finance the loans it offered end-users.

With the launch and success of *saemaul undong*, villages surveyed by KEPCO and deemed cost-effective, were further prioritized for electrification if they had earned the title of a 'self-help' or a 'self-reliant' village. Rural electrification therefore followed the process used for allocating other infrastructure projects and basic resources. In practice, this meant that villages had to have been successful in utilizing the resources either invested in villages from the government or resources raised directly by the village community. Additionally, priority was granted to villages that could demonstrate the current engagement or the potential to productively engage in economic activities that required electricity (e.g. sericulture, light manufacturing) (Yim et al., 2012; Kim et al., 2013).

The issue of dealing with unlicensed internal wiring contractors was dealt with swiftly. The main issue was that end-users were unable to distinguish between licensed and unlicensed private contractors. This information asymmetry was addressed through having KEPCO serve as an intermediary. Legislative amendments mandated that instead of directly paying private contractors, customers deposited the cost of internal wiring with KEPCO. A member of KEPCO's survey team was then responsible for ensuring that the internal wiring was satisfactory. Only after this, was the payment transferred from KEPCO directly to the contractor, who in-turn was registered with KEPCO through presentation of a valid license to undertake internal wiring (Park, 1997; Yim et al., 2012; Kim et al., 2013).

Poor dissemination of information was addressed through concerted information campaigns mandated by the Ministry and run by local governments. These campaigns disseminated information on the benefits of rural electrification through local-government operated loud speaker systems that had been installed in even the most remote villages, through schools and head-teachers, and the very influential and respected village technical leaders (Kim, 2004; Yim et al., 2012).

Rural apathy and opposition to electrification were dealt with both directly and indirectly. Direct means included well-publicized personal visits from President Park to numerous villages, 'reeducation' programs at schools, and coercion. Indirect means included observation of the tangible economic and quality of life benefits seen in villages with electricity. President Park's visits to villages were seen as being far more than merely ceremonial among villagers due to his background and upbringing in a humble farming household with no access to electricity. This lent sufficient credibility to his comments addressing the positive

[1] KEPCO independently considered rural electrification to increase its revenue as early as 1964 (Yim et al., 2012).

Table 2
Construction costs (in 2014 US dollars).
Source: Based on Yim et al. (2012).

Year	Loans[a]	KEPCO[b]	Customers[c]	Total
1966	758,612 (66.38%)	312,026 (27.30%)	72,156 (6.31%)	1,142,794
1967	569,447 (71.66%)	202,817 (25.52%)	22,427 (2.82%)	794,691
1968	832,718 (78.57%)	216,468 (20.42%)	10,726 (1.01%)	1,059,912
1969	1,168,146 (72.00%)	348,104 (21.45%)	106,284 (6.55%)	1,622,534
1970	1,842,901 (79.21%)	456,337 (19.61%)	27,302 (1.17%)	2,326,540
1971	3,295,770 (79.42%)	782,014 (18.84%)	72,156 (1.74%)	4,149,940
1972	3,510,288 (80.41%)	782,989 (17.94%)	72,156 (1.65%)	4,365,433
1973	7,205,841 (82.82%)	1,304,657 (15.00%)	190,141 (2.19%)	8,700,639
1974	6,311,693 (81.21%)	886,348 (11.40%)	574,322 (7.39%)	7,772,363
1975	5,938,237 (76.72%)	927,301 (11.98%)	874,647 (11.30%)	7,740,185
1976	14,869,970 (77.10%)	2,218,307 (11.50%)	2,199,780 (11.41%)	19,288,057
1977	12,773,548 (79.76%)	1,392,414 (8.70)	1,848,752 (11.54%)	16,014,714
1978	12,630,211 (85.21%)	898,049 (6.06%)	1,293,931 (8.73%)	14,822,191
1979	9,729,348 (85.58%)	558,721 (4.92%)	1,080,389 (9.50%)	11,368,458
Total	81,729,254 (80.42%)	11,416,238 (11.23%)	8,489,048 (8.35%)	101,634,540

[a] Loans obtained by KEPCO.
[b] Reinvested profits.
[c] Government loans for internal wiring taken out by customers.

