Systems Integration Model:
Combining areas of human health, animal health and economic development

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Abstract

According to the World Health Organization (1999), more than 90% of the estimated 36 million people with HIV/AIDS are living in developing countries with agricultural pursuits as both their primary means of income and food source, suggesting a critical relationship between the three areas of human health, animal health and agricultural economic development in emerging world areas. While there are organizations that provide treatment, intervention or aid in terms of one or more of these areas, a review of the literature did not reveal any which deal with the three in the aggregate. This paper examines the correlations that exist between human health, animal health, and economic development and sets forth a trivariate approach known as the Systems Integration Model (SIM), as the proposed interventional concept. The SIM intervention concept targets all three areas as opposed to being singularly focused on one, which has widespread implications for organizational responses to diseases of poverty, such as HIV/AIDS.
Introduction

Pasteur was one of the first scientists to observe that the environment, including the macro environmental level of policy, culture, economy and an individual's microbiological environment, nutritional and health status, are interrelated. A broad spectrum application of Pasteur's observation to a public health concern of epidemic proportions such as HIV/AIDS in Africa is not difficult. Swaans, Broerse and Bunders (2000) propose that although scientists have "known for 20 years what causes HIV infection, only now are we beginning to understand what fuels the HIV epidemic." This "fuel" is endemic and may take many different forms such as cultural and religious mores, governmental policies, corruption, and other issues.

While peer reviewed literature largely addresses HIV epidemic concerns in a global fashion, the interconnectivity and interdependence of human health, animal health, and economic development disciplines and interventions that encompass these three areas are somewhat less explored. This is not to say that each area has not been studied in a particular "silò" of research and intervention. Rather, the three areas, serving as determinants of health, appear to not have been evaluated together as viable
interdependent interventions.

Utilizing a standard Venn diagram, this study proposes an integrated model (see Figure 1) that illustrates the interdependent relationship between the areas of human health, animal health, and economic development. We set the conditional area, where the three circles converge signifying a shared management, as representative of the Systems Integration Model (SIM), the proposed interventional concept. It is thus proposed that the SIM concept, the interventions and aid based upon this concept touches upon all three areas as opposed to being silo focused. Further, this study proposes one more assumption for the SIM: that education as a component of each area, while an important part of all interventions is not in itself sufficient. Intervention components must be concurrently impactful to be integrated and thus have the greatest sustainable effect upon those being served with different types of aid and assistance. Since the 1970s there has been an increasing recognition that knowledge of technical, socio-economic and cultural aspects of care needed to be integrated to develop sustainable innovations to combat HIV/AIDS in developing countries (Cernea, 1991; Dusseldorp and Box, 1990). Scientists and development practitioners have particularly stressed the importance of using integrated and interactive approaches, as isolated and top-down approaches are inadequate to mitigate the impact of HIV/AIDS on agriculture and rural development (FAO, 2003, 2004). Despite this knowledge and the recognition for the need for integrated approaches, they are not commonly employed.

HIV/AIDS, as defined by The World Health Organization, is regarded as one of the "diseases of poverty", along with tuberculosis, malaria, measles, pneumonia and diarrheal disease (2005). These illnesses are regarded as diseases of poverty because they primarily affect the poor, they worsen poverty's toll, and can generally be treated or
prevented for a small amount of money. In this we see a correlation of poverty and disease and from this correlation we build the case that a need exists for an intervention that addresses both of these areas. Although there are a multitude of organizations providing aid and support to people with diseases of poverty, the majority of these organizations are not utilizing an intervention model where a combination of the three areas of interrelated concerns—human health, animal health, and economic development—are addressed simultaneously. This paper will examine three organizations using differing approaches to combat disease and/or poverty. The Joint Clinical Research Centre (JCRC), based in Kampala, Uganda with antiretroviral dissemination to individuals infected with HIV/AIDS as its primary mission; Grameen Foundation with microcredit interventions as its chief mission; Heifer International, an organization with its chief mission being livestock and sustainable agriculture interventions, all provide a parallel to potential integrations for the fight of HIV/AIDS in Africa. The proposed Systems Intervention Model encompasses trivariate interventions of human health, animal health, and economic development.

While this paper focuses on the issue of HIV/AIDS the concept of the multivariate systems intervention model is intended for utilization of a multitude of health issues that encompass and expand beyond the health problems presented with the HIV epidemic. Further, the interventions described, particularly of Grameen Bank and Heifer International, are not specific to treatment of the AIDS epidemic in Africa; rather they are interventions which target the poor and populations more susceptible to diseases of poverty such as HIV/AIDS.
Background: AIDS in Africa

Prior to any further exploration of SIM and its application to strategic health policy development, we will explore in greater depth key concepts and organizations in order to more clearly understand the need for a multivariate approach. In particular, each of the three organizations with their ‘silo’ focused programs creates one module of our integrated system. Furthermore, this section will elucidate [for the health policy professionals] the rationale for conjoining the seemingly disparate arenas of human health, animal health, and economic development.

