ADDRESSING POVERTY IN PERU: DEGROWTH, INDIGENOUS LOCAL FARMING, AND TECHNOLOGY INNOVATION

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ABSTRACT

Persons living in least-developed countries (LDCs) often face life-threatening issues with respect to lack of water, nutrition and economic freedom. Thus development practitioners focus on the practicability, sustainability, implementability and economic viability of projects that aim to address poverty. One area in which development practitioners and LDCs communities can come together to solve serious problems in development is sustainable animal husbandry and local farming. In particular, guinea pig farming in Peru may be one feasible prospect for practitioners and participants to explore. Innovations are developing in local farming, and in this case, the keeping and farming of guinea pigs. This study presents a firsthand account of local guinea pig farming to observe how and where innovation occurs in guinea pig farming and technology. Information about guinea pig farming from expert and government sources is also considered. Other studies researchers have performed deal with many facets of guinea pig husbandry, such as its popularity across cultures and continents, including but not limited to LDCs. Local efforts at farming (chicken and livestock) have proven increasingly difficult for indigenous people in attempting to compete with corporate producers. This study indicates a competitive model for indigenous people in Peru.

Keywords: poverty, development, degrowth, technology, innovation,

INTRODUCTION

It is not uncommon for social scientists of all disciplines to analyze what has been called the "peasant economy" in Peru. At present, the capitalist regime in Peru is a product of many changes to the country's political, social and economic history that have taken place over a sizeable stretch of time (Figueroa, 2009; Atter Calero, 1998). The relationship of the peasant economy to the current international capitalist system has also been affected by these changes. As such, the overarching historical process has created for Peru a tremendous inequality, as well as serious problems that pertain to rural poverty. Some have argued that the concept of "economic duality" is nowhere more applicable than in Peru.

The word *poverty* signals a bifurcation of "legitimate needs and available resources" and, in addition, it encompasses inequality. Persons who are poor are considered lacking access to different social services and institutions, such as credit, human services, information, etc. (Uccelli, 1997, p.2-3). Much of this dimension of poverty corresponds to institutional biases, as well as other problems that stem from "insufficient ownership of material wealth and human assets" (Ahluwalia, 1990; Uccelli, 1997, p.3). As Ivan Illich (1970) states, "Every simple need to which an institutional answer is found permits the invention of a new class of poor and a new definition of poverty" (p.3). This notion is very much in keeping with the strictures of poverty presented above, and thus it is included within the same parameters. It is fundamental to acknowledge that society may reinterpret certain needs as demands for what Illich describes as "scientifically produced commodities," and this, moreover, contributes to the definition of poor persons as "those who have fallen behind in an advertised ideal of consumption in some important respect" (p.3).

There are also many causes of poverty despite the difficulty with reaching scholarly consensus in terms of a definition (Burki, 1990). Many of the agreed upon factors that contribute to poverty are as follows: (1) economic growth rates that are sluggish or low; (2) a stagnation in productivity; (3) general

unemployment and also underemployment; (4) little or low formal educational experience; (5) a rapid growth in population and high rates of fertility; (6) the degradation of the environment; and (6) political instability and political violence (Uccelli, 1997; Burki, 1990). Economic growth rates that are sluggish or low correspond to a drop in per capita income that occurs when a country's population grows at a faster pace than its economic growth rate. Stagnation in productivity speaks to the levels of income and standards of living that trajectories in productivity affect.

General unemployment and also underemployment may stem from sluggish economic growth, which in turn pushes people below the line of poverty. Low levels of formal educational experience may translate as a paucity of skill, which then begets limited job opportunity and marketability that lead, finally, to poverty. Rapid increases in population constrain the flow of economic benefits that otherwise come with economic growth. For the poor, the association of poverty with environmental degradation is often a result of living in inadequate arrangements underscored by precarious economic limitations and high levels of pollution. Finally, political violence propagates and expands poverty in that it affects the allocation of resources, which can adversely impact social programs; it stifles private industry and discourages investment (Uccelli, 1997; Burki, 1990; Ahluwalia, 1990).

Furthermore, the manifestations of poverty that exist and affect the everyday lives of so many living at the margins, which have historically affected Peru, are manifold. Five typologies of poverty in Peru are: (1) the poverty that affects the demographic of Peruvians which does not possess much in terms of material wealth, has limited formal education and has little access to socially active groups that can leverage demands in their favor; (2) the poverty that affects the persons excluded from economic activity due to age, and who subsequently lack the basic amount of resources necessary to fend for themselves but do not enjoy the social protection afforded by benefits; (3) the poverty that affects the demographic of Peruvians who are victimized due to various manifestations of discrimination (e.g., language, class, race, gender, sexual orientation, etc.); (4) the poverty that affects

workers with requisite skills and sufficient competence but whose employment poor macroeconomic conditions adversely affect; (5) the poverty that affects persons whose lives are adversely affected by technological innovation in sundry ways; and (6) the poverty that affects workers who (a) lost their jobs due to austerity measures, are (b) low-income earners whose lives are adversely affected by scarcity of, and price volatility of, essential products, (c) suffer due to cuts to social spending, or (d) are structurally poor and victimized by a short lifespan, illiteracy, malnutrition, poor health, high rates of infant mortality, etc. (Uccelli, 1997).

Poverty Alleviation

Though no singular antidote for poverty is to be found, much can be done by way of public policy. As Burki and Edwards (1995) state, "…addressing the needs of the poorest citizens is a political as well as a social issue…" (p.8). Moreover, it is imperative to note that allaying poverty is not an economic issue alone; thus, development programs need to be specifically designed to target goals pertinent to eradicating poverty in general (Uccelli, 1997). With respect to strategies, Uccelli (1997) combines the suggestions of four researchers in a table that warrants revisiting today. He notes that Ahluwalia (1990) proposes a "direct approach," meaning special wage employment programs and financial assistance programs, as well as an "indirect approach," which signals a focus on the "poverty reducing potential of economic growth. Uccelli also notes Psacharopoulos (1990), who recommends the stimulation of macroeconomic growth through implementation of programs aimed at improving the prospects that the poor have for generating income (e.g., education, skills training, and land reform); and the implementation of social programs that target the poor with direct state action that might improve everyday living conditions. Finally, Uccelli invokes Demery and Addison (1987), who propose five items: (1) increase the poor's access to productive assets (land, credit); (2) raise the return on productive assets held by the poor; (3) improve the employment opportunities of the poor; (4) insure the poor's access to

education and health so as to raise their human capital stock; and (5) supplement the poor's resources with targeted transfers of scarce resources.

An Overview of Local Guinea Pig Farming and Consumption

Uccelli and Psacharopoulos note that the guinea pig farming activity of Andean peoples serves a source of food and desperately needed cash income. Guinea pigs have also proven their worth as a lucrative means of augmenting the nutritional and fiscal lives of Andean families. Guinea pigs have many advantageous qualities: a high fertility rate; a rich nutritional value; a rapid rate of reproduction; and the potential for highly-sustainable husbandry and upkeep. Studies in recent decades have compiled exhaustive rubrics for guinea pig farmers to better capitalize on these biological benefits. One of the aims of these studies has been to benefit workers and their ability to evaluate the effectiveness of animal husbandry practices wherever they may occur. With an eye to development, similar studies have proffered novel ways for augmenting guinea pig cultivation in the Peruvian Andes, specifically among rural *campesinos*. Extensive literature reviews and on-the-ground interviews support research claims that Andean peoples in remote Peruvian villages normally raise relatively few guinea pigs for commercial or subsistence purposes (Atter Calero, 1998). This speaks to the compatibility extant between the local farming of guinea pigs and a potentially general adoption of a degrowth-forward paradigm.