impact of electricity on livelihoods (Kim, 2004; Lee, 2011). Schools and head-teachers were also enlisted with head teachers disseminating 're-education' programs designed by the Ministry of Education to promote electrification and rural development among rural households. This is purported to have been effective in communicating images of modernity and progress related to electrification and rural development to younger villagers, which were communicated upwards to family members (Lee, 2011). Brandt (1980, 1971) and Goldsmith (1981) note that households that continued to be apathetic or opposed to rural electrification were subject to coercion by local government officials, hired thugs, village technical leaders, village leaders, and members of a number of village-level community organizations (e.g. savings clubs, forestry associations) (Kim, 2004). Although cases of coercion are not well documented, Goldsmith's (1981) description of several obstinate households being evicted and their household belongings confiscated provides a picture of the effectiveness that coercion likely had in encouraging households to embrace electrification.

Indirectly, rural apathy and opposition to electrification was addressed through observation of the tangible economic and quality of life benefits seen in villages with electricity. For example, in their detailed exploration of journal entries and village meeting minutes, Kim et al. (2013) note several fascinating cases. For example, *Chulpo* village in *Dangjin* county, South *Chungcheong* province, which due to its status as a model *saemaul* village was given priority for electrification, is recorded as being the envy of other nearby villages for its impending electrification. Another illuminating example is that of *Sinpoong* village in South *Jeju* County, *Jeju* province. Due to the village's relatively remote geographical location on the large island province of *Jeju*, *Sinpoong* village was overlooked for rural electrification. Records indicate, however, that having seen electrified villages either first-hand or in photographs, the village mobilized sufficient capital to pay for KEPCO to provide electricity sufficient for household lighting in 1973. Park (1997) also notes that several small mountain villages engaged in economic activities such as sericulture – which required electricity for lighting to continue feeding the silkworms with mulberry leaves – with the explicit goal of improving the likelihood of being selected for electrification.

The issue of a shortage of electrical generation capacity continued beyond the Five-year Electrification Plan well into the Long-term Rural Electrification Scheme. For example, in the last three months of 1974, 39 interrupted transmissions were recorded. To tackle this, a two pronged-approach was taken. Firstly, the government initiated a nation-wide energy conservation campaign with the slogan: "Turn off one light per one household". In addition, efforts were made in urban areas to reduce energy consumption. These involved having some manufacturers operate at night rather than in the day, as well as restrictions on decorative lights. Secondly, power plants scheduled for construction were built early and small hydroelectric power stations were constructed in suitable rural areas. This largely overcame the shortage of electrical generation capacity by 1977 (Kim, 2011; Yim et al., 2012).

Outcomes

As shown in Table 3, South Korea went from 12% of rural households having electricity in 1964 to 98% of rural households having electricity suitable for lighting and productive uses by the end of 1979. The remaining 2% of households were located in remote island regions that required the installation of a submarine distribution system or the deployment of local generators. By 2001, all island communities were connected to the electricity grid or served by suitable local generators (Yim et al., 2012).

Economic outcomes

Table 4 shows the dramatic increase in household income from an annual income of USD 249 in 1970 to USD 2172 in 1979. Notably, the increase in household income is attributable to both increases in income derived from agriculture and non-agricultural income. Although it is difficult to tease out the direct contribution of electricity to household income improvements, it is possible to see how electricity – when combined with improvements in rural infrastructure and government

Table 3
Rural electrification.
Data sources: Park (1997) and Yim et al. (2012).

Year	Number of households electrified (thousands)	Proportion of households electrified
1964		12%
1965	39	13%
1966	65	16%
1967	46	18%
1968	54	20%
1969	73	23%
1970	91	24%
1971	172	30%
1972	177	36%
1973	285	47%
1974	177	53%
1975	611	74%
1976	470	90%
1977	120	95%
1978	59	97%
1979	24	98%

Table 4
Annual rural household income (1970–1979) in 2014 US dollars.
Source: Based on National Council of Saemaul Undong (1999; 2011).

Year	Household income	Agriculture income	Non-agricultural income
1970	USD 249	USD 189	USD 60
1973	USD 469	USD 381	USD 88
1976	USD 1128	USD 898	USD 229
1979	USD 2172	USD 1493	USD 649

support in agriculture and rural industry – helped improve household incomes and contributed to the overall economy.