Economic Impact

There is little question HIV/AIDS has made a significant impact upon the African continent. The United Nations Development Programme (2005) points out AIDS has had a more significant role in the reversal of overall human development than any other single factor. One aspect of this development reversal has been the damage that the epidemic has done to the African economy, which in turn, has made it more difficult for countries and populations to respond to the crisis (United Nations Development Programme, 2005). In Uganda alone, thousands of families have endured the death of spouses or parents resulting in one or zero income households as well as the drain of orphaned children on public systems. Additionally, most individuals are dying within the prime of their lives and are decreasing the available labor force which also impacts the economic environment of a given area. In Uganda it is estimated that that AIDS has reduced gross domestic product by 2 percent annually due to the impact of the disease on both morbidity and mortality (Mugyenyi, 2007).

Sub-Saharan Africa is more heavily affected by HIV and AIDS than any other region of the world. Nearly two-thirds (66%) of all people living with HIV are found in sub-Saharan
Africa, although this region contains little more than 10% of the world’s population (UNAIDS, 2006). An estimated 24.5 million people were living with HIV at the end of 2005 and approximately 2.7 million additional people were infected with HIV during that year (UNAIDS, 2006). During 2006 alone, an estimated 2.1 million adults and children died as a result of AIDS in Sub-Saharan Africa. Since the beginning of the epidemic more than 15 million Africans have died from AIDS (UNAIDS, 2006).

The effects of the AIDS crisis have been reaching well beyond the health sector to households, schools, workplaces and economies (AVERT, 2007, Rysavy, 2007). However, it is generally difficult to quantitatively measure the impact AIDS has had on the economies of African countries. Many of the countries considered to be most effected had already been struggling with economic development challenges prior to the epidemic. The effect of HIV/AIDS has exacerbated already profound challenges such as debt and declining trade before the epidemic started to affect the continent. Experts estimate that the impact of HIV/AIDS to sub-Saharan Africa’s gross domestic product (GDP) is a loss of 1%. Although this amount seems modest it is significant over time and compounds already declining areas of productivity (Rosen S. et al, 2004).

As mentioned above, one way in which HIV and AIDS affects the economy is by reducing the labor supply through increased mortality and illness. Amongst those who are able to work, productivity is likely to decline as a result of HIV-related illness. With fewer available workers in the labor market due to death as a result of AIDS, labor becomes more costly and thus limits the ability of the most affected countries to compete for industry and makes investments in African businesses less desirable (Rosen S. et al, 2004). Governmental resources also decline as a result of the labor market, as tax revenues fall but without relief to public agencies burdened to increase their spending to
deal with the social costs of an expanding HIV epidemic (United Nations Development Programme, 2005). Experts agree that HIV/AIDS threatens the foundation of economic development across the African continent by eroding the ability of African countries to diversify their industrial base, expand exports, access capital markets (obtaining financing), and attract foreign investment—activities integral to the economic progress of the continent.

Direct medical costs of AIDS (excluding antiretroviral therapy) in sub-Saharan Africa are estimated at about US$30 per year for each person infected. Unfortunately this amount far overshadows that which is spent by most African countries as it is estimated by UNAIDS (2002) that overall public health spending is less than US$10 per year. The Bureau for Economic Research at Stellenbosch University (2006) estimates that the impact of such meager spending could be decreased through the provision of antiretroviral drugs to people living with HIV. This research body further suggests that if ARV coverage was expanded to reach 50% of those in need of the ARVs then the effect of the epidemic on economic growth has the possibility of being reduced by 17%.

Antiretroviral Drugs

Antiretroviral drugs (ARVs) which significantly delay the progression of HIV to AIDS have been readily available in more affluent areas of the world since 1996 (UNAIDS, 2006). Unfortunately the distribution of ARVs requires the financial resources to fund a system of care and the related healthcare workers. Developing countries often lack these assets and have struggled to keep up with the burgeoning number of people requiring care for HIV/AIDS. For most Africans living with HIV, ARVs are still not available - fewer than one of five in need of the treatment are receiving it. Many millions are not even
receiving treatment for opportunistic infections, which affect individuals whose immune systems have been weakened by HIV infection (AVERT, 2007).