In contrast to degrowth, however, there exists decades-old research which underscores the potential profitability of guinea pig farming. Researchers have cited the highly adaptable nature of the guinea pig, especially given the altitudinal extremes at which guinea pigs are sustainably farmed. This, some conclude, makes the guinea pig viable for commercial breeding. Nevertheless, the availability of proper forage has been identified as an encumbering issue. Some have envisaged prepackaging guinea pig meat and byproducts, possibly even forging a path right into the supermarkets of industrialized societies, such as the United States, where many Andean people

already live. Sensing a potential source of economic breakthrough, some propose that guinea pig products would foreseeably make their way to various new markets and be served at a number of eateries in large urban areas. Some establishments opened by Andean immigrants in New York City have already served their patrons roast guinea pig, fetching between $20 and $30 per plate (Morales, 1994).

There may be other marketable benefits that accompany eating and marketing this low-fat, protein-rich animal, especially to customers in foreign national economies where consumers grow in their conscious efforts to mitigate increasingly sedentary lifestyles with healthy dietary habits. One hindrance has been the fact that people in industrialized societies favor the guinea pig as a pet. Some have speculated that this attitude might change should the significance of the industrial use of guinea pig grows. Guinea pigs may subsequently transition from pets to merely another kind of commodified food that endures the same phases of production, distribution, preparation, packaging, and consumption as any other animal consumed in the global, pro-growth economy. Today, it is important to note that various facets of the Andean environment can be described as "fragile," with "limited" resources (Thomson, 2011).

Still, even before climate change and globalization imperiled age-old modes of existence, life was difficult for many in the Peruvian Andes, including those who regularly farmed the guinea pig. This especially holds true for those who adapted only by devising a creative bouquet of strategies capable of mitigating the usual pitfalls faced in agriculture. Now, however, it is absolutely uncertain whether such traditional institutions will endure the new environmental reality, which is drastically contoured by climate change (Lennox & Gowdy, 2014). Thanks to long-held practices of reconciling individual priorities with those of the community (e.g., social responsibilities), informed economic choices have worked to the benefit of the many in Andean communities over the centuries. Truly, shared governance and sustainability have become the byproducts of human existence in the rural Peruvian mountains.

To be certain, there exist a number of differences among *campesino* societies. Furthermore, these communities cannot be

naively idealized as perfect; many have been rivaled each other through inter- and intra-ethnic conflicts (Thomson, 2011). Nonetheless, those that flourish espouse and engender comparable pro-communal strategies that are often generalizable (e.g., Elinor Ostrom's "design principles") among different rural communities (Wilson *et al.*, 2013; Thomson, 2011). This study questions whether innovations in guinea pig husbandry occur as a normative practice within such communities. There may well exist a normative standard for increasing the efficiency of guinea pig farming at the local and national levels, which would be economically pertinent and fascinating for further study — in terms of both commerce and local subsistence.

The study also investigates the significance of micro innovations in Peruvian guinea pig farming, as well as what it means for the rural impoverished who inherit guinea pig farming as a cultural practice or custom that is several centuries old and which continues to depend on the animal. A key point of this study involves an interview with an individual from a rural area in the Peruvian Andes, where guinea pig farming is common, and to gather at least a modicum of information about innovation in guinea pig farming and technology so as to encourage further research on the topic. To supplement the interview, reports from the Peruvian government on guinea pig farming during the 1970s will be explored and evaluated, as they mark the inception of state efforts to modernize guinea pig production.

Similarly, a potpourri of relatively recent history and theory will also accompany the interview and government reports throughout the various sections of this paper. Other research demonstrates the many facets of guinea pig farming, such as its popularity across cultures and continents (Manjeli et al., 1998). This includes but is not limited to LDCs and their respective populations in the African continent. Albeit to differing degrees, such studies may promote guinea pig farming as a potential solution to many current and future problems in food scarcity. They may go so far as to argue that guinea pig farming is viable, even highly sustainable form of local agriculture. Unsurprisingly, other topical studies include the rich pre-Conquest history of guinea pig farming in Peru and other parts of

South America, as well as later in Sub-Saharan Africa and Europe.

It should come as no surprise — especially when compared to the global scale of development projects by institutions like the World Bank or the International Monetary Fund — that some of the most obviously innovative and secure sites for vital projects, like development and sustainability, frequently occur on a small scale. That is, ordinary alterations to human interaction with technology and necessary components of human life can themselves be minute steps toward the perfection and maintenance of culturally and scientifically relevant practices of technological innovation and development, even if the changes qualify as categorically informal.

LESSONS FROM LOCAL FARMING AND ADAPTATION: GLOBAL HUMAN AGRICULTURE

Local farming, animal husbandry, and adaptation in the rural Peruvian Andes reveal similar diversity and attention to detail. A 2007 article in *The Washington Post*, for example, reported Aymara villagers harvesting 2,000 types of potatoes from a 2 ½-acre field (Sumida Huaman, 2014; Berry 2010; Hayes, 2007). Family and communal farming in Peru amounts to a system that is structured to a great extent by interconnectedness. The primacy of environmental knowledge, like that of the abovementioned British sheep farmers, is apparent, as are the many agricultural traditions and cultural practices alive in the Andes. Consequently, the interconnectedness and interdependence, however, of these long-standing systems presently reveal a struggle for the maintenance of contemporary regional subsistence farming. Incidentally, there are many negative effects on critical areas that are complementary to the success of local farming.

These include education, social constructs of success, food management, and more. Economic, social and environmental issues also encompass much of the now localized aftermath that globalization has wrought. Moreover, understanding rural and indigenous modes of existence can be difficult without a commensurate understanding of the fundamental elements of

rural and indigenous ecology and tradition vis-à-vis local farming. Perhaps, then, it would even be difficult to understand the interconnected systems that support local and subsistence farming without also having a clear understanding of how pollution, climate change, global warming, and economic policies (e.g., the Peru-United States Trade Promotion Agreement) and corporate interests all coalesce and oppress already marginalized rural and indigenous farmers. This is the reality; thus, it is additionally imperative to recognize that for rural Andean peoples be able to continue farming at all, merely generating an awareness about the terminal and severely deteriorating environmental conditions they face is not likely to produce commensurate long term solutions (Sumida Huaman, 2014).

Generally speaking, as prices for certain crops considered staples in the Andean diet have dropped, the increase in climate change and variability has also spurred a reduction in traditional crops, which include pseudocereals and tubers (Bunnett, 2002; Nagayets, 2005; International Finance Corporation, 2013; Lennox & Gowdy, 2014). In their stead, the production of improved grasses meant to sustain livestock have picked up momentum and become profitable in the global money economy. Within the region, the mere presence of a transnational dairy corporation, for instance, can spark the need to sustain the growth of the livestock economy, which is not traditional given centuries of different kinds of agricultural management and stewardship. This, and more, is already taking place.

Additionally, an increase in emigration has led to the reduction of the local labor pool for many Andean communities. Due to a loss of traditional crops and the labor required to sustain them, sustainable agricultural management techniques, which make local management possible in the Peruvian Andes, will now play an even larger role in increasing the difficulty that local smallholders — i.e., the roughly 525 million people worldwide who maintain small tracts of low-rent value land used to cultivate crops, keep animals, and participate in key sectors of agribusiness, such as cocoa and coffee — face as they attempt to maintain self-sufficient means of food production and

agrobiodiversity maintenance amidst ominous climate change and a spurious global economy.

But for those living in the Andes, adapting to inclement change is hardly a novel task. Indigenous farmers have long braved marginalization and alienation as the very institutions of their communities have molded to, and responded to, harsh economic and political conditions imposed on them by outside actors (Lennox & Gowdy, 2014). What is more, there now exist threats even to this fairly old exercise in adaptation that are well beyond the scope of the traditional ways of responding to what might otherwise be considered "normal" change. Today's threats are environmentally pressurized and amplified over and again. Unfortunately, global, growth-dependent forces only seem to exacerbate issues; farfetched tales of ever-widening global market inclusivity have not particularly mitigated the environmental or economic threats to a traditional ways of life. If they had, associated problems in global poverty and food scarcity, let alone environmental destruction, would perhaps be less hazardous than they are.