As previously mentioned, the late 1960s saw the introduction of new high-yield varieties of rice and barley, the strengthening of extension services, land reclamation, and reforestation to improve soil fertility. Within this context, electricity contributed by helping enable a significant increase in agriculture productivity. For example, electricity powered the majority of water pumps and draining pumps which were used to irrigate rice fields and enabled cultivation of rice and barley, among other crops, in periods of drought and poor weather. Additionally, electricity helped improve agricultural productivity by allowing for electric-powered processing of crops and for seedlings to be nurtured in polyethylene greenhouses which allowed for early harvesting and multiple cropping (Brandt, 1979, 1980). Another key contribution of electricity to agricultural productivity was achieved through television programs targeted towards farmers. These programs addressed different agricultural technologies and methods to improve yields. Viewing statistics recorded in 1978 suggest that approximately 85% of rural households tuned in to these programs at some point (Park, 1997; Yim et al., 2012).

Another key channel through which electricity enabled agricultural income to increase was through allowing households to diversify their crop portfolio. The time and labor saved by electric motors, the opportunity to work in the evening with electric lighting, and the introduction of greenhouses and electric-powered dryers combined to allow households to cultivate cash crops, such as tobacco, ginseng, high-value mushrooms, and silkworms (Park, 2010). Furthermore, electricity made investment in livestock profitable for many rural households. For example, feed pulverisers enabled households to engage in larger-scale ranch management and electric milking machines helped improve the productivity of milk production. Electrified chicken farms are also recorded to have seen a significant increase in egg production (Park, 1997; Yim et al., 2012).

Electricity helped rural households capitalize on high market demand from an increasingly large urban population and government guarantees of relatively high purchase prices for staple crops. Firstly, electricity allowed for crops to be processed and appropriately stored before being transported (Brandt, 1979; Ban et al., 1980). This reduced crop losses from the point of harvest to the point of consumption. Secondly, increased information on market structure and conditions through the television helped improve the bargaining power of rural households with middlemen and traders (Yim et al., 2012; van Gevelt, 2014).

In addition to enabling improvements in agricultural productivity, diversification and access to market, electricity contributed to the development of rural industry in the 1970s. In particular, a number of companies manufacturing light industrial goods – for both export and domestic markets – were moved into rural areas and 717 cottage industries – known as *saemaul* factories[2] – were constructed (Park, 1997; Choe, 2005). There are conflicting reports in the literature regarding the success of rural industry and its contribution to household income and the economy. For example, Brandt (1980) notes that with few exceptions, the *saemaul* factories have been largely unsuccessful and offered a minimal contribution to rural household income. Choi (1986), however, found that *saemaul* factories and other rural-based industry contributed significantly to both the rural economy – primarily through generating an additional income stream for rural households – and to the national economy by contributing approximately one-third of the country's total export earnings in 1980.

Further economic benefits were felt throughout the wider economy with government estimates suggesting that investment in rural electrification and other rural infrastructure offered a three-fold return on investment costs (Kim, 2004). For example, Brandt (1979) reports that, as of 1979, more than 80% of children from rural areas were being sent to junior high school at private expense and that the number of students continuing to senior high school, vocational schools, and university was approximately four times higher than that in 1970. Additionally, increased rural incomes created a new market for urban producers of consumable goods who consequently established rural distribution channels (Park, 1997). Lastly, companies involved in the manufacturing or installation of rural infrastructure during the 1970s generally turned a profit. For example, KEPCO achieved a decent overall price to earnings ratio of 14.2%. Furthermore, the experience gained in providing to South Korean villages enabled some companies to become sufficiently competitive to succeed in export markets (Yim et al., 2012).

Quality of life

Rural electrification in South Korea had a profound impact on the quality of life. Perhaps the most significant improvement was alleviating the drudgery that was pervasive in the lives of villagers prior to electrification. This is best captured by anthropologist Sorensen (1998: 3) in his description of a typical farmer in the mid-1980s.