In January 2002 Botswana pioneered the provision of ARVs in Africa with the establishment of its national treatment program. According to World Health Organization figures, 84,000 people were receiving treatment at the end of 2006, including those using the private sector, giving a coverage rate above 95% (WHO, 2007). While most African countries have now started to distribute ARVs, progress in providing sufficient quantities of the drugs has been uneven and Botswana's success has not been emulated elsewhere. Among other African countries that have made advances are Rwanda and Namibia, where more than 70% of people in need of ARVs are receiving them. In Cameroon, Côte d'Ivoire, Kenya, Malawi and Zambia, between 25% and 45% of people requiring antiretroviral drugs were receiving them as of December 2006 (AVENT 2007, WHO, 2007). While South Africa is considered to be the richest nation in Sub-Saharan Africa only 33% of those in need of treatment are receiving it (WHO, 2007). In other countries, such as Ghana, Mozambique, Nigeria, the United Republic of Tanzania, and Zimbabwe, those receiving treatment is less than 20% (WHO, 2007). However, the overall situation is slowly improving; the number of people receiving ARVs in Africa doubled in 2005 alone (WHO, 2006). In 2003 the World Health Organization (WHO) initiated the '3 by 5' program which aimed to have three million people in developing countries on ARVs by the end of 2005. While this target was not reached, a number of African nations made substantial progress toward the goal.

There are a number of impediments to ARV provision. One major challenge is the majority of African countries have a poor healthcare infrastructure and a shortage of medical professionals (AVENT, 2007). Given this factor, a considerable emphasis
needs to be placed not only on the availability of ARVs, but also on the availability of professionals who are able to administer the drugs. Many healthcare professionals are leaving the less affluent developing countries in Africa and moving to areas of Europe and America where they are able to command a living wage (UNAIDS, 2006). Another major challenge is ensuring that drugs are not only disseminated widely but that sufficient quantities of drugs are also supplied. Sufficient quantities of ARVs are critically important once an individual begins ARV treatment as they must continue the regimen for the rest of their life. Should the hospital or dissemination source deplete their supply of ARVs, the interruption in their treatment could result in therapeutic resistance to the drug regimen (WHO, 2006).

**Human Health Approach: Joint Clinical Research Centre (JCRC)**

HIV/AIDS treatment programs will only succeed if they are sensitive to the situation on the ground, not just in terms of the health crisis but also in terms of overall economic and social conditions (UNAIDS, 2006). If facilities are too few in number or if clinics that are in existence are located too far from where the majority of people live, and if the drugs are inaccessible and too expensive for most people to use, the epidemic will continue to spread and intensify (Mugyenyi, 2007). One organization which demonstrates this human health approach to AIDS intervention is The Joint Clinical Research Centre (JCRC) based in Kampala, Uganda. The JCRC was founded in 1991 when it was estimated that approximately 3 million Ugandan adults, roughly 15% of the adult population, was infected with HIV/AIDS.

Mugyenyi (2007) cites that more than 80% of all Ugandans live in rural areas where poverty is most acute. JCRC was founded to match the challenge of developing a system to treat HIV/AIDS that would reach the rural poor, often considered
unreachable" while simultaneously developing and executing a revenue generating strategy to cover a portion of the cost of care. Touted as an “innovative emergency medical facility” JCRC was the first clinic of its kind in Uganda designed to meet this need. Despite the wide reach of care initiatives in which the JCRC is involved they consider the provision of antiretroviral drugs throughout Uganda as being the most important (Mugyenyi 2007). JCRC’s ARV distribution efforts began in 1992 soon after JCRC’s creation at a time when it was thought impossible to launch such an initiative at a rapid pace. Prior to JCRC’s antiretroviral treatment efforts Uganda’s HIV/AIDS treatment facilities were largely located in or around the capital city of Kampala and were few in number due to the exorbitant costs of antiretroviral drugs which Uganda and other developing countries were unable to afford (Mugyenyi, 2007).

Since JCRC’s establishment, the ‘JCRC network model’ where the JCRC main facility is part of a nationwide network of more than 50 research and treatment centers has helped to build Uganda’s research and clinical capacity. JCRC uses both patient fees and research overhead funds to extend care to the impoverished that are unable to pay for treatment and to also build treatment capacity to enhance the reach of the JCRC center’s effectiveness. The JCRC Network model has been cited as “saving thousands of lives and offering an opportunity to train large numbers of healthcare providers as well as establish one of the most advanced diagnostic and monitoring laboratories in sub-Saharan Africa (Mugyenyi, 2007).”

The JCRC primarily takes an approach that is human health based with little attention to animal health or economic development. Although JCRC is involved in education efforts with their treatment population, their educational foci are largely toward HIV/AIDS awareness and ways to stop the spread of the disease. While JCRC’s results are
remarkable, this study finds their approach lacking in the animal health and economic development aspects of care. This is not to say that the silo focus is not effective, but rather collaboration and integration with interventions that combine the other two disciplines would create a multiplier effect on their program impact. By not addressing these other two areas there are gaps in the overall care of the individual, particularly since many living in rural areas are dependent upon healthy livestock for their sustenance and livelihood thus illustrating the link of human health interventions to animal health and economic development (FAO, 2003; Strauss and Thomas, 1998).