On the contrary, the ways in which the marginalized govern their human-made ecosystem services, or the governance thereof, are endangered. It is unlikely, then, that economic development opportunities in the future will be anything other than limited, if not virtually nonexistent. Located in northwestern South America, Peru is one of seventeen countries around the world that boasts incredible amounts of biological diversity and corresponding traditional knowledge. Together, these nations call themselves Like-Minded Megadiverse Countries, or LMMCs (Sigüñas, 2008). For centuries, in fact, the Peruvian Andes have played host to civilizations whose maintenance of agricultural systems has been possible thanks to locally adapted management practices, which promote agrobiodiversity while simultaneously providing for local human inhabitants (Lennox & Gowdy, 2014).

The losses these communities face today are technological, economic, and political, like the case of the sheep farmers in Britain. The long history of sustainable management in Peru (Costanza, 1994; Pearce *et al*., 1989) comes up against the growth-dependent globalizing industrialization of the 21st

century and now confronts a number of economic and environmental threats. These threats infringe upon what have been, traditionally speaking, locally-managed ecosystems and the associated services they have long provided Andean populations (Sumida Huaman, 2014). Additionally, there exist distinct pitfalls at every level of governance, whether individual, communal, or global.

Added pressure from competing free market systems further compel Andean farmers to participate in agriculture that provides for far-off markets, rather than for local ones, or even simply for their families (Sumida Huaman, 2014). This directly correlates with a reduction in the diversity of Andean crops as market demands dictate which animals command attention or not. Climate change imperils regional ecosystem services via its sundry, pervasive effects (e.g., rising temperatures, drastic temperature flux, altered rainfall patterns, greater glacial melt, flooding, etc.). Nonetheless, local populations have innovatively responded to these pressures and their effects, just as they have responded to other effects on the surrounding environment at other points in time.

A welcome addition to local farming and adaptation would be a dedication to honoring local knowledge of the natural world. For instance, science lessons could be transmitted to children, informing them that they can be both indigenous farmers and scientists. Sumida Huaman (2014) writes, "In Peru, … a gap between what Indigenous communities already contribute and what is accepted as legitimate scientific and intellectual knowledge, [reflects] the power of top-down institutions" (pp.1-19). Similarly, Abrams *et al*. (2014) argue that a truly democratized scientific literacy should necessarily seek to innovate and renovate science itself, because at present, "...the boundaries around the common notions of science are too rigid to enact the equal option in science education and to allow underserved populations to consider being scientists, given the unique psychic costs associated with this move" (pp.671-96).

For indigenous peoples, there are actually multiple losses in terms of the environment, cultural practices, languages, and so on. As stated, these losses are myriad. Vigorous formal and informal educational systems should strive to "value and

enhance Indigenous epistemologies explored through collaborative and participatory research…" This would possibly function as a radically democratic way to engender creative strategies for satisfying questions and pressing problems beyond simply farming food as sustainably as possible. Thus Sumida Huaman states:

These strategies must transcend the oversimplification of a mash-up of Western knowledge and Indigenous local knowledges, void of critical reflection and Indigenous participation. Inclusive educational development — in the home, community, at schools, and with conscientious stakeholders — that acknowledges the breadth of ecology and diverse voices and pedagogical approaches is an intersection that can result in rich experiences for our children who deserve the best education that our earth and we have to give them (p.1-19).

ENVIRONMRNTAL POLITICS, CLIMATE CHANGE, AND INEQUALITY

The advent of human agriculture (roughly10, 000 years ago) invariably marks one of the most significant cataclysms ever to affect the natural world. Evidence suggests that a short supply of natural resources, and possibly the overexploitation thereof, compelled hunter-gatherers to domesticate crops and lead increasingly sedentary lives. The increase in organization necessary to sustain this profound change in human subsistence is thought to have facilitated the very emergence of human civilization. Ever since, the global human population has largely depended on the fruits of agriculture to sustain its dietary habits. Even today, any hopes of economic industrialization are quixotic without a solid base of agriculture. The natural environment still poses limitations to human agriculture, which can fail wherever the intense exploitation of land is not practicable due to manmade disasters or surrounding environmental conditions. This includes, for example, the Arctic regions, or wherever there is an exhaustion of resources, such as the loss of topsoil — supposedly the death knell for a number of past human civilizations. In the aggregate, however, the utility of agriculture has been evident in its widespread success as a strategy for

generating a viable food supply for incredibly large populations of human beings (Cohen, 1977; Diamond, 2005; Ehrlick *et al*., 1997; Sage, 1995, Germer *et al*., 2011).

More than 150,000 years of human existence passed before modern humans started cultivating crops. After agriculture and cultivation could finally satisfy a major part of the human need for food, it has been argued that another leap was necessary to help the production of food comply with the growing demands of an increasing human population. The Green Revolution, which fused research progress with development and technology transfer, catalyzed an upsurge in production and made possible a hike in the global human population. Somewhat ironically, population developments now allow for projections that can spot looming food shortages; some causes for these shortages include a limited supply of land, water, and the availability of requisite nutrients. To ably live within the confines of these limits, one suggestion has been to strictly limit population growth (Huxley, 1966). Even if this were a more socially acceptable solution to many population-related problems, it would take a half-century before immediate action on limiting global population growth through suitable policy could stabilize the world's human population (Cohen, 1977; Diamond, 2005; Ehrlick et al., 1997; Sage, 1995, Germer et al., 2011).

Those involved with environmental politics have long considered the idea that the ways in which human beings use resources will not change unless human relations change. Consider how scholars in the mid-1970s vocalized the need to economize energy. In the process, they broached some of the nebulous ways in which human relations stymie environmental conservation. Some were of the mind that rich countries should be prohibited from wasting energy, while others would be just as content simply letting market forces decide the fate of persons (Stretton, 1976). As pressing as the need is for different publics around the world to understand the impending physical dangers of the current ecological destruction, even total annihilation, in LDCs and at the margins, development practitioners need to work to engender practical solutions that are technically effective in their capacity to heal and promote sustainable relationships with resources, other human beings, and the environment and the

many publics resistant to surrounding the universal benefits of sustainability, technology, and innovation, but whose lifestyles nonetheless principally and directly contribute to unmitigated climate change.

Today, arguably, so much has changed in terms of the concentrated stores of global wealth, and yet, in terms of distributive justice, so much seems the same (Stretton, 1976). Agronomists now recognize that climate change will reduce the world's general agricultural output. This has intensified the need to discover and realize new means of producing food sustainably, and preferably without exacerbating current problems that arise. Concomitant technologies will need to assist in all efforts to expand the efficiency of resources, while helping to protect what natural resources and ecosystems remain (Geels & Schot, 2007; Mumford, 1962; Schumacher, 1973; Smith, 2009; Winner, 1986). As the global human population continues to grow, the demand for food will increase. Meeting this demand will require intensifying the means of agricultural production as they currently exist; the same kind of intensification will also necessarily apply to many forms of land cultivation. But insofar as it is possible to increase both cultivation and agricultural production in their current forms heedless of climate change, there remain definite limits to sustaining what foreseeably is a precipitous increase in human life. Thus, a solution that ignores climate change is, in all reality, woefully misunderstanding and misplaced (Cohen, 1977; Diamond, 2005; Ehrlick et al., 1997; Sage, 1995, Germer et al., 2011).

Ultimately, boundless cultivation and agriculture proves little more than an inelegant way to think about sustaining future human life. It is a highly uncreative solution at best. By simply breeding more and sowing more, food security is neither attainable nor sustainable for a future in which human life undergoes immoderate instances of growth. Consider today's agricultural production and cultivation, which already exact a manifold negative toll on the environment. Both production and cultivation largely contribute to today's global climatic change, which threatens (Klein, 2014). If sustainability is to have any place in the future of food security, or if food security is to be sustainable at all, increasing throughput is likely an inimical

approach, even if it seems an obvious one (Cohen, 1977; Diamond, 2005; Ehrlick et al., 1997; Jasanoff & Kim, 2009; Sage, 1995, Germer et al., 2011).