> *Today he has electricity and television, access to motortillers and mechanical transport, and his life is comfortable, but, like most Koreans his age, he remembers when things were different. In his youth most farming was done by hard stoop labour, and one family could manage only a small farm. Fields were reaped with a sickle, and every day for weeks afterward farmers like Chang had to spread dried sheaves in the courtyards and thresh them with a flail. Wives had to separate the grain from the chaff with winnowing baskets, and husk each day's grain laboriously with a mortar and pestle.*

The above account paints a picture of the impact rural electrification had on the quality of life of rural households. A look at household electric appliance ownership (see Table 5) gives a further indication of improvements in the quality of life. For example, Table 5 shows dramatic increases in appliances that made life more comfortable: electric fans, sewing machines, electric irons, and refrigerators. Along with two additional appliances that were not recorded: the rice cooker and electric cooking pots, these appliances had a disproportionately beneficial impact on women who were traditionally expected to undertake all household chores. Electric lighting also made life both more convenient than before and led to health gains through replacing harmful kerosene lanterns (Lim, 2007; Baek et al., 2012; Douglass, 2013). Electricity had a notable impact on improving sanitary conditions in villages, which helped reduce the incidence of dysentery, typhoid and other diseases. This was as electricity-powered pumps made it easier to supply water to homes and community areas (Kim, 2011).

Having been partly freed from several time-consuming household tasks and with higher incomes, rural households were afforded more opportunities for leisure. For example, many rural households began to visit relatives in urban areas or go on sightseeing tours. Furthermore, as shown in Table 5, many more households began listening to the radio and records, and watching television and video cassettes (Brandt, 1979, 1980). Street lighting is also noted to have improved safety after dark,

[2] *Saemaul* factories operated in the following areas: food processing, textiles, leather products, wigs, furniture, paper products, chemicals, ceramics, electronics and machine parts (Choi, 1986).

Table 5
Household electric appliances ownership (% of rural households).
Source: Data obtained from Brandt (1979).

Item	1971	1977	1979
Radio	79.6	95	100
Television	9.5	48	76.9
Record player	7.1	–	18.5
Video cassette recorder	3.5	–	20.8
Refrigerator	–	–	9.3
Electric fan	13.4	55	66.7
Washing machine	0.1	–	0.9
Telephone	–	–	100
Sewing machine	–	82	–
Electric iron	–	55	–

especially for women, therefore allowing for more gatherings in the evening than previously (Yim et al., 2012).

Other impacts

Rural electrification, in the context of *saemaul undong*, helped empower rural households and village communities. The bottom-up element of *saemaul undong* and the efforts that many rural communities undertook to improve the likelihood of being selected for rural electrification led many to see electrification as embodying development. For example, in a diary entry dated 16 May 1975, the villager *Sin Gwon-sik* wrote, upon electrification of his village: "A historical light has arrived. Our efforts have finally seen the light" (Kim et al., 2013: 189). The symbolism of electrification as development, which has also been noted in Europe, the USA and in other countries (Zomers, 2003) led to a positive shift in the attitude of village populations (Park, 2009; Baek et al., 2012).

There were a number of less positive or negative impacts associated with rural electrification during the 1970s that are important to note. Firstly, anecdotal evidence presented by Brandt (1979) suggested that the benefits of electrification were not captured by the poorest 25% of the rural population who could not afford the loans. This is supported by Han's (1987) study of 209 households from 28 villages in seven provinces, where Han's (1987) survey data found that 22.9% of respondent households did not benefit economically with 17.4% recording no change in income and 5.4% a decrease in income. Han (1987) also found a strong correlation between capital assets and increased income. Furthermore, given land reform and the dissolution of the more divisive class and clan barriers in the 1950s and 1960s, electrification helped create a new class division of the haves and have-nots, particularly with respect to household appliance ownership (Eikemeier, 1980; Turner et al., 1993).

Household debt increased significantly for both poorer and wealthier households. For poorer households, this was due to the loans taken out to finance internal wiring costs. For wealthier households, this was largely due to loans taken out to pay for electric appliances, such as televisions (Baek et al., 2012). Han (1987), in his analysis of savings behavior of households suggests that increased household debt became particularly burdensome on poorer households who lacked the assets to make economically productive use of electricity and increase their income. Taken together, this suggests that rural electrification disproportionately benefited more wealthy households at the expense of poorer households. This increase in income inequality was additionally solidified through the creation of a divisive class structure defined by ownership of electric household appliances.