Economic Development Approach: Grameen Bank and Grameen Foundation

Microfinance is a leading strategy in economic development built on the idea of making small loans, also known as microcredit, to the impoverished without the formality of collateral required by standard financial institutions. The system is based on the idea the poor are creditworthy and have entrepreneurial skills that are underutilized who, when given the opportunity, will build their own economic capacity (Pronyk, Hargreaves, Morduch, 2007). One of the most notable, the Grameen Bank, is a microfinance organization and community development bank started in Bangladesh. The organization and its founder Muhammad Yunus were jointly awarded the Nobel Peace Prize in 2006 (Nobel Prize website, 2006).

Muhammad Yunus, the bank's founder, was inspired during the Bangladesh famine of 1974 to make a small loan of $27 to a group of 42 families, who had no access to capital through the traditional banking system, so that they could create small items for sale without the burdens of predatory lending (Giridharas, Bradsher 2006). Predatory lending is broadly defined as "the practice of a lender deceptively convincing borrowers to agree
to unfair and abusive loan terms, or systematically violating those terms in ways that make it difficult for the borrower to defend against" (Investor Dictionary, 2007). Yunus believed the poor were creditworthy, predatory lending was a poverty trap, and that making such loans available to a wide population would have a positive impact on the rampant rural poverty in Bangladesh (Yunus, 1999).

Grameen Bank is best known for its system of solidarity lending (Yunus, 1999). Solidarity lending takes place through 'solidarity groups'. These groups are a distinctive banking distribution channel used primarily to deliver microcredit to poor people. By eliminating the need for collateral solidarity lending lowers the costs to a financial institution related to assessing, managing and collecting loans. Fixed costs are associated with each loan delivered which results in substantial administrative savings for a bank that bundles individual loans together (Armendáriz de Aghion, Morduch 2005).

16 Decisions

1. We shall follow and advance the four principles of Grameen Bank: Discipline, Unity, Courage and Hard work – in all walks of our lives.
2. Prosperity we shall bring to our families.
3. We shall not live in dilapidated houses. We shall repair our houses and work towards constructing new houses at the earliest.
4. We shall grow vegetables all the year round. We shall eat plenty of them and sell the surplus.
5. During the plantation seasons, we shall plant as many seedlings as possible.
6. We shall plan to keep our families small. We shall minimize our expenditures. We shall look after our health.
7. We shall educate our children and ensure that they can earn to pay for their education.
8. We shall always keep our children and the environment clean.
9. We shall build and use pit-latrines.
10. We shall drink water from tubewells. If it is not available, we shall boil water or use alum.
11. We shall not take any dowry at our sons' weddings, neither shall we give any dowry at our daughter's wedding. We shall keep our centre free from the curse of dowry. We shall not practice child marriage.
12. We shall not inflict any injustice on anyone, neither shall we allow anyone to do so.
13. We shall collectively undertake bigger investments for higher incomes.
14. We shall always be ready to help each other. If anyone is in difficulty, we shall all help him or her.
15. If we come to know of any breach of discipline in any centre, we shall all go there and help restore discipline.
16. We shall take part in all social activities collectively.

Figure 2
The Bank also incorporates a set of values embodied in Bangladesh by the Sixteen Decisions (Grameen, 2007) as shown in Figure 2.

The Grameen system is the basis for the microcredit and self-help group system now in place in over 43 countries. Although it is required that each borrower belong to a five-member lending group, it is not a requirement that other members give a loan guarantee to the other members of the group. Rather, repayment responsibility is that of the individual and rests on the individual borrower, while the lending group and the overarching lending center see that everyone is responsible for their individual actions. Joint liability where group members are responsible to pay on behalf of a defaulting member is not part of the Grameen system (Yunus, 1999).

Grameen Foundation, is a global 501(c)(3) non-profit organization based in Washington DC that works to replicate the Grameen Bank microfinance model around the world through a global network of partner microfinance institutions. Grameen Foundation operates under the mission, "to empower the world's poorest people to lift themselves out of poverty with dignity through access to financial services and to information" (Grameen Foundation, 2007). The reach of Grameen Foundation is substantial—as of March 2007 the foundation has worked with over 40 microfinance institutions reaching over 3.5 million clients across 25 countries (Grameen Foundation, 2007).

The Grameen microfinance model can be very effective as the economic development component mentioned in the Systems Integration Model. Grameen estimates that close to 50 million borrowers in Bangladesh have risen out of acute poverty as a result of their loan. Their rise from poverty is measured by such standards as the ability to repay an approximate 4 USD loan, having all children of school age in school, all household
members eating three meals a day, a sanitary toilet, a rainproof house, and clean drinking water (Grameen, 2007). Thus we see that microfinance is a beneficial tool in enabling the very poor to make human capital self-investments in nutrition, sanitation, and education.