At present, climate change persists as an unwavering threat to global agricultural production, and thus to food security (Thomson, 2011). Achieving food security for the future will require providing staples for much of the global population in sustainable ways. This, in turn, will require eliminating greenhouse gas emissions that current modes of agricultural production and cultivation cause and exacerbate. Greenhouse gases emitted by the major systems of food production must be cut to an appreciable degree for food security to be sustainable. Though some look to means of farming and cultivation that will facilitate "optimal growth and development" scientists, publics, governments, innovators, and development practitioners all need to consider the benefits of limiting growth, even democratizing it, rather than simply replacing existing major, unsustainable agricultural systems with moderately "greener" ones.

Suffice it to say, modern humans have lived for roughly 100,000 years, which is about the average duration of the lifespan of a given species on Earth. The pending environmental disaster, which is human-made, will determine if the human species will continue to exist in future — that is, if something significant is done to correct the situation. If not, humanity faces what is almost certain peril, as do several other species that face their demise, largely as a consequence of the human mode of existence (Chomsky, 2014). Another problem is that the global corporate sector is deeply invested in publicizing climate change as a hoax, or some kind of illusion that has been slapped together by the media in order to deceive people and keep them from benefitting from, or participating in, consumer-advantageous markets. These targeted consumers are also the people who comprise the distant foreign markets for which the world's vulnerable poor and at-risk groups are coerced to provide. As the Cuban poet and revolutionary hero José Martí famously observed more than a century ago, the buying nation commands, and the selling nation serves.

The actions of the global corporate sector, however self-serving and rational they may seem, are actually quite irrational.

In fact, they jeopardize the very survival of a great deal of earthly life, including the populations responsible for powerful economic demand and those who are pressured to supply. Rationally, however, the market systems in which the corporate sector operates (and accumulates and stratifies enormous quantities of wealth) are precisely the institutions which allow the sector to ignore the externalities that their business renders. These externalities have been adding up for some time; now, they amount to what is the mass extinction event presently unfolding around the world. The effects of human participation in these market system institutions may have something to do with creating and maintaining wealth (if only for a rich few). They also reinforce the heavily-multiplied sources of pollution, and worse (Chomsky, 2014).

DEGROWTH AND ECOSYSTEM GOVERNANCE

Enhancing food security through innovation may require turning away from growth and systematically adopting the ideals of sustainable degrowth. As opposed to concepts that undergird the world's current economic penchant for growth, sustainable degrowth promises to equip various, ever-distinct groups with the appropriate framework for engendering alternatives to the for-profit ethos that currently dominates enterprises and economic systems — particularly where free market systems prevail. Sustainable degrowth can moreover be understood to mean an equitable downscaling intended to enhance ecological conditions to protect local and global economies of scale (Schneider et al., 2010). Thus sustainable degrowth provides a multi-faceted framework that connects diverse policies and local initiatives (Kallis, 2011).

Finally, sustainable degrowth can help connect development practitioners to other concepts and modes of existence in the so-called developing world, including the pluralinational ideas of '*buen vivir'* in Spanish, 'sumak kawsay' in Quechua, 'suma kamaña' in Aymará, 'ñande reko' in Guarini, 'shiir waras' in Ashuar, 'küme mongen' in Mapuche, among others (Thomson, 2011). The "growth imperative" remains an integral part of the growth-centric paradigm that sustainable degrowth aims to

subvert. This imperative encompasses the need to continuously grow characterized by unfettered capitalism, a need fired by the fear of not being able to sustain a structural deepening of debt-dependent economics. Debt is thus critical, and because debt is critical, global finance and global capital are at the heart of the problem that degrowth aims to solve (Graeber, 2011).

No matter the consequences, the growth imperative categorically drives forward Gross Domestic Products (GDPs), which are sustained by the most prevalent actor in this current economic scenario: the shareholder-owned, profit-driven enterprise, as well as mass consumerism. An ever-increasing debt necessarily makes an increasing consumerism possible, and it only encourages more of the same (Truscello & Gordon, 2013). Sustainable degrowth has many underlying assumptions that are reactions to the current, growth-based paradigms of the economic mainstream. One assumption bespeaks the fact that growth-based paradigms emphasize growth as the logical result of policy. Hence, such paradigms are mutable, just as policy is mutable. Sustainable degrowth assumes, however, that such a growth-centric emphasis, coupled to policy, is not only outmoded in the 21st century, but also arguably far too devastating to propagate further (Truscello & Gordon, 2013).

Another assumption of sustainable degrowth is that the correlation between economic growth and an increase in energy use and material throughput is fundamentally unsustainable. Now, global warming and peak oil serve as two forceful reminders that growth nears its limits (Truscello & Gordon, 2013). This is not to say, necessarily, that sustainable degrowth argues for a declining GDP, though it stands to reason that many degrowth approaches could well result in a decline in GDP, at least at first. Instead, degrowth illuminates the obvious problem with growth-based economic systems in general: The institutions and systems that power GDP growth are too heavily enmeshed with today's prevailing economic structures, and growth itself depends on the external pressures that compel firms to expand, a reaction that is only antagonized by the failed neoliberal deregulation that has been a hallmark of the last several decades of global economics (Ostry *et al*., 2016).

Today's growth-dependent economic systems preclude much of the capacity of small and rural social enterprises to comply with the kinds of regulation that favor large economic competitors. Our systems, which are ever more transnational in nature, favor firms that continue to grow, and these are precisely the firms that easily escape paying taxes or abiding by local standards of economic practice. What is more, their workers bear the brunt of unceasing costs, which global firms regularly externalize. These costs haunt nature and often wreak irreparable damage; they are a bad omen for future generations that will have fewer resources and perhaps entirely unsustainable existences doomed by scarcity. Hence, the markets meant to propagate growth effectively tyrannize all who serve them, and they relegate nature to a position of unimportance or subservience (Johanisova et al., 2013; Ostry *et al*., 2016).

None should misunderstand the growth advocated by avaricious transnationals as a boon to the lifeblood of the global economy, though this may seem to be the case. By offering an unending number of specious products to satisfy demand created through advertising, ever-growing firms hardly need to worry about satisfying the basic needs communities might have (Douthwaite, 2000). Even if only superficially, this system and the politics that serve it seem functional, but its myriad negative externalities are socially and environmentally destructive. This does more than suggest that the fruits of the presently dominant growth-dependent system do not work quite like proponents of neoliberalism would have us believe.

GUINEA PIG FARMING AND FOOD SCARCITY[1]

As rural populations commonly face issues in global poverty, including food security, sustainable agriculture becomes an increasingly important human project. It would be especially valuable for development practitioners to work on making sustainable agriculture concur with sustainable degrowth and other approaches that signal an ecologically friendly future. Two of the key features of sustainable degrowth are simple quantities of capital and few external inputs. For these reasons, guinea pig farming is promising. Moreover, for sustainable agriculture

systems to maximally benefit development efforts toward development through sustainable agriculture, enhancing resource bases for production is critical.

Specifically, sustainable agricultural development encompasses everything from the smallholder farmers themselves to their animals. In this regard, a systemic approach becomes possible for practically dealing with issues in rural poverty and food insecurity. Meat animal production is but one aspect in which sustainable agricultural development can enhance farm family nutrition, even supplementing or providing extra cash income to farmers — or entire livelihoods, especially for rural populations whose life already revolves around agriculture (Lammers *et al*., 2009). In terms of its value as a meat animal, the guinea pig normally thrives on diverse types of forage. Furthermore, the guinea pig is completely compatible with its human keepers. That is, human beings and guinea pigs do not compete for food relative to sources of nutrition.

The keeping of guinea pigs encompasses care and management, and these tasks often fall under the care of women and children. For this reason, some invoke the possibility that keeping and farming guinea pigs may offer additional development benefits for women. Perhaps less obvious than the roles of women and children, however, is the fact that guinea pigs chiefly serve their keepers as a source of nutrition and income. This calls to mind the capabilities approach, which stems from the economics of Amartya Sen, an economist whose work has influenced the United Nations Development Programme's Human Development Reports (Lammers *et al*., 2009; Sen, 1980).