Lastly, despite improvements in income and quality of life, rural–urban migration accelerated during this period and into the 1980s, especially among wealthier households. According to Park (1997), it was television and the glamorous depiction of urban life that accelerated the migration of younger villages. Chang (2010) further notes that many of the more wealthy, older villagers who did not migrate, effectively indirectly migrated through having encouraged their children to migrate to cities. A survey of the literature on rural–urban migration in South Korea suggests that the key driver for the migration of the younger members of wealthier households was education as a good tertiary education was seen, and continues to be seen, as the most important determinant for 'a good life' (Turner et al., 1993; Sorensen, 1994). Combined with the agglomeration of elite high schools and universities in urban centers, particularly Seoul, it seems that the improvements in rural living standards were not sufficient to stem rural–urban migration, but rather the increase in income accrued by wealthier households allowed for an increase in rural–urban migration.

Discussion

In 1965, South Korea's economic and political situation was broadly similar to many of today's developing countries: crippling electricity generation shortages; rural–urban inequality; the need to improve the livelihoods of rural households; and concerns over the national food supply (Park, 1997; Kim, 2011). The successful case of rural electrification and development over the next fifteen years, however, resulted in a significant increase in average rural household income levels and improved the quality of life in villages substantially. This success is arguably the result of a novel top-down and bottom-up approach that balanced local control and participation with central government control. This approach was able to deal effectively with many of the issues that continue to beset today's developing countries' efforts to extend the grid to rural areas and, to a lesser extent, pursue off grid electrification approaches, such as mini-grids. Three main issues are discussed: economically sustainable rural electrification; information asymmetries, rural apathy and opposition to electrification; and complementary investment. This if followed by a cautionary note on the negative impacts of rural electrification experienced in South Korea.

The South Korean government made a strong and long-term commitment to achieving rural electrification. From the outset, the government recognized the significant benefits that providing reliable electricity for both lighting and productive uses would have on productivity and the quality of life of rural households. The government, however, also recognized its relatively limited resources to achieve this and the need for its approach to rural electrification to be economically sustainable. KEPCO, the national utility, was tasked with reinvesting profit made from urban electricity sales and seeking international loans backed by the South Korean government. The end-user in rural areas was not subsidized, but instead tasked with paying for internal wiring costs in addition to the monthly electricity fee. To achieve this, the government elected for provision of a guaranteed low interest, long-term loan. Bureaucratic, technical and economic issues threatened to derail rural electrification, however in each case the government bureaucracy was able to identify the issues and act swiftly.

The South Korean case shows how long-term commitment, flexibility and pragmatism helped achieve economically sustainable rural electrification. Although the South Korean approach to economically sustainable rural electrification benefited from a strong authoritarian government led by a President with a keen personal interest in rural development, it is more than conceivable that the conditions of long-term commitment, flexibility and pragmatism displayed in South Korea can be fostered under different partnership structures between governments, international organizations, financiers, NGOs, and state-owned and private sector utilities in developing countries today, both for grid-extension and off-grid electrification approaches.

Information asymmetries, rural apathy and opposition to electrification are common barriers to both grid extension and off-grid approaches in many developing countries today (e.g. Sovacool, 2012). In South Korea, the quality of internal wiring due to unlicensed contractors caused some households to perceive electricity as unreliable. This was directly addressed by the government through using KEPCO as a mediating agent between end-users and private contractors and ensuring that internal wiring was undertaken by licensed private contractors

and of sufficient quality. Incorrect information concerning the costs of rural electrification and its impact on rural households were tackled through a variety of innovative methods. For example, village technical leaders and schools were enlisted to disseminate information, and President Park Chung Hee made numerous visits to villages to promote the benefits of rural electrification and development. Apathy and opposition to electrification were addressed directly through less tactful methods such as coercion by village technical leaders and local thugs hired by the local government, and through observation of the tangible economic and quality of life benefits seen in villages with electricity, both through villagers' own networks and through programs set up by the government to share village experiences with other village technical leaders.

In overcoming information asymmetries, rural apathy and opposition, a variety of legitimate and respected channels and institutions were used. KEPCO was used as a legitimate agent to intermediate between end-users and private contractors. Village technical leaders, schools and President Park Chung Hee were crucial in disseminating information and overcoming rural apathy and opposition. Training programs organized by the government where village leaders with model villages shared their experiences with other village leaders also helped create support for rural electrification among villagers. This approach suggests that there a number of legitimate channels and institutional actors that can be leveraged in developing countries today. Furthermore, the South Korean case also presents an example of how new channels, such as village technical leaders, can effectively be created to mediate between government and villagers.