Despite the enormous reach of microfinance across the world, economic development alone lacks the components of animal health and human health interventions. In terms of Africa and its endemic health problems, this “silo” creates gaps as many entrepreneurs utilizing microfinance funds are livestock farmers without animal health strategies to maintain a healthy disease free population, or with cultural mores that continue to put them at risk of contracting HIV/AIDS. Microfinance programs such as Grameen’s could strengthen their impact by combining these two areas of intervention so as to have a greater positive impact upon the individuals whom they serve.

Animal Health and Economic Development: Heifer International

More than 90% of the estimated 36 million people living with HIV/AIDS are living in developing countries (WHO, 1999) with agricultural pursuits as both their primary means of income and food source. The World Health Organization has indicated that the “impact of the epidemic [HIV] in these countries has been greatest in rural areas and has spread to remote villages, where it has impaired food production, including animal husbandry (FAO, 1999).” This statement by the FAO suggests a critical relationship between human health, animal health and agricultural economic development in emerging world areas.

Heifer International is known for taking a systems approach to animal interventions with an economic development aspect. Heifer International is a non-profit charitable
organization based in Little Rock, Arkansas, with its mission to "relieve global hunger and poverty." With a world-wide reach Heifer International provides gifts of livestock and plants, as well as education in sustainable agriculture, to financially-disadvantaged families (Heifer 2007).

The founder of Heifer International, Dan West, started the organization while a relief worker in Spain during the Spanish American War. Frustrated with having to decide how to allocate food aid resources he felt that there must be a way to promote permanent freedom from hunger by providing livestock and training so as to spare individuals from depending upon others to feed themselves and their children. The philosophy of Heifer International is based upon the adage, "Give a man a fish; you have fed him for today. Teach a man to fish; you have fed him for a lifetime (Heifer, 2007)."

The organization was started in 1944 when 17 heifers, young cows that had not yet given birth, were shipped from the United States to Puerto Rico in hopes of providing a continual source of milk, offspring, and fertilizer. Dan West's vision for Heifer revolved around the idea that a single gift would have a reach much greater than the initial gift itself, and multiply far beyond the original investment. In an effort to achieve the long term goal of having each gift animal to retain a lasting benefit in the region, West asked each recipient family to agree to an education in animal husbandry and to donate any female offspring to another family (Heifer, 2007).

In subsequent years, Heifer International has expanded to over 125 countries and has grown to include other livestock including sheep, rabbits, honeybees, pigs, llamas, water buffalo, chicks, ducks, goats, geese and trees as well as heifers. However, rather than purchasing the livestock and shipping it to various countries the livestock is purchased in
the country it is destined for. The rationale for this approach is to infuse capital into the local economy, reduce transportation costs, and promote better health for the animals due to their being accustomed to the local climate, food and diseases (Heifer, 2007).

West also felt that animals provided a means far beyond that of any other financial type of intervention. For instance, goats, water buffalo and camels are considered "seven M" animals because they provide “meat, milk, muscle, manure, money, materials and motivation.” In another unique approach Heifer International provides a breeding animal along with the gift animal so that it can produce offspring. In this manner the family is required to "pass on the gift" and give at least one of the female offspring to a neighbor who has undergone Heifer's training. That neighbor must, in turn, “pass the gift” and will, in time, pass along one of the offspring of its animal (Heifer 2007). This method helps an entire community to develop self-sustaining, capacity building economic development.

Heifer is an excellent example of a multivariate approach of dealing with poverty by combining areas of economic development and animal health. Despite this and the organization’s involvement in educational initiatives, the area of human health does not appear to be a part of its core mission. This being said there are some corollary positive impacts that can be assessed from Heifer's approach. By providing a source of food there is a positive correlation to improvements in human health. Likewise, by providing a source of income the animals can indirectly impact human health by providing financial resources for human health interventions such as ARV's and other medical care. However these interventions are implied and do not appear specific to Heifer International.
**Systems Integration Model**

*Human Health*

When considering human health interventions as a sphere of the *Systems Integration Model* there must be an emphasis on the disease process, and in the case of this concept paper, the disease process of HIV/AIDS. Considering Figure 3, there are a wealth of multidisciplinary factors at work within the aspect of human health and the disease process with HIV such as cultural contexts. Considering areas of Africa, tribal interventions and tribal healers can present positive as well as negative cultural
interplays. For instance, a tribal healer could influence their followers to take anti-retroviral medicines and other interventions known to be advantageous to assist in slowing the disease process of HIV/AIDS. However, the cultural and tribal influence could also be detrimental if the belief is that herbal therapies are seen as acceptable remedies to slow the progression of HIV/AIDS.

Again referencing Figure 3, contracting HIV/AIDS leads to the increased susceptibility of an individual to opportunistic infections such as pneumonia and Kaposi's Sarcoma. Opportunistic infections are infections caused by pathogens that usually do not cause disease in a person with a healthy immune system, but can affect people with a poorly functioning or suppressed immune system. These pathogens take this "opportunity" to cause an infection (Goldsby, et al. 2003). These opportunistic infections can quicken the disease process. Further, HIV/AIDS disease processes are exacerbated by issues of poverty, famine, and malnutrition. Many individuals with HIV/AIDS typically have difficulty assimilating what food they consume, worsening already present malnutrition issues. This is secondary to lack of economic resources to purchase foodstuffs, supplies to farm, or otherwise produce food (UNAIDS, 2004).

