

Making the Case for Food Security through Contextual Engineering

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Abstract

A non-westernized nation's food security often depends on preservation of rural agricultural livelihoods, yet a globalization-driven international effort to "develop" societies by providing modern infrastructure has focused on population centers, creating two-tiered economies that frequently leave rural populations behind. As a result, young residents of rural communities are migrating with greater frequency to urban areas, viewing their home society as outdated and irrelevant.

To address this disparity, organizations and volunteer groups attempt to deliver infrastructure interventions to small rural communities, often drawing upon their own experience or out-of-the-box designs to provide water, sanitation, transportation, or energy. The success rate of these interventions in meeting societal needs are marginal at best, often disregarding indigenous practices and beliefs and further demeaning rural lifestyles. A new approach is needed to stabilize rural communities and sustain agricultural livelihoods throughout the alternately developed world through quality-of-life improvements via engineered infrastructure.

Contextual engineering merges technical design with sociological understanding to identify the critical influences that govern each client community, dispensing with the artifice of scalability to address specific physical needs. By focusing on client society beliefs, values, and needs, the infrastructure designer may better create an affordable, functional, and appropriate infrastructure to support and advance that rural society.

This paper will present the contextual engineering concept's potential to support rural growth for stronger agricultural productivity and national food security.

Keywords: Food Security, Contextual Engineering, International, Development, Globalization, Rural.

Introduction

The Globalization Project has promoted modernization of alternately developed societies, using standards of the industrialized world to define development metrics by which others may assess themselves [1]. Accompanying this modernization is a worldwide consumer-driven development and information-technology network that pervades urban life and valorizes the identity associated with population centers [2]. One result of this valorization is a further devaluation of rural life and rural livelihoods, particularly those associated with agriculture [3]. As a result, many rural populations, particularly the young adults of farm-based communities, move to cities to enhance their comfort, economic opportunity, and identity with urban sophistication [4].

Identities associated with tradition, cultural history, and family heritage then become less significant and often are abandoned, resulting in the loss of place-based knowledge and capability [5]. The loss of agricultural production that accompanies abandonment

of rural livelihoods creates a reliance on world food markets, often associated either with industrial agriculture and agronomic business, or with importation of agricultural products grown elsewhere [6,7]. The perpetuation of the urban-growth cycle, then, holds the potential to create dependency on outside resources or industries to provide sufficient food to a non-industrialized nation even as it strives to achieve industrialized modernity, or "development."

Application of contextual engineering, a new technical discipline that incorporates rural identity and knowledge to elevate and support agricultural livelihoods, holds promise as a method of overcoming globalized approaches to "developing" alternately developed societies [8]. The basis of contextual engineering lies in recognition that the combination of physical and societal conditions are unique for each client society and determine adoption and operation of technical interventions. This combines with an awareness that predispositions and motivations among project stakeholders may differ and result in inhibition of client understanding. Awareness of client and practitioner conditions allows the contextual engineer to implement technical designs that best fit the needs of the client, validating place-based lifestyles and supporting local identity.

The Conditions that Demand Contextual Understanding

A compelling demonstration of the devaluation of rurality is provided by Creed and Ching (1997) in the introduction to their collection of essays that focus on redressing the denigration of the rural. In their analysis, rurality corresponds with rusticity while urban life corresponds with urbanity. Particularly for young adults, they suggest, the rural way of life – and all the livelihoods associated with it – is so disparaged that one who strives for prestige or sophistication has no choice but to abandon tradition and move to the city.

Meanwhile, international modernization efforts in aid of alternately developed societies focus on optimization of impact, leading development organizations to launch efforts to improve infrastructure, education, transportation, and interconnectivity particularly in urban areas where they can serve the most residents for the least cost [5]. The drivers among organizations and NGOs performing development work frequently disregard concentration of need and focus instead on ease of access or comfort level for aid workers [9,10]. The services provided by industrialized-world humanitarian efforts often focus on modernizing communications technology to provide developing nations with access to global markets, global expertise, and global experience, producing the arguably unintended consequence of neutralizing place and local production [5]. But researchers have demonstrated that globally conforming access to information and economic opportunity isn't the only driver that draws rural youth to the cities [4]. In addition to economic opportunity and information connectivity, access to basic infrastructure – power, water, sanitation, and transportation – are significant drivers for youth who flee the countryside. Further, the youth most likely to be wooed to the urban life are among the most educated and ambitious of their communities [11]. One may infer, then, that place-based identity and knowledge cannot compete with money and comfort to retain residents in agricultural communities, particularly the most capable and productive residents in alternately developed societies who are attracted through globalization to obtain industrialized-world amenities.

Examination of population data provided by the United Nations demonstrates that the trend toward urbanization is neither new nor is it waning. Figure 1 depicts world population projections for urban and rural regions of the world. While rural populations continue to dominate in low-income countries even though world urban population has exceeded rural population since the early 2000s, the gap between rural and urban low-income populations closes significantly in projections so that urban population exceeds rural by the year 2050.

