

## *Contextual Engineering To Address Preservation Of Rural Societies*

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### **ABSTRACT**

Lack of infrastructure to meet basic life needs has been identified as a significant driver for rural youth to leave their indigenous identities and knowledge so that they may seek opportunity in cities, and global trends toward urban migration signal a significant threat to preservation of place-based values, beliefs and skills. Large development agencies attempt to address basic needs such as sanitary drinking water, improved sanitation, and safe transportation modes, but economic optimization frequently drives them to focus on serving population centers, leaving rural communities further and further behind. Filling the infrastructure gap are less resourced, sometimes inadequately trained, and often special-interest organizations seeking to promote agendas or follow practices that may conflict with the objectives of the society they support.

As a result, efforts to stabilize rural populations through development-engineered infrastructure often are ineffective, as evidenced by the number of abandoned or neglected infrastructures that litter the global countryside. A new, place-based engineering approach to infrastructure design that separates technical intervention from global development is warranted to provide rural societies with relief, reduce the imperative for urban migration, and preserve rural identity and contextual knowledge. Contextual Engineering provides the methodology for merging technical infrastructure design with societal understanding and recognition of rural identity.

### **INTRODUCTION**

Throughout the globe, rural societies act as the kitchen pantry of the world's local identities, stocked with a diversity of knowledge, beliefs and value systems (Creed and Ching, 1997). Indigenous beliefs, practices, and knowledges in rural communities throughout the world are as diverse as the flora that has evolved in different regions based on climate, topography and geology.

In the 21<sup>st</sup> century, though, rural communities also are home to the world's poorest populations. As Lipton observes in *Why Poor People Stay Poor* (1977), "the worst-off one-third of mankind comprises the village underclass of the Third World." Development policymakers cast their eyes toward rural societies as targets for poverty reduction, but trends indicate many peoples are self-managing poverty by migrating to population centers (Imai et al., 2017). Urban melting pots of global bombardment, with a blur of fast-food restaurants, product advertisements, and access to viral internet memes, rapidly dissipate the place-based knowledge and identity of local societies (Creed and Ching, 1997). Drivers of this migration

to urban areas frequently are economic, but a significant reason given by migrants is a desire to live in conditions that more adequately address basic human needs – safe drinking water, improved sanitation, electrical power, and passable roadways among them (Radhakrishnan and Arunachalam, 2017).