The capabilities approach asks the question on what actually women are able to do and to be. This question is fundamental to considering what a woman's opportunities and liberties might look like in practice. Moreover, the capabilities approach holds two assumptions: (1) the existence of a category of functions that are vital to human life; (2) as with both Marx and Aristotle, to function in a "truly human way" is a distinct feature endogenous to human beings. These two basic tenets of the capabilities approach speak to the idea that a human being — dignified and free — may determine her life instead of living as a passive

observer. This approach furthermore, takes to task the traditional economic (or resource-based) approaches and their defects, which evince that they are not sufficiently comprehensive.

Questions of Gross National Product (GNP), and problems relative to the distribution of wealth and income does not give an accurate idea of what people's lives are like. These measures only go so far in describing critical factors like life expectancy, infant mortality, educational opportunities, health care, employment opportunities, land rights, political liberties, etc. (Nussbaum, 1990). Equality is another issue which economics alone will not sufficiently address. Social variants — like those in traditional hierarchies — or prejudice and other such attitudes are not necessarily intelligible from mere economics. Even looking at preference-based approaches indicates a contrast among various approaches to development (Nussbaum, 1990).

As Lammers *et al*. (2009) argue, "The biological, ecological and economic advantages of guinea pigs deserve further attention by those working to alleviate global poverty and food insecurity" (p.155-62). When it comes to nutrients, animals generally hold the promise of conversion, recycling, and banking. This is incredibly important for human beings and for smallholders and local farmers in particular. It is not uncommon for such groups to manage and breed several kinds of animals or livestock simultaneously. Critical traits for ensuring advantageous meat production (normally intended for a diversity of markets, including consumption at home and in local markets) include high fertility among the diversity of livestock, as well as flexible dietary requirements and an ease in adaptability vis-à-vis housing and breeding methods. To provide an apt example here, one might think of chicken, to which guinea pigs and others are comparable.

The viability of keeping and farming guinea pigs necessarily impacts different areas of development, particularly sustainable agricultural development, addressing food security, and providing cash income for a typical rural household. Though deriving nutrition and added income from guinea pigs may generally be far less culturally acceptable than, say, from chicken production (which is almost entirely monopolized by large industrial producers), development practitioners cannot

ignore the fact that the biological, ecological, and economic benefits to breeding guinea pigs warrant further investigation, certainly when the goal is to eradicate global poverty and food insecurity in radically sustainable ways.

Just after the turn of the century, in 2001, the Food and Agricultural Organization (FAO) described in broad terms what constituted food security. The FAO's definition included adequate access — physically, socially, and economically — to safe, nutritious food. This, moreover, had to be commensurate in order to satisfy the dietary needs of a healthy life. Problems in food security, as it is defined here, persist despite all efforts to address related issues in global poverty (Lammers *et al*., 2009). Almost a decade later, in 2009, three-quarters of the global poor living in LDCs were located in rural areas. These populations in particular tend to depend on agriculture for livelihoods and cash income. Developing sustainable agriculture to benefit this population would therefore be likely to require the espousal and creation of systems that demand little capital and few external inputs in order to maintain and even enhance local resource bases. Thus, the environment necessarily plays a significant part and should not be ignored at any juncture in the ideation processes related to innovation.

With virtually half of the world's hungriest people living in smallholder farms, people whose very contexts change with every geographic location and social nexus, another way to understand smallholder farming might be to bear in mind the aspect of labor. That is, smallholder farming and agriculture exist where family members who live on or near farms provide the labor necessary to generate farm products. Such products include but are not limited to food, fuel, and fibers. It should be noted that smallholders in many cases are also the direct consumers of these goods. Some researchers indicate that smallholder production diversity, including animal farming and husbandry, supplement efforts to reduce food insecurity while, at the same time, alleviating other critical issues in global poverty. For example, the production of consumable protein and saleable animal products can increase economic security in conjunction with increasing food security.

Food security may be directly or indirectly affected by the amount of available food resources. Whereas consuming grain-fed animals may be nutritious, such a dietary habit would require the production of more total calories to support, rather than directly consuming the feed itself. It may be a dire mismanagement of resources if we simply try to generate the same degree of calories to match the human caloric intake through the consumption of grain-fed animals. Nor would it be sustainable. This is the thermodynamic reality, which goes to the heart of many demands to completely strike animal protein from human diets. This is a significant detail worth discussing and certainly deserves more attention than it currently receives.

One supporting argument for adopting strictly vegetarian diets is that they suffice to satisfy adequate nutrition so long as there is a diversity of food available. Even so, diversity and the quality of nutrition remain incredibly important in assessing food security. Moreover, animal-based foods supply their consumers with an array of micronutrients in addition to protein and energy, and these micronutrients can be difficult to acquire from plant sources alone, especially in areas where food scarcity is already a central problem for people. Meat, milk, and eggs, for instance, have a much higher nutritive concentration of highly biological availability than plants alone. Thus if plants and animals are consumed in tandem, achieving a diet that is nutritionally balanced becomes easier and even more practical for people who live in impoverished rural areas and suffer from food scarcity. The ecological niche of human beings and respective cultural heritages generally make it doubtful that our omnivorous ways will collectively end. At some level, a modicum of animal protein will always be consumed somewhere in the world, so it makes sense for that protein to be as agriculturally sustainable and ecofriendly as possible.

Because livestock and animals generally have the ability to convert, recycle, and store nutrients, they play a key role in the lives of a great number of human beings around the world. There are many kinds of forages and crop refuse that are difficult or impossible for human beings to digest. For that matter, there are all kinds of crop wastes we simply do not want to eat — like insect-ridden grain. Yet, animals can convert this and more into

what are possibly highly desirable animal products. It is no wonder, then, that animal farming has long been associated with human agriculture and crop production activities. The timing of nutrient availability is yet another crucial factor in food security.

It is important to note that crops are seasonal. This means that harvests will not always coincide with the need for cash income. On the other hand, smallholders and local farmers might sell livestock at any time throughout the year. Hence, animal agriculture is able to provide rural farmers with an income at critical points in time. Keeping animals and livestock thus increases diversity, stability, and certainly the security of smallholders' livelihoods, as well as their food supply. It is clear that incorporating livestock into local farming and smallholder operations can benefit the entire farming unit or family, especially given that livestock continue to consume forage crops and/or food refuse.

Finally, guinea pigs are a native animal of the Andes in South America. They have long sustained Andean peoples with income and nutritional value. The guinea pig is well adapted to its natural settings, yielding meat and generating income for local farmers today. It often works well for the purposes of local markets (Costanza, 1994; Pearce et al., 1989; Lammers et al., 2009). The fertility of guinea pigs can only be described as "prolific," as they express their estrus non-seasonally, with a gestation period allowing them to produce several litters annually. Guinea pigs also produce multiple animals at each birth. Furthermore, the guinea pig will grow and reproduce on a diverse range of diets, and it adapts well to an array of climates. The fact that the guinea pig is a herd animal, and favorably responsive to animal husbandry and sustainable management, is additionally encouraging.

FORMAL AGRICULTURAL TECHNOLOGY INNOVATION

Researchers have indicated that guinea pig production for everyday consumption, and even commercial purposes, is not new to people living in the Andes or the Andean sub-regions (Morales, 1994). Even though it is not a novel activity, guinea

pig production for commercial purposes would invariably demand what some have called "more effective" means of production than those utilized in the traditional breeding of guinea pigs. To supplement this demand, some have called for the integration of isolated, rural Andean populations due to their adaptability and openness to elements of foreign culture. One underlying assumption is that "modern" and "rational" means of guinea pig production might work especially well at the family and communal level. The argument holds that this is a viable strategy for moving towards more inclusive, integrative economic development.