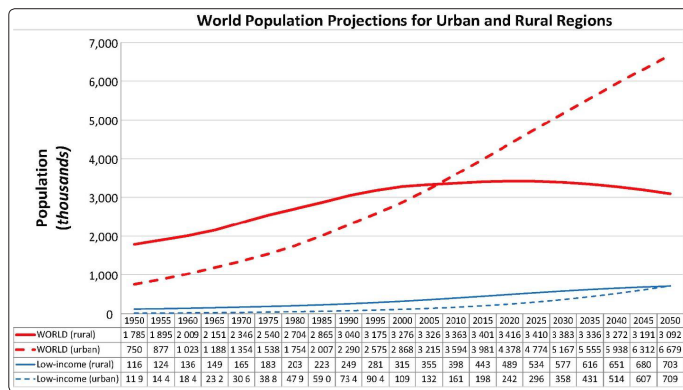


Figure 1: United Nations population trends, projected to the year 2050, for urban and rural populations globally and in low-income

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

National Food Security Threats

The analysis of food security in the last three decades has shifted from the concept of national food security, in which a nation-state is capable of producing and feeding its population independently, to individual food security, in which families possess sufficient resources to either grow or purchase adequate nutrition for their members [7]. Nonetheless, there is a strong connection in the literature between “agrarianism” and food security, with the notion that a decrease in the farming identity not only endangers rural economies and livelihoods but threatens social and moral values of an agrarian society while promoting technological exploitation of croplands that ultimately degrades resources [12]. This suggests that food production, rural lifestyles, and the agrarian identity all are integrally tied together, and each vertex of this pyramidal relationship is affected by changes in the other two.

Examples in both China and Nepal demonstrate that outmigration to cities from rural communities – particularly of the strongest, brightest and most ambitious men – leaves farmlands with less labor, less productivity, and less opportunity to compete with global, industrialized food producers [6,7]. Additionally, Qi and Dang point out, there is a stronger drive toward chemical and machinery inputs in traditional Chinese farmlands, causing serious damage to the environment both upstream and downstream of the agricultural sector as well as on the farms themselves. This latter condition is of particular concern because it creates a conflict between intensified crop production and environmental degradation that could affect future yields or even land usability.

Thus, we recognize that a threat to national food security lies in a series of conditions associated with traditional farming – declining labor and agricultural activity associated with the desire to achieve modernity in urban areas, and inappropriate incorporation of technology practices that degrade land and threaten future production. One could argue that the latter condition stems from the former, since those who remain in farming feel pressure to increase yields and compete with outside crop producers. This further reinforces the notion that preservation of rurality through contextual intervention and support is a critical key to maintaining national food security in the face of expanding globalization.

Observational Analysis

Observations from the author’s personal journals accumulated during nearly two dozen international humanitarian infrastructure field visits show that infrastructure interventions in rural areas, particularly for small, remote farming areas, often are left to “hobbyist” engineers, or those who are not employed by large international humanitarian organizations [13]. Often, service organizations and student-group volunteers cover the gap in support of rural societies needing infrastructure intervention, and the intent of these volunteers frequently is tied to social and economic development efforts as well as technical designs. The assumption of superiority by humanitarian engineers has been well documented in the literature, as well as through ethnographic research by the author. Typically, the result of this sense of superiority is that the place-based traditions, practices and knowledge are disregarded in an effort to provide modernity of design. In fact, the disregard for client values, skills, and identities often results in rejection and abandonment of the

provided infrastructure, for the following reasons:

- The infrastructure does not conform with physical conditions
- The infrastructure conflicts with recipient culture, belief, or practice
- The infrastructure is of a complexity that the recipient cannot or will not maintain it

Infrastructure interventions by hobbyist designers, then, fail to address the physical needs of the client society because of non-physical influences, further expanding the gulf in accessibility to economic well being between rural and urban communities. But what is lost in this rural decline?

Perhaps the greatest loss is the place-based knowledge that has developed, evolved, and flourished in rural societies. To understand the significance of this place-based knowledge, one may draw an analogy to the evolution of organisms dependent upon location. A river trout could no better survive on the bottom of a riverbed than a freshwater flounder could feed at the surface of a fast stream, and no ecologist would propose populating the habitat of a trout with flounder to enhance the river ecosystem. And yet, in agriculture, farming techniques that apply to one set of conditions often are promoted in different conditions with the promise of enhancing productivity by implementing industrialized-world knowledge and capability.

The disregarded knowledge of rural places may not comfortably incorporate modern technology or implements, but it often carries with it a proven functionality for the location in which it is used, a sort of innovative self-sufficiency that can address lack of access to industrialized-world tools and methods through creativity and ingenuity [14]. Incorporation of innovative self-sufficiency does not in itself ensure functionality of infrastructure interventions, as demonstrated by many of the innovative but substandard efforts communities have employed to maintain infrastructure systems (ranging from bicycle inner tubes used to patch PVC pipe to flimsy tree branches used to prop up sagging bridges). But recognition of the type of self-sufficiency employed by a particular society and validation of the thought process may be necessary to create an infrastructure that local populations can operate, maintain, and improve.