Therefore, when intervening in the area of human health one must look beyond an approach that focuses on the disease process. Many aid organizations are focused on the intervention of antiretroviral medications to combat HIV. Although they are an excellent starting point for treatment, in actuality, an approach that touches the entire system of human health including care (or lack of care) within cultural contexts and poverty, including malnutrition and famine issues must also be addressed.
Animal Health

Animal health is also an important sphere in the proposed Systems Integration Model. Considering Figure 4, one can see a diagram of proposed interrelated factors stemming from animal health.

In most developing parts of the world livestock is seen as a primary medium of trade as well as a staple food source. It provides tremendous opportunities for poverty reduction, given an estimated 42% of the poor worldwide are dependent upon livestock as part of their livelihood (Thorton et al., 2002). In the area of animal health the disease process must be intervened upon as it has a direct impact upon human health. Two such diseases with a direct human-animal connection are avian influenza and hoof and mouth disease. The World Organization of Animal Health's position supports the proposed
model in that the "avian influenza epizootic shows the extent to which a serious event affecting the animal kingdom can have global consequences both for the rural economy and food security, while causing threats to public health (2005)." In addition, if someone is infected with HIV/AIDS these animal diseases could also prove to be deadly as the individual has a compromised immune system and thus a decreased resistance to opportunistic infections as mentioned previously.

The intersection of livestock health and related disease processes are also closely associated with the overall field of agriculture, farming and crop production, feed production, and ultimately food safety and "security." Unavailable adequate and nutritional feed production increases the probability of livestock succumbing to disease, thus amplifying threats to overall human food security and direct impacts to human health. It has been noted by a number of authors, and in particular the World Organization for Animal Health (OIE) that these zoonotic diseases can be a great source of panic on a global scale and cause considerable economic and social disruption on a global scale (OIE, 2005).

Another area of interrelatedness that ties directly into the overall health of livestock is feed production. If feed production is in some way decreased or becomes diseased then livestock may become sick thus rendering it unfit to eat. The ability for individuals within developing areas to have healthy livestock directly relates to adequate and nutritional feed production. Healthy livestock, in turn, leads to nutritional and adequate foodstuff production. Over the last 20 years it has been determined by researchers that due to a lack of feed resources domestic livestock production has largely not satisfied increased national meat or milk demand (Pica-Ciamarra, 2004). This example illustrates the interconnectedness of human and animal health.
Food security as a concept refers to "physical and economic access to food of sufficient quality and quantity" (FAO, 2005). The FAO (2004, 2005) further adds that "food security is necessary, but of itself insufficient, for ensuring nutrition security. Nutrition security is achieved for a household when secure access to food is coupled with a sanitary environment, adequate health services, and adequate care to ensure a healthy life for all household members." Clearly, the achievement of food and nutrition security is based upon interventions which occur at both animal and human health levels.

**Economic Development**

The third sphere in the *Systems Integration Model* (Figure 5) encompasses economic development and related factors. In many aspects it is the engine that runs the gears or spheres of the SIM. Access to finance is seen as the key driver in unlocking economic growth in Africa as well as in other developing parts of the world (Honohan, Beck, 2007)." Although it is commonly believed that poor and impoverished individuals do not typically utilize financial services, they do in fact actually utilize financial services to seize business opportunities, improve their homes, contend with large expenses, and cope with emergencies (Littlefield and Rosenberg, 2004).

Many impoverished individuals lack access to banks and other formal financial institutions. However, informal financial systems (e.g. moneylenders, savings and credit clubs, and mutual insurance societies) are available in nearly every developing country (Littlefield and Rosenberg, 2004). The poor can also tap into their other assets, such as animals, when the need arises. However, financial services usually available to the poor are crippling in terms of cost, risk, and convenience. Livestock cannot typically be divided and sold in parcels to meet small cash needs. Credit, especially from moneylenders, is often very expensive. Other constraints exist with other informal means
of finance including a lack of flexibility in amount or in the timing of deposits and loans, minimum amounts, inflexible withdrawal rules, and collateral requirements that exclude most of the poor. Overall these limitations and requirements of traditional finance institutions have resulted in a failure to meet the needs of the poor (Littlefield and Rosenberg, 2004).