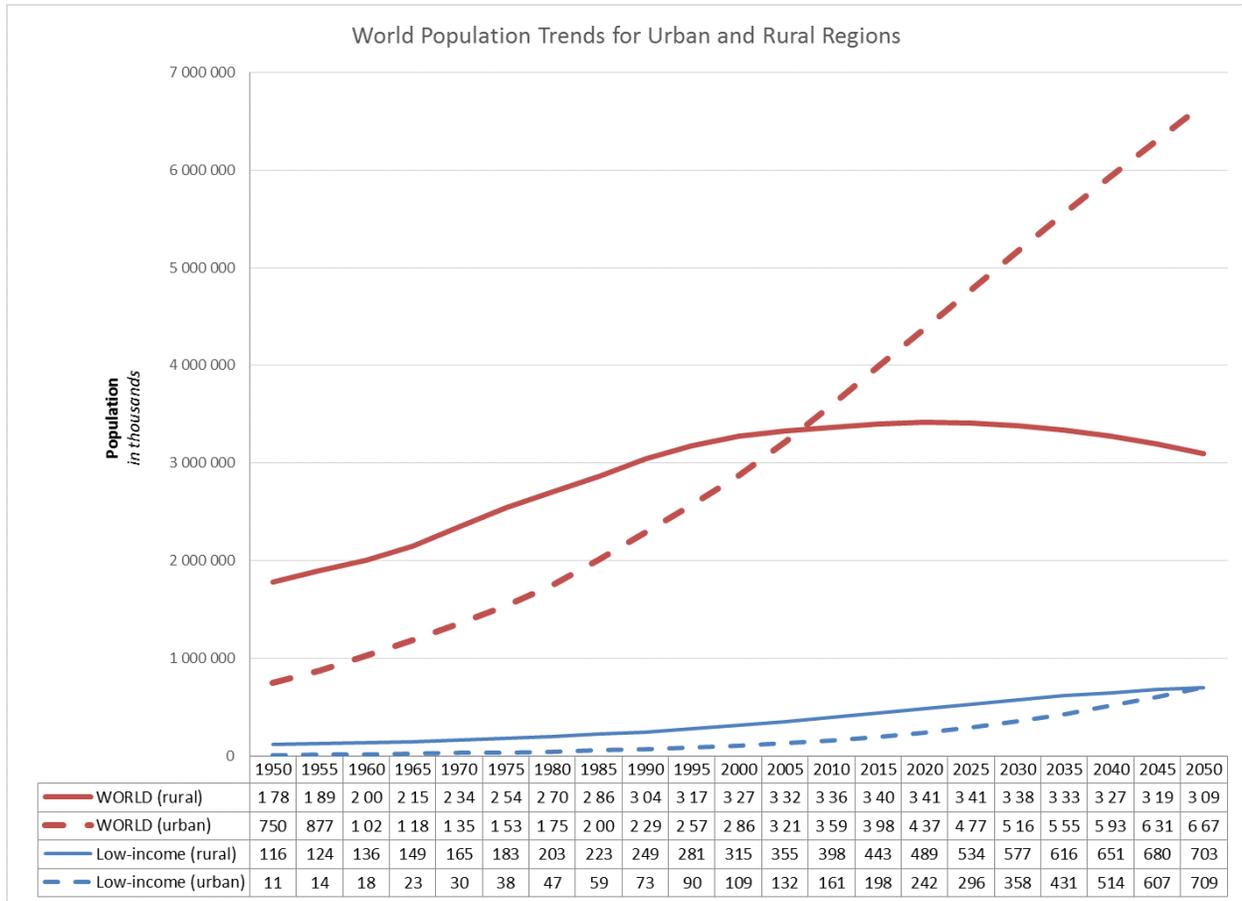
International aid organizations have provided engineered infrastructure interventions to non-industrialized societies for decades, dating back to the time of the Bretton Woods Agreement of 1944. But as the business of development has grown with the onset of the Globalization Project in the 1970s, the emphasis of these interventions has been on reducing the *volume* of people living without basic services (Krause, 2014). Initiatives such as the United Nations Millennium Development Goals of 2015 effectively set quotas for the reduction of the number of people without access to clean water or improved sanitation, driving organizations toward supporting urban interventions to optimize service delivery. As a result, the largest and most-resourced aid agencies have placed a strong focus on population-center interventions, providing generalized and “scalable” guidance<sup>1</sup> to rural-focused organizations but leaving the global countryside largely in the hands of less well-endowed volunteer groups, missions, and non-government organization (NGO) interventions (Matthew et al., 2016). Rural infrastructure support, then, often falls to organizations ill-equipped to address local needs and frequently reliant upon global attitudes and values that conflict with local identities. The remnants of failed infrastructure systems that litter the global countryside bear witness to the widening gap between rural and urban intervention effectiveness (Witmer, 2018).

Assuming one values the preservation of indigenous knowledge and values, in much the same way one values the preservation of an endangered species, it may be necessary to rethink the worth of rural societies and the importance of addressing rural interventions in a new way that supports specifically place-based needs. In this paper, we explore the conditions that drive rural residents into forced urban migration as well as the state of infrastructure interventions that fail to stabilize rural community populations by contextually addressing their needs. The ultimate objective of this discourse is to provide evidence of the need for a new, contextualized engineering approach if mobility is to be converted from a forced

condition to one that is voluntary.

### **THE CONDITION OF FORCED MIGRATION**

Data from the United Nations Department of Economic and Social Affairs (2018) portray a strong trend toward urbanization and decay of rurality throughout the globe. Figure 1 depicts past and projected trends in rural and urban populations for the entire world (in red) and particularly for low-income countries (in blue). Though most low-income countries have been more heavily populated in rural areas than urban since the start of modern development efforts, urban population is projected to overtake rurality in this sector before 2050. Globally, urbanization overtook rural population in the late 2000s, and Figure 1 graphically demonstrates that future population growth is projected to dominate in cities while rural populations are projected to decline despite an increase in overall population expansion. Some of this transition to urban dominance may be attributed to migration of rural residents, particularly younger generations who seek access to greater opportunity and more modern services than they may be able to access in rural communities (Eshetu and Beshir, 2017). With their departure to cities, the number of rural residents of child-bearing age will decrease, leading to an aging and less robust rural workforce. Though strong urban pull factors among young rural migrants in one study were identified as greater employment opportunities (66%) and higher level of income (62%), 57 percent of urban migrants cited availability of good infrastructure facilities as a prime pull factor for shifting to urban life, placing it ahead of improved social life (36%) and lower risk from natural hazards (46%) as a critical decision factor (Radhakrishnan and Arunachalam, 2017).