It should be mentioned that not all rural societies desire to maintain and valorize agricultural productivity. In one case documented through travel journals, an indigenous Ecuadoran community with long-standing agricultural roots and traditional Andean identity maintained more than 225 hectares of agricultural land for communal farming but shared no collective interest in producing crops [13]. While the elderly of the community, dressed in traditional Quechuan garb, recounted with tears in their eyes the days they would harvest crops then walk over a mountain ridge to Quito to sell at market, the young of the town have largely abandoned this identity and many work as highly educated professionals in the nearby city. A non-government organization partner, closely allied with the elderly population, promoted establishment of an irrigation system for the El Tablon farmlands to preserve indigenous identity. But for the young adults of the community, El Tablon was viewed as potential real estate development, and any irrigation infrastructure system the NGO may have installed would have been removed as soon as their generation took control of the collective land ownership.

Concomitant with a contextual understanding of a society, then, is a resistance to romanticize past identity that disregards upcoming generations' desire to modernize. Thus, contextual engineering is a balancing act between identifying inherently heterogeneous populations' objectives and desires while disentangling the stakeholders' own perceptions and stated objectives in providing infrastructure interventions.

Development Engineering vs. Contextual Engineering

Recognizing the value of innovative self-sufficiency and the place-based understanding of rural livelihoods, can lead to a restructuring of globalized attitudes focused on urbanity and population-aggregating development processes. Rural agricultural livelihoods may continue to increase crop productivity within a nation's borders and discourage increasing dependency on outside producers or industrial agriculture reliance using this contextual approach.

Table 1 shows the typical approach used by a development engineer who seeks to improve the overall economic standing of a client through intervention, contrasted with the approach a contextual engineer would adopt and the impact this method would have upon the client society.

Table 1: Comparison of the conditions and impacts associated with development engineering and contextual engineering approaches

Condition	Development Engineering	Contextual Engineering	Impact of Contextual Approach
Development as an objective of infrastructure	Imposes an interconnectedness between the two	Focuses solely on the intervention	Infrastructure does not carry baggage or place conditions upon client
Industrialized-world technology	Leverages advanced practices and technology regardless of client	Matches technology to needs and capabilities of client	Does not overwhelm client with unnecessary or inappropriate tools
Engineer predispositions	Desire to elevate client's status	Acceptance of client's conditions and needs	Eliminates judgment of inferiority associated with intervention
Client competence and capability	Assumes inferior knowledge, skills, intellect	Recognizes knowledge, adaptability, and creativity of client	Leverages place-based practices as appropriate starting point for design
Diverse stakeholder objectives	Disregards variability of motives among parties	Identifies and addresses stakeholder motive conflicts and synergies	Reduces likelihood of conflict in execution of intervention by identifying and rectifying them in advance of design

Impact of Contextual Design

While contextual engineering does not provide a cure-all for stabilization of rural livelihoods and economic opportunities, it does provide significant support for societies that seek to maintain and flourish in agricultural occupations by providing reliable infrastructure

that more effectively meets the populations' needs, expectations, and constraints. At the same time, contextual engineering offers rural agricultural populations the dignity associated with acknowledgment of their specific place-based capabilities, enhancing the attractiveness of farming occupations for younger generations who currently feel devalued by the global glorification of urban lifestyles, livelihoods, and advances. This latter point creates a paradox, in that the disassociation of infrastructure interventions from the motive of development actually can increase the economic standing of alternately developed societies by reducing their dependence on industrialized-nation producers for food and agricultural products. In essence, by delinking infrastructure interventions from food security efforts, food self-reliance is improved through rural stabilization.

Conclusions

Rural populations who practice agricultural livelihoods are largely responsible for providing food security to alternately developed societies. But global drivers over the past 50 years have encouraged urban aggregation, which threatens crop production for many non-industrialized countries. Among those global drivers, a development effort to address infrastructure needs as efficiently as possible for the largest population of a given country has resulted in focus on urban areas. As cities have become more connected to the globe through infrastructure and information technology, rural societies have become more neglected and less respected [15,16].

Efforts to address rural infrastructure needs increasingly fall to hobbyist humanitarian engineering groups, whose approach to infrastructure design relies heavily on their own knowledge and experience while disregarding place-based conditions. Romanticizing traditional practices, though, without addressing them using an evolutionary design approach, can further disregard and discourage rural populations and their ability to self-determine their future path.

Contextual engineering provides practitioners with tools and understanding to serve rural clients more effectively, leveraging the innovative self-sufficiency that has evolved over time and glorifying rural contributions to the world's food needs. Implementation of contextual engineering practices, then, can contribute toward stabilizing rural society populations, venerating rural livelihoods, and promoting self-sufficiency in food production for increased food security.

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