As noted in the literature, complementary investment in, for example, roads, communications, credit, extension services, access to markets, and other rural infrastructure is necessary for rural electrification to translate into significant economic and quality of life gains (Cabraal et al., 2005; Haanyika, 2006; Peters et al., 2009; Cook, 2013). In the South Korean case, the government reinvested funds accrued by industry in key rural infrastructure and in agricultural support policies. Perhaps the most significant move made by the government, however, was involving and empowering villagers to participate in complementary investment through the *saemaul* movement. In the South Korean case, the approach of harnessing village participation had its roots in the efforts of a village that President Park observed in rural Gyeongsang province. This model was scaled up by enhancing the credibility of the government and its policies through village technical leaders who functioned as a respected liaison between villagers and local government, and a transparent system of sticks and carrots targeted to incentivize villager participation.

Although South Korea's cultural, ethnic and linguistic homogeneity (Reed, 2010); the removal of many lineage and class divisions (Brandt, 1979); and a strong sense of community identity and cooperation at the village-level (Moore, 1985; Park, 2009) are likely to have played a role in the effectiveness of the *saemaul* movement, the harnessing of village participation is arguably a feasible approach for developing countries today. It is likely that, similar to the case in South Korea, there are villages that have or are currently undertaking innovative infrastructure development projects. Just like *Sindo ri* — the flood devastated village that impressed President Park with its actions, these villages can help form the basis for a model similar to the *saemaul* movement. It is also conceivable that a system similar to the village technical leaders' approach in the South Korean case can be implemented to improve local government legitimacy and improve information flows.

Although the outcomes of rural electrification and development in South Korea were broadly successful, there are cautionary lessons that should be heeded by developing countries today. Firstly, rural electrification in South Korea increased income inequality within the village, with wealthier households benefitting significantly more than poorer households despite both sets of households incurring commensurate capital and operational costs. This had the notable effect of burdening poorer households with substantial debt. Furthermore, increased inequality manifested itself through changes in the relatively egalitarian social structure and social fabric of South Korean villages through the transition to a more market-based village economy dominated by consumption of electrical appliances.

In today's developing countries, it is likely that similar situations may result from, particularly, grid-based or mini-grid approaches where a minimum number of connections are required for economic feasibility. In such cases, poorer households may in effect be subsidizing the gains accrued from rural electrification by wealthier households through their capital and operational cost contributions. This strongly suggests that developing countries may require flexible and progressive financing arrangements or take measures to ensure that poorer households are able to benefit significantly from rural electrification through, for example, facilitating pro-poor income generation projects that make productive use of electricity.

The South Korean case has also shown how rural electrification counter-intuitively accelerated migration, particularly among the younger members of wealthier households. This is potentially an important finding as an objective of rural development is often to alleviate the pressure on urban centers from rural–urban migration. This finding suggests that rural electrification and its associated impact on income and quality of life may not be sufficient to reduce rural–urban migration flows and that other drivers of migration, such as aspirations for the glamorous urban life depicted on television or for an elite education, need to be targeted and addressed to reduce stress on cities in developing countries today.

Conclusion

There are many general lessons that can be learned from historical examples of rural electrification that can be of practical help in helping improve the livelihoods of rural households. This paper has provided a detailed summary and analysis of rural electrification and development in South Korea from 1965 to 1979. During this time, the proportion of rural households with access to electricity increased from 12% to 98%. Furthermore, rural household income saw almost a ten-fold increase in income from 1970 to 1979 and the quality of life in villages was significantly improved. A the same time, however, rural electrification failed to provide significant benefits to the poorest quartile of households, increased household debt, and accelerated migration to urban areas. Although the South Korean experience is rooted in its own contextual set of economic, political, social and technological factors, the top-down and bottom-up approach that balanced local control and participation with central government control is largely replicable and can provide a useful framework to help overcome many of the main issues facing rural electrification in today's developing countries. Furthermore, awareness of the negative impacts of rural electrification in South Korea provides developing countries and partner institutions with the ability to actively take action to ensure that the benefits of rural electrification and development are broad-based and pro-poor.

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