But where do international development institutions and the Peruvian government stand? Do their interests lean toward the growth-dependent stability of foreign markets, or with the marginalized whose innovation in farming they hope will help them capitalize on increased production and economic growth? What does their research say at present, and does it indicate a direction or the significance of traditional, indigenous culture and knowledge (Morales, 1994)? Answers to these and similar questions are likely bleak given what the USAID Country Development Cooperation Strategy for Peru (2012) concluded only years ago:

Despite a decade of impressive economic growth and democratic progress, many Peruvians—particularly outside of the coastal urban areas—have yet to see tangible benefits from these advances. Many feel that they receive few or inadequate basic services from the government and have not seen their incomes increase commensurate with the country's growing economy. This perceived disparity between the economic 'boom' of the coastal areas and continued poverty in Peru's mountain and jungle regions has, in some cases, fostered a sense of social, economic, and political exclusion … (p.ix).

For indigenous guinea pig production to move beyond local farming meant for the sake of sustaining immediate consumption, the problems that farmers face, especially those who depend on at least semi-subsistence farming systems, must be addressed. Researchers have noted the "insufficient use of improved local and advanced knowledge and technology, and low levels of productivity" in Bolivia, one of Peru's contiguous

Andean neighbors whose cultural inheritance is similar (Klein, 2003). Problems persist despite a good deal of research, development programs, and the creation of "new knowledge in agricultural production and value added." It is additionally difficult for research organizations to generate knowledge that can be easily passed on to different development programs and services which fully intend to disseminate the knowledge among farmers. For this and other reasons, LDCs have focused anew on different dynamics, like participation and collaborative learning among farmers and others contributing to development and knowledge distribution beyond the usual expert-lay conduits (Hartwich *et al*., 2007).

Another issue is the fact that farmers and cooperatives and farmer organizations have limited access to knowledge and technology experts, whose roles are sometimes contentious. Non-governmental organizations (NGOs), agencies promoting development, and state-run support programs are the experts who normally provide one-dimensional support in a specific area (e.g., seeds, irrigation, land-use, financial credit, etc.). Their ability to provide knowledge is thus limited in its own regard, and limitations can inspire caution in traditional and rural farmers, who may find it far more worthwhile to cross-reference and weigh potential costs and benefits with the opinions of other farmers and entities that can complement the knowledge they already have about particular issues. This is part and parcel of what currently dominates knowledge improvement and adaptation processes. Farmers rely on their network of surrounding agents, systems of practices, and processes in order to decide whether to espouse new knowledge and techniques, make changes, and adapt as they see fit.

By the end of the 1970s, there was an increasing amount of interest in agriculture's environmental and biological characteristics (Briggs & Clay, 1981). Many recognized that these characteristics were part of something that routinely shaped technical innovation. Of particular interest to researchers was the notion that natural selection and "human purposive selection and experimentation" frequently interacted with one another. Especially fascinating was the idea that the interaction between nature and human beings spurred a continuous process of

innovation with farmers and scientists at the heart of powerful research and development (R&D) systems. Focusing on many informal R&D systems, researchers showed interest in the kinds of limitations that significantly impacted major policy problems. Specifically, these problems concerned agricultural research resources and their organization and management.

Prior to formal R&D involvement, technological transfers were not only unsystematic and uncontrolled; they also took place among "unorganized" producers. In poorer countries, this informal activity remained technical innovation's chief source until after World War II. Small plantation activity also made contributions, however minor (Briggs & Clay, 1981). By the early 1980s, this informal activity was only beginning to be supplemented by both public and private formal R&D. This was also transcendent of national and international spheres. Thus, researchers observed that "awareness of the processes of informal innovation" was vital to "understanding the workings and dynamics of agricultural systems" — most notably in so-called developing countries.

Informally, farmers would normally choose economically significant crops with which to work. They would retain seeds and reuse them, selecting whatever material had preferable traits or characteristics. Within a given environment, the interaction between a farmer's experimentation and "purposive selection with natural selection" would give rise to what was labeled the *endogenous* process of innovation. Moreover, because of farmers' interactions with plants (i.e., scrutinizing attributes associated with performance, especially in yield, robustness, suitability for production, etc.), purposive selection, as a major component of the endogenous process of innovation, is primarily implemented by informal experimentation in agronomy.

In his preface to the United Nations Conference on Trade and Development's 2015 Technology and Innovation Report, UN Secretary General Ban Ki-Moon stresses that fostering productive capacities while promoting sustainable industrialization will significantly impact the 2030 Agenda for Sustainable Development. The agenda itself has already acknowledged the multifaceted nature of sustainable industrialization. In terms of the environment, industrialization

cannot simply stop at sustainability alone. According to Moon, there must also be efforts to enhance productivity and reduce poverty. Moon takes sustainable industrialization a step further, recognizing that sustainable industrialization is very much technology-driven. Moreover, the industrial policy that undergirds sustainable industrialization is largely incomplete if it fails to address innovation and innovation policy. Today, prosperity and development depend on technology and innovation, which are often anything but complementary. The United Nations Conference on Trade and Development (UNCTAD) report for 2015 thus emphasizes the "urgent policy priority" that is elemental to technological learning and the capacity for innovation (Moon, UNCTAD, 2015).

Moon states that promoting industrialization is indeed a global challenge, and that policymakers and development partners should understand the implications of technology and innovation when attempting to formulate effective approaches to achieving the United Nations' Sustainable Development Goals. The UN recognizes industrialization as elemental to development around the world, and clearly, development is no easy process. For this reason, many countries have emphasized their policy frameworks anew, specifically with regards to science, technology, and innovation — an area otherwise known as "STI" or "innovation policies." The underlying hope is that an STI focus will address and navigate the challenges that impede the fomenting of industrialization. This necessarily includes addressing challenges to closing the technology gap. Moreover, the UNCTAD's 2015 Technology and Innovation Report seeks to analyze policy-relevant issues, such as how synergies between industrial and innovation policy frameworks might be calibrated to assist countries to control their general development and transformation (Moon, UNCTAD, 2015).

Undertaking a grand transformation in the economic and industrial centers of any state certainly requires a special attention to development and STI policies that often intersect at questions of how best to promote technological learning. Additionally, this requires the construction of capability. The intersections of certain policies and frameworks lead to the assumption that there is an added significance for developing

countries because there exists, as Moon describes, a "parallel narrative on technological learning." Practically speaking, both of the policies in question here seem to have similar incentives and instruments. So if the allocation of necessary resources causes interference, inter-agency competition, or unsatisfactory outcomes, it clearly makes sense that nations looking to develop further would place a special emphasis on coordinating their policy processes well (Moon, UNCTAD, 2015).

Still another reason why the intersection of development and STI policies is so significant is that the corresponding approaches to technological learning assume different perspectives. Industrial development, for example, may establish what the economic targets ultimately are, and STI (or innovation) policies may facilitate the institutional infrastructure necessary for learning, or even individual targets and support incentives for private firms. Whereas strategies for industrial development seek to cultivate a country's high-technology sectors, fuel job growth, and eliminate poverty, STI frameworks usually already prioritize target sectors. A country's emphasis on job growth, say, in order to induce economic and financial recovery from the collapse of the global capitalist system from 2007 to 2008, depends on a plan for industrial development. Nevertheless, the STI framework is thought to define how technological and innovation development will govern job growth — and whether and how good, sustainable jobs can be created.

Though both policy frameworks for industrial development and STI complement one another, neither is considered redundant. Moreover, reinforcing developmental outcomes depends on close coordination, which is crucial. Historically, some states within the developing world have done a commendable job of coordinating their STI policy objectives with strategies for industrial development. Not all have managed to do this well. Both sets of policies have given rise to great instances of friction, especially in terms of the consolidation of existing industries. For example, in various small countries, industry remains traditional, and even largely composed of small and medium enterprises (SMEs). On the other hand, the friction in question might result from innovation and industrial

development having been promoted as two distinct issues (Moon, UNCTAD, 2015). As part of the Peruvian government's Ministerio de Agricultura y Riego, the Instituto Nacional de Innovación Agraria (INIA) has published a website[1] dedicated to the agricultural technologies which are profoundly important to the health of Peru's national agronomy.