Data Source: United Nations Department of Economic and Social Affairs, 2018

Figure 1. United Nations population trends, projected to the year 2050, for urban and rural populations globally and in low-income nations.

Regardless of reasons cited to explain this phenomenon of a global shift toward urbanization, the result is that rural societies across the globe find themselves more and more separated from markets, resources, economic growth and even self-respect (Rignall and Atia, 2017). The power that once accompanied an intimate knowledge of rural space and its resources has been completely reversed, and “modern” knowledge and resources that flow through the global marketplace to urban centers has thoroughly disempowered the place-based societies rooted in the countryside (Creed and Ching, 1997).

The loss of ambitious rural youth to urban communities particularly hampers rural societies, most of which are agriculturally based and dependent upon physical labor, and endangers the preservation of place-based knowledge and identity. If we consider the

possibility that access to reliable infrastructure could dissuade a portion of these migrants from leaving their native societies, an imperative is placed upon more effectively serving rural communities with appropriate engineering design to retain a country's diversity of indigenous knowledge, land management, agricultural practices and cultural identity.

### **THE STATE OF RURAL INFRASTRUCTURE**

A number of papers have considered the effectiveness of international rural infrastructure interventions, usually espousing the perspective and technical knowledge of industrialized-nation engineers, and often focusing on case studies to generalize attitudes and behaviors associated with those interventions (Starkl et al., 2013; Shannon et al., 2008; Carter et al., 1999). The very definition of effectiveness in these case studies typically relies upon standards and knowledge residing within the engineer himself and rarely considers the perspective of the client society for whom the infrastructure is implemented. In addition, in conformity with development practices dating back to creation of the World Bank, infrastructure engineering design is commonly invested with the added responsibility of providing economic and social adjustment (Witmer, forthcoming), often using the physical infrastructure as leverage to promote behavioral change. As a result, the infrastructure itself may conflict with local values, needs, knowledge or practice, leading to a lack of desire on the part of the recipient to maintain its operation. The author can attest that regardless of location, from sub-Saharan Africa to Andean South America, rural communities frequently amass remnants of project after project constructed by service organizations to address infrastructure needs that have failed because of lack of understanding of local context and conditions. Interviews with residents of many of these communities reveal a growing distrust of the effectiveness of outside organizations in addressing an infrastructure need, as well as an increasing disenchantment with design engineers who fail to recognize and address local conditions and knowledge when implementing physical infrastructure interventions.

### **DEVELOPMENT ENGINEERING PRACTITIONERS AS HOBBYISTS**

The notion of optimization of resources is not a new one and applies as much to the delivery of infrastructure aid to alternately developing societies as to any other economic endeavor. Because the metrics of development in recent decades have focused on quotas – Millennium Development Goals of 2015, for example, set a 50% reduction in the proportion of people without sustainable

access to safe drinking water – the greatest impact for the least use of resources has driven development agencies toward urban interventions. One evaluation of where non-governmental organizations work in Kenya, for example, found that agencies show a strong urban bias when choosing locations to work, drawn by ease of access, comfort, convenience, and population density as well as by client need (Diependra, 2018; Brass, 2011).

As a result, the small-scale projects associated with rural communities often fall within the purview of mission trips, service-education organizations, and volunteer groups whose financial resources are limited and expertise is variable (Matthew et al., 2016). A decade of the author's own project observation and participation attests to the practice by such organizations of relying on guidance manuals produced for infrastructure development – manuals that are not context-specific but offer generic technical guidance – and design engineers drawing from their professional experiences in conforming to industrialized-world standards such as U.S. Safe Drinking Water Act standards or EN Eurocodes. Equally frequently, the organizations are associated with, or partner with, agencies that promote particular foci such as religious dogma, capitalistic entrepreneurship, or even market development for particular products. The author has witnessed many clashes of rural identity with practitioner perspective reflecting these foci that have led to infrastructure design rejection. Two notable examples are described here:

An indigenous Honduran agricultural community seeking a safe water supply strongly objected to NGO insistence that a nearby spring source be enclosed in concrete, in accordance with national standards for drinking-water protection. The reason? This spiritually focused society has believed for generations that the spring is a supernatural portal into the afterlife, and any encasement of the source would necessitate immediate removal if residents hoped to gain access to eternal existence upon death.