In an effort to meet the financial needs of the poor, Microfinance institutions (MFIs) have emerged over the past three decades. Most early MFIs operated as nonprofit, socially motivated nongovernmental organizations developing new credit techniques. These novel approaches included not requiring collateral, group guarantees to reduce loan risk, appraisals of household cash flow, and small initial loans to test clients. Since the inception of the MFI movement it has been noted that the poor repay uncollateralized loans reliably and are willing to pay the full cost of providing the loans as access to capital is more important than the cost of the capital (Littlefield and Rosenberg, 2004). According to Grameen's records, the poor have a repayment rate above the 95 percentile range, a stark comparison when one considers that most private banks in the world lending exclusively to the "creditworthy" and affluent only maintain a repayment rate in the high 80's or low 90's (Yunus, 1999).

In a recent Millennium Challenge Hearing (2007) it was determined that "the most pressing needs in African finance are (a) to increase the availability and lower the cost of credit to productive enterprises and (b) to extend the reach of basic savings, payments, credit, and insurance services for low income people and for the smallholder farms and microenterprises that provide their livelihood (Millennium Challenge Hearing, 2007)." Microfinance is a direct answer to these pressing needs.
Microenterprise is an example of what Midgley (1995) has called a “developmental approach to improving social welfare.” A social welfare provision refers to “any government program and which also seeks to provide a minimum level of income, service or other support for disadvantaged peoples such as the poor, elderly, disabled, students, unpaid workers (e.g. mothers and other caregivers), and minority groups. Social welfare payments and services are typically provided free of charge or at a nominal fee, and are funded by the state, or by compulsory enrollment of the poor themselves (Policy Almanac, 2007).”

Combining social and economic development approaches, microenterprise provides opportunities for the poor to successfully compete in the market economy (Servon, 1999). This is important because individuals with diseases of poverty are more likely to have access to goods and services to decrease the resultant health impacts of their disease if they are able to have economic means. This can be illustrated in Figure 5 of the Systems Integration Model:

![Diagram](image)

Although the concept of economic development is very broad and wide reaching, for the purposes of the Systems Integration Model the concept will primarily encompass the
area of microenterprise which has subsets of microloans and microfinance. Microenterprise development programs (MDPs) assist low-income people to develop very small businesses by offering micro-loans and, depending on the program, training, technical assistance, and other support.

When one looks at the concept of economic development we can see the links that exist between the other SIM spheres of human health, animal health and worker availability and productivity. The FAO indicates that there are over 450 million waged agricultural workers in the world (FAO, 2005), and that HIV/AIDS "disproportionately affects sectors that are highly labor-intensive or have large numbers of mobile or migratory workers, including agriculture, transportation and mining (FAO, 2003)." Workers who do not have their nutritional needs met due to poverty and famine will experience a decline in their productivity and thus their capacity to be involved in microenterprise ventures also will be negatively impacted (Strauss, Thomas, 1998). From this we can ascertain that the economic development sphere as a gear of SIM cannot turn outside the proper functioning of the spheres/gears of human health and animal health.

Basic economics dictates that when individuals are financially equipped to contribute to the infrastructure of an area through taxes and other means then the regional infrastructure often improves and the impact upon the encompassing area is as significant as that of the impact upon the entrepreneur who founded the venture. This ripple effect can positively impact the sustainability of the area economy. Resource allocation based upon credit worthiness and prospective returns can allow a finance-rich economy greater conduciveness to distribution of economic power and influence, which, ideally will lead to improved national economic performance (Eifert, Gelb, and Ramachandran 2006; Rajan, Zingales 2003). Conversely, if individuals are not offered
opportunities to participate in microenterprise development then the economy of an area may deteriorate due to a lack of positive cash flow in the form of taxes and other revenues to build an area’s infrastructure.

From an animal health perspective, livestock are considered a foundation for economic support of livestock keepers, consumers, traders and laborers throughout the developing world (Pica-Ciamarra, 2004). From this we extrapolate that disease affecting livestock has great potential to have significant impact on food security, especially aspects of animal production and productivity, on “human health (diseases transmissible from animals to humans), (Pica-Ciamarra, 2004)” and, consequently, on the overall process of economic development.

Yet another impact of the animal and human disease is upon sustainable economies. Consider that in Asia, more than 140 million birds have died or been destroyed at a cost of 10 billion to 15 billion USD as a result of avian influenza (FAO, 2005). This type of tremendous economic impact also has profound effects on the impoverished for whom there are already limited resources. An FAO study estimated that in Vietnam alone, avian influenza had affected 36 000 people living on the edge of poverty and 88,000 who were at or below poverty (FAO, 2005). Therefore the capacity to have a sustainable economy is compromised when there are compromises to food security. Thus we see within the SIM that animal health is a gear that can drive or stall the gears of economic development.

Considering the economic impact-HIV interconnectivity, it has been noted that “poverty and food insecurity may place people in situations of heightened risk of exposure to the [HIV]” (FAO, 2004). This assertion is based upon the widely documented probability that
hungry individuals will go to great lengths to earn money—such as separation from family to earn a livelihood or transactional sexual behavior—to buy food (WHO, 2005). Furthermore, in the case of individuals who are already HIV positive, lack of food often leads to malnutrition and compromises the immune system, thus affording a greater possibility for opportunistic infections.