In its digital introduction to those technologies, INIA defines itself as the principal originator of the relevant commercial and management technologies that are actually in use. INIA describes its technologies as contributive to the slow-but-steady increase in the production and yield of major Peruvian crops and livestock. In a subsection of its webpage on technology, INIA lists three vital classes of Peruvian livestock: guinea pigs, bovine, and camelids. Per the guinea pigs, INIA states that along the Peruvian sierra, and among the nation's coastal villages, no "*familias campesinas*" exist which do not farm and breed guinea pigs, a principal source of dietary protein for such families. INIA also emphasizes the tangible benefits along Peru's central coast, where at least one project, INCAGRO, has taken effect. Salles-Filho *et al*. (2009) describe INCAGRO as "a World Bank-financed program of the Peruvian government set up with the principal mission of promoting innovation among small farmers by supporting research, training and the introduction of new management and production techniques" (p.361).

According to the 2011 OECD Reviews of Innovation Policy for Peru, INCAGRO was developed in 2001 by INIA and the Ministerio de Agricultura y Riego, and supported by the World Bank. The OECD Review says the purpose of INCAGRO is "to improve the innovative capacity and competitiveness of the Peruvian agricultural sector, essentially through projects related to [science and technology] capacity building and the provision of technological services" (OECD 2011). In another area online[2] INIA describes the different services it offers for technical knowledge transfer, which includes support to services pertaining to general technical information, the public domain, and for INIA-generated information or information produced by other entities. Producers are reportedly the direct recipients of these technical services, which can also benefit the Proveedores de Asistencia Técnica (PAT), or technical assistance providers,

as well as other agents. With PAT, the transfer of technical knowledge and other services may take place either remotely or via face-to-face encounters. PAT producers facilitate this, as do visits and technological care and support. INIA has improved guinea pigs with rations of nutrient-dense forage and considers the consequent economic appreciation to be indicative of the use of alternative technologies; the INIA also considers those technologies to have proven their worth via real-world application.[3]

INIA reports that the viability of Peru's coastal ecosystems has raised questions about commercialization, and this might generally increase the viability of reaching scales necessary for export in general. Nationally, the current impact that INIA efforts have had is positive; nevertheless, they are potentially unsustainable given key factors like climate, which determines the production of forage for guinea pigs. Nor are there enough materials available to prepare a regional supply of forage needed for commercialization.[4] Regardless of such hindrances, INIA reports the social function of food security to be of the utmost national importance. Upon evaluating the production systems of Peru's central coast, as well as the areas just north, south, and east of Lima, INIA has observed the effects wrought by related economic impacts.[5] Suffice it to say, would-be relevant microenterprises are not considered part of the formal economy; they do not incur expenses beyond the cost of food for guinea pigs, which includes the cultivation of forage in the form of corn husks or the purchasing of nutritionally balanced feed that has been experimentally evaluated (and is now commercially available at the Universidad Nacional Agraria). Considering the microenterprises separately means that generated revenues pertaining to guinea pig farming is interpreted in two different ways.[6]

INIA GUINEA PIG RESEARCH, 1971 to 1977[7]

INIA has published a series of reports about the productive and reproductive characteristics of its guinea pigs since the early 1970s. Their reports are fully digitized and located online. The following are assessments and interpretations of those research

reports, which were written originally in Peruvian Spanish. From 1971 to 1975, INIA published a document titled *Características Productivas y Reproductivas del Cuy Tipo 4* (or, The Productive and Reproductive Characteristics of the Type 4 Guinea Pig). This earliest INIA report, published online and written by Juan Muscari and Lilia Chauca, concerns the productive and reproductive characteristics, or traits, of guinea pig type number 4, otherwise known as the "Merino" guinea pig. Muscari and Chauca observe the Merino guinea pig, located mostly in the northern part of Peru. Its formative characteristics are different from those of other guinea pig types, and it is well suited to modes of meat production.

From 1971 to 1975, the Merino was a highly prized animal in its zone of origin. Guinea pigs of this kind are characterized by their curly hair, which they show upon birth. It has a sheep's wool appearance. With age, the hair becomes more bristly. Muscari and Chauca reported the utilization of this guinea pig to be limited because of its low dissemination and overuse, in addition to the fact that it grows slowly compared to the "improved" cuy. This inconvenience, noted Muscari and Chauca, could be solved by applying a rigorous method of selection. These researchers argued that people might eventually take proper advantage of this hardy animal. Muscari and Chauca performed their research with the records of El Proyecto Animales Menores de la Estación Experimental la Molina (an experimental small animals project). In these records, the assessments performed accounted for 156 births from 74 mothers and 22 fathers, who together produced a total of 420 calves born between 1971 and 1975.

According to the data obtained, it seemed possible to realize an improvement in the prolificacy of weight characteristics in this type of guinea pig. The coefficients of variation obtained from an early selection of animals suggested as much. This guinea pig type showed a high phenotypic correlation among weights and different stages of aging. The 1977 INIA publication on guinea pigs was titled *Efecto de la Temperatura y Humedad Relativa Ambiental en la Crianza de Cuyes* (or, The Effect of Relative Ambient Temperature and Humidity on Guinea Pig Breeding).

Published by another researcher, Miguel Ortiz, this is the last INIA report of the 1970s, and it follows the earlier research performed by Muscari and Chauca. Ortiz argues that it is important to provide guinea pigs with the best environmental conditions possible so that they might express the entirety of their genetic capacity. He further observes temperature, humidity, food, and management as being among the many factors that influence greater yields through use of guinea pigs. Because some combination of these factors might very well play a key role in raising guinea pigs, it is important to know how they interrelate in order to take the right measures to counteract any mitigating negative effects.

In order to determine the impact that temperature and humidity have on guinea pig yields, the averages of 5,000 offspring from 2,000 births (registered with the small animals project) were studied. The data was classified by year (from 1971 to 1975), and season (summer, fall, winter, and spring). This information was studied by electronic computation under the methodology of minimum frames. In the first table average yields are presented according to the variables shown, for both years and seasons. These variables are (1) calves born by birth, (2) birth weight, (3) weaning weight at four weeks, and (4) weight at 13 weeks. Throughout the years, seasonal irregularities are evident. In addition, yields in most characteristics are lower in the summer and higher in the spring. Meteorological data from summer months during the period encompassing the study was 17.81 ºC and 20.88 ºC in autumn. In winter, it was 15.45 ºC and 17.47 ºC in the springtime. Correlation coefficients and determination between temperature and humidity were estimated, and there was a highly negative relationship (-0.86). The observed 74% variation in humidity was due to temperature variation.

A statistical analysis of the data was realized, modeled, and plotted for clarity. In the variance analysis of the variables studied, including temperature and humidity, the year and season are an important source of variation. These sources prove to be equally important in the variance analysis raised, however, except in birth weights where the sum of all the calculated tables, each variable regression on environmental temperature is

insignificant due to the regression in birth weight at specific room temperature. The results from Ortiz's 1977 contribution to INIA publications on guinea pigs largely indicated that the greatest care and attention that guinea pig farmers give their animals occur during the summer and fall. Taking necessary precautions to prevent the diminishing of yield production, Ortiz argued, was an especially evident activity during these months.

Interview

Several decades have passed since the Peruvian state's early initiatives in guinea pig production during the 1970s. It is important to contrast those initial efforts with the ongoing local, degrowth-friendly guinea pig farming that persists in rural Peru. One female interviewee from the rural Peruvian Andes provides a brief, semi-descriptive narrative, specifically about her experience with, and knowledge about, local guinea pig farming in Peru. The questions posed to our female interviewee rely on a method of phenomenological interviewing. Within the context of phenomenological research, it is important to recognize that the interview is typically underemphasized in the research process. Nevertheless, phenomenological research is interested in describing a person's experience according to her experience, rather than, say, describing the experience from a merely theoretical or quantitative point of view. Our interviewee was therefore treated as the real, active, and learning being that she is — an individual who intends to find meaning in her experience, including in the research interview.