A Senegalese farming community located far from a natural water source was gifted by a Christian provider with a hand-dug well and rope pump to ease the burden of village women who collected water for household use. Particular consideration was given to gender equity with the intent of freeing rural women to engage in more economically productive activity. This Muslim community consisted of compounds within whose walls the multiple

wives of a single husband were sequestered except when required to leave the confines to attend to household tasks. Within weeks, the women of the community disabled the pump, expressing a need to regain their freedom to associate with non-family friends while walking the distance to the natural water source.

The infrastructure designers' desires to address overt needs without identifying local context led to a failure of function for the target recipients, in the first case because globalized standards conflicted with indigenous beliefs and in the second case because design failed to consider user motivations and values.

### **CONTEXTUAL ENGINEERING TO ADDRESS RURAL NEED**

If one accepts that rural societies will require effective physical infrastructure to combat increasing migration to urban areas and associated disappearance of local identity and knowledge, how can organizations combat the tendency to apply industrialized-nation standards and scalable technologies? The answer lies in a Contextual Engineering approach that merges an understanding of local societal influences with a disengagement of infrastructure implementation from development principles.

The author defines Contextual Engineering as “The creative application of science, mathematical methods, societal understanding and indigenous knowledge to address a physical need that serves the user of the innovation while recognizing the influence of stakeholder motivations and objectives.” (Witmer, 2018) In other words, contextual engineering identifies local conditions and influences to inform technical design of infrastructure when the designers are not intimately familiar with the society and its constraints.

Associated with this approach is a recognition that the engineer is not a development specialist and is tasked with the sole objective of addressing a physical need. Thus, Contextual Engineering dissociates any imperatives to “develop” the recipient community through modification of belief, practice or identity. Detailed exploration of Contextual Engineering exceeds the scope of this paper, but it is the assertion of the author that implementation of a place-based approach to infrastructure design holds the potential to recognize context-specific conditions necessary for the sustainability and functionality of a physical infrastructure that

does not discard or reject societal identity, thereby making it more likely to meet local needs and reduce the rural drive to migrate to urban areas for those who seek reliable infrastructure facilities.

### CONCLUSIONS

Global trends toward urban migration and abandonment of rural lifestyles and communities pose a threat to preservation of place-based, indigenous identity, knowledge and practices. Particularly the youngest, most ambitious and most able population of rural areas has been identified as moving to cities to gain greater access to reliable infrastructure, hold better jobs, and live in greater comfort. As they are compelled to leave their rural lives behind for the promise of opportunity and ease, the identities and knowledges that diversify the global society diminish and are lost to future generations.

Many urban migrants cite reliable infrastructure as a driver for leaving rural society, and established development processes exacerbate the disparity between rural and urban infrastructure by focusing on large-scale improvements, which may be most effectively funded, implemented and managed for urban areas. Additionally, the globalized identity that pervades cities because of population diversity, broader access to wealth, and access to global communication technology makes implementation of a place-blind infrastructure more feasible.

Organizations that continue to serve rural populations are often smaller, less experienced in international service, and more likely to implement a design that conforms to their own experience and standards. When those designs clash with local values, identities and beliefs, the infrastructure is neglected, considered non-functional or even destroyed, leaving rural residents disheartened and distrustful of outside support.

To effectively implement an engineered infrastructure for the rural population of the globe, a new intervention approach is necessary that detaches physical design from “development” objectives, incorporates an understanding of local context and influence, and discards the notion of scalability or universal applicability. Contextual Engineering provides a process for stabilizing rural flight and preserving indigenous knowledge, culture and

identity.

## NOTES

<sup>1</sup>The U.S. Peace Corps, for example, provides an extensive library of guidance for volunteers as well as the general public. A recent search of the online library using the term “water,” for example, generated five pages of resources that range from tools to plan implement and monitor well projects to pocket guides for addressing water resource management through climate change. (Peace Corps, n.d.)

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