The systems integration model is an intervention concept to treat endemic health issues, such as HIV/AIDS in Zambia. To intervene in the human health sphere alone is insufficient unless human health operates within a vacuum.

**Implications and Conclusions**

The systems integration model dictates that human health is integrally interlinked with animal health and economic development. It has been demonstrated that human health, animal health, and economic development are not just peripherally linked, but rather interdependent upon each other for functionality. The diagram in Figure 6 illustrates the interconnectedness of the areas described within the context of the Systems Integration Model:
More questions than answers remain when considering possible intervention tactics. One could surmise that given the interconnectedness of these three areas that an intervention model with equal interconnectedness would be called for. In actuality, this has been true from a theoretical perspective. Over the last 40 years there has been recognition that “knowledge on technical, socio-economic and cultural aspects needs to be integrated to develop sustainable innovations (Cernea, 1991; Dusseldorp and Box, 1990).”

However, despite this recognition to integrate disciplines and develop multivariate interventions, such, interventions appear to remain “silo-ed” within each particular domain. For example, in a recent evaluation of extension workers who regularly interact
with agriculturally based workers (e.g. crop farmers, livestock farmers and fishers) it was found that these staff are not involved in any type of public health intervention (e.g. HIV/AIDS interventions), as it is perceived as a health matter and does not fall within their “mandate.” This “siloing” demonstrates how one area of intervention (animal health and agriculture) could be incorporated into public health interventions. The FAO asserted that the “agricultural sector must recognize that the epidemic is not only a health issue, but a development issue” (FAO, 2003).

Considering the literature, there are many proposed interventions to the challenges AIDS presents. The linkage between agriculture and HIV, it has asserted (HSRC, 2003) that “clear guidelines for good practice are scarce...interventions should combine prevention, mitigation and care, be sensitive to the variety of needs of households, go beyond labor-saving technologies, and learn from practice (HSRC, 2003).” Swaans, Broerse and Bunders, (2000) state that particularly at the interface of agriculture and HIV/AIDS there is “almost no systematic knowledge to build upon,” thus making the challenge to find interventions more difficult.

Other authors contend that because many farmers affected by HIV/AIDS are subsistence farmers, “agricultural innovation should be seen in a broader livelihoods perspective to be effective (Gillespie et al., 2001; Seeley, 2002; Harvey, 2004; du Guerny et al., 2002),” with the implementation of large scale governmental policy change regarding poverty-livestock programs (Pica-Ciamarra, 2004).

Although there is evidence that agricultural organizations working in research, development and extension can contribute to the prevention and spread HIV as well as mitigate AIDS' impacts (Ngwira et al., 2001; Loevinsohn and Bigman, 2001), it is also
clear that there is a poor base of evidence to guide action: evaluated experience is rare, studies are scattered and of small scale (Ngwira et al., 2001; HSRC, 2003). There have been “few studies [that] have rigorously investigated the direct impact of food insecurity on the adoption of high-risk behaviors, and those who have done so use a poverty/equity lens without consideration to the multiplicity of concerns faced by people with HIV (Farmer 1999; Loevinsohn and Gillespie 2003a),” thus demonstrating the need for expansion of intervention impact measurement.

Since we know that human health is linked to animal health and economic development in emerging world areas and there is a significant need for a combination of the approaches to expand into a new practice. We have shown the links between human health and economic development, and animal health and economic development, as well as ascertained the correlation between human health to animal health. This paper proposes the application of the systems integration model as the bridging methodology for interventions that would incorporate the practice of all three.

The SIM intervention concept envisions organizations such as JCRC, Grameen, and Heifer partnering to form regional cooperatives with a tri-fold mission considering the well-being of the treatment population as whole beings requiring not just singular treatment, but rather a greater totality of care. Such cooperatives would enable the treatment population to develop or be employed by agricultural microenterprises funded under a microloan format with the resource capacity to intervene with the treatment population in terms of health, technology, animal husbandry and finance. The cooperative action of the SIM concept would bring together the knowledge and infrastructure of three organizations practicing disparate disciplines, creating a multiplier effect on the impact of the integrated intervention. Because of the intervention (“the fix”)
occurs to all three “gears” of the system, the efficacy of treatment is far greater because
the human health intervention is given to a recipient who enjoys the benefits of improved
nutrition, housing, means to acquire medications, economic stability which is translated
into more effective participation in the economic infrastructure which infuses the
maintenance of the food supply. Thus one gear perpetuates the turning of the other and
the human engine progresses.


http://whqlibdoc.who.int/trs/WHO_TRS_907.pdf


Enemy at the gate: saving farms and people from bird flu: Asia reels from bird flu - Disruption of family life, diet, regional economy  


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