Key concepts for describing the phenomenological interview method include specific touchstones: description and natural attitude (the "normal unreflective mode of being engaged in an already known world"); life world (the "consciousness of the world, including objects or experiences within it … always set against horizon that provides context"); modes of appearing (how a phenomenon appears to someone experiencing it); phenomenological reduction (i.e., using questions whose vocabulary allows access to the interviewee's perspective without distortion from theoretical jargon); and imaginative variation (allowing for different accounts of the appearance of

the phenomenon in question). The interview structure follows (Bevan, 2014, p.136-44).

Table 1. Structure and Content of Phenomenological Interview

Phenomenological Attitude	Research Approach	Interview Structure	Method	Questions
Phenomenological Reduction	Acceptance of Natural Attitude of Participants	Contextualization (Elucidating the Lifeworld in Natural Attitude)	Descriptive or Narrative Context Questions	"Tell me about raising guinea pigs."
Phenomenological Reduction	Reflexive Critical Dialogue with Self	Apprehending the Phenomenon (Modes of Appearing in Natural Attitude)	Descriptive and Structural Questions of Modes of Appearing	"Tell me about people's typical interactions with guinea pigs."
Phenomenological Reduction	Active Listening	Clarifying the Phenomenon (Through Imaginative Variation)	Imaginative Variation: Varying of Structure Questions	"How might people change how they work with guinea pigs?"

Interview Responses

1. In response to the first statement (i.e., Tell me about raising guinea pigs), the interviewee states that the guinea pig is an animal which many families in her rural Andean hamlet raise. Each family raises their own guinea pigs in-home. When the interviewee was a child, she recalls that she and her family raised guinea pigs in the kitchen, a place where they would cook and sometimes eat. They used tables in order to keep the guinea pigs separate from people; however, more often than not, the guinea pigs were simply free to roam "all over the place." Specifically, the interviewee remembers the guinea pigs needing to be in the

kitchen in order to stay warm. Her family raised guinea pigs mostly for their own immediate consumption. “It is a traditional dish,” she says, “for every special occasion like birthdays, religious celebrations, etc.” She claims that no special or sophisticated precautions or measures were taken in order to raise the guinea pigs: “We simply had the space in the kitchen and grass, oats, or alfalfa. We did not invest in buying oats or alfalfa; we went to our farm and picked it from our fields. We also fed them with corn leaves and the peal of vegetables which were scraps from cooking.” The interviewee reported maintaining only two kinds of guinea pigs: “At the beginning they all lived together, but then we separated them. One group was the *chuscos* and the others were the *maurominas*, both of which are the most common types that families raise.” In time, however, she and her family took the guinea pigs from the kitchen and located them in wooden cages with two floors, which made it easier to count how many there were. This also made it easier for them to catch the guinea pigs.

2. In response to the second statement (i.e., Tell me about peoples’ typical interactions with guinea pigs), the interviewee states that the guinea pig is a traditional animal, and it is important for families to raise their own, given that it is what people commonly eat on special days and at times of celebration. She adds, “The guinea pigs give you a kind of social status,” and goes on to provide a relative example of people seated around a table on a special occasion: The person “who has an entire guinea pig is probably the most important person at the table. It is likely that it is a special occasion for him or her, or the family is demonstrating a higher level of respect toward that person.” Furthermore, “There is a kind of guinea pig which is the black one, and some people believe that it has curative attributes. It is used in traditional rituals to take out the bad energy.” Yet another node in the cultural importance of guinea pig consumption is that “in a big celebration, if you serve as a main dish a guinea pig instead of chicken, pork, etc., it would be considered a good celebration…” In turn, the people hosting the party would be considered notably laudable for their hospitality. Gender, the interviewee notes, also plays an important role. “For women,” she states, “if a family does not raise guinea pigs, then

the woman of the house would be considered lacking as a wife." She adds that "respect towards the guinea pigs is shown also in the way that people take care of them. Different from pigs or cows, people try to provide a good space for the guinea pigs, like the house or, more specifically, like a kitchen. People believe that is better to have them under a traditional roof with *tejas*."

3. In response to the third question (i.e., How might people change how they work with guinea pigs), the interviewee states that some people have begun making changes "in the way in which they raise the guinea pigs." She reports that these changes are "oriented mainly toward creating a business around the guinea pigs." Some of the changes the interviewee reports seeing people in her hamlet make include: (1) building a new space for their guinea pigs, with some divisions to separate them by sex, age, and race; (2) building shorter cages with a door, so it is easier to catch their guinea pigs; (3) feeding their guinea pigs at least three times a day; (4) cleaning the cages more frequently; and (5) growing their own alfalfa or oats instead of buying them.

CONCLUSION

We argue for an Andean and indigenous approach, called "*buen vivir,*" in order to challenge the neoliberal models that have excluded indigenous persons from participating in market economies of scale. The European and Andean streams of degrowth discourse follow similar patterns of economic development on a small scale and offer a viable alternative to the disastrous outcomes of globally liberalized trade (Diamond, 1997; Homer-Dixon, 2007; Weisman, 2007; and Victor, 2008, as referenced in Thomson, 2001). Even the North American push for a steady-state economy suggests that various cultures and societal contexts have taken to elaborating solutions that have subsequently been propagated (Thomson, 2011). Other similar economic models include deep ecology, climate change, ecosocialism, ecofeminism, and energy, entropy. Nevertheless, development practitioners can include analyses such as local guinea pig farming in the rural Peruvian Andes in order to assess what can best be useful for current and future public policy.

Today, half of the world's hungriest people live in smallholder farms (Lammers et al., 2009). Each of their respective contexts changes according to geography and social nexus, which ultimately affects a large number of indigenous persons. Smallholder production diversity, including animal farming and husbandry, greatly benefits reducing food insecurity at a local level, while at the same time alleviating other critical issues in global poverty. Self-sufficiency for indigenous persons is critical for implementing an alternative to the current growth-dependent global economic system, which by and large, excludes some of the Western Hemisphere's poorest people. The means of human subsistence, which for so many are the very pillars of human well-being, warrant deliberate consideration when development practitioners seek to press into service the sustainable and environmental justice. The Bolivian Catholic Bishops state, "both everyday experience and scientific research show that the gravest effects of all attacks on the environment are suffered by the poorest" (Bolivian Bishops' Conference, 2012, p. 17).

Guinea pig farming has invariably enriched the lives of millions of people over the centuries, both culturally and physically. It has been a foundation of human culture and human thriving for quite some time. Despite the ubiquitous presence of environmental disaster, it seems unlikely that it should otherwise disappear from the repertoire of human farming (Ceballos *et al*., 2015). Given the magnitude of the current destructive trend toward unfettered growth-dependent market systems and economic institutions, alternatives for local indigenous persons, is becoming increasingly important (Ceballos *et al*., 2015). Such efforts in economic and human ecology, in line with Schumacher's *Small is Beautiful* revolution, provide a backdrop for the everyday innovation that takes place all around the world. Guinea pig farming, as a prime example, calls for our careful attention.

Acronyms

INIA	Instituto Nacional de Innovación Agraria
LDCs	Less-developed countries

NGOs	Non-governmental organizations
OECD	Organization for Economic Co-operation and Development
PAT	Proveedores de Asistencia Técnica
INCAGRO	Proyecto de investigación y extensión agrícola
R&D	Research and development
STI	Science, technology and innovation
SMEs	Small and medium enterprises
USAID	United States Agency for International Development
UNCTAD	United Nations Conference on Trade and Development

NOTES

1. http://www.inia.gob.pe/tecnologias/crianzas/131-cat-tecnologias/crianza/397-tecnologia-en-cuyes
2. http://www.inia.gob.pe/tecnologias/crianzas/131-cat-tecnologias/crianza/397-tecnologia-en-cuyes
3 Ibid.
4. http://www.inia.gob.pe/tecnologias/crianzas/131-cat-tecnologias/crianza/397-tecnologia-en-cuyes
5. Ibid.
6. Ibid.
7. Ibid.

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