

REVIEW

Competing food concepts – Implications for Hawai'i, USA

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Abstract

As public interest in food security continues in Hawai'i and elsewhere in the United States of America, so does the deluge of competing food concepts. Many issues in these overlapping concepts remain hazy, with various proponents advocating for different objectives. While food self-sufficiency is less desirable from an efficiency or trade standpoint, this does not preclude its usefulness for noneconomic policy objectives. In Hawai'i, free trade has opened a pathway for invasive species that is destructive to local agriculture, native species, and the host ecosystem. Due to Hawai'i geographic isolation and cultural diversity, many residents will support food concepts which promote the theme, "local production for local consumption, under local control," despite apparent advantages in food security which impacts more people in more places than other competing food concepts.

Background

As public interest in and debate about food self-sufficiency and food security continues in Hawai'i and elsewhere in the United States of America (USA), so does the deluge of competing concepts that share the common goal of increasing food consumption arising from local sources.

Some of the other more popular food concepts being discussed include food sovereignty and food localization. Meanwhile, the issues of food self-sufficiency and food security remain hazy, with various proponents advocating for different policy objectives. This divergence in opinions is to be expected as food, like politics, religion, or culture, can be emotionally charged and tends to elicit strong

viewpoints. The purpose of this paper is to clarify the various concepts mentioned above, explore the motivations and intents of advocates for each, suggest possible metrics with which to measure the extent of the activity, and to discuss the relevance within the context of a small, open economy such as Hawai'i, USA.

The state Office of Planning in a recent report suggests that food self-sufficiency enjoys unequivocal support under Article XI, Section 3 of the Hawai'i State Constitution (OP-DBEDT, 2012). A closer review of the section suggests this may be the case if food self-sufficiency is considered a subset of agricultural self-sufficiency.

Hawai'i State Constitution, Article XI, Section 3

The state shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands. The legislature shall provide standards and criteria to accomplish the foregoing. Lands identified by the State as important agricultural lands needed to fulfill the purposes above shall not be reclassified by the State or rezoned by its political subdivisions without meeting the standards and criteria established by the legislature and approved by a two-thirds vote of the body responsible for the reclassification or rezoning action.

Irrespective of the State Constitution, most food policy pundits would argue that the recent food security concern in Hawai'i and the United States was sparked by the global food crisis in 2008, triggered by a combination of skyrocketing oil prices, depreciating U.S. dollar, increasing demand for biofuels, and export restrictions imposed by leading food producing countries (Heady and Fan, 2008).

Economics of Food Self-Sufficiency

Within a neo-classical context of achieving economic efficiency, food self-sufficiency as a policy objective, as opposed to free trade, is arguably irrelevant. The works of Adam Smith and David Ricardo, among many economists, have long established the value of specialization and gains from free trade.¹ However, food self-sufficiency has captured the imagination of many advocates in the areas of development and politics with broader policy objectives, both in low- and high-income countries. In the 1960s, food self-sufficiency was an important tool for many developing countries, providing the impetus to feed the population, create employment and capital, and earn scarce foreign exchange (Ruppel and Kellogg, 1991). It was often instituted with a complementary policy of tariffs and quotas to protect domestic agricultural producers. In developed countries, the focus is traditionally on the production of grains, commodities which can be stored and preserved for an extended period of time. Hawai'i, in contrast, is neither a commercial producer of grain nor

has the privilege, as a state in the USA, to impose tariffs or duties on imported food.

Food self-sufficiency is often measured by the self-sufficiency ratio (SSR). Likewise, there is a complementary measure referred to as the import dependency ratio (IDR). The Food and Agricultural Organization of the United Nations (FAO) defines SSR as the proportion of domestic production in relation to domestic food utilization, excluding stock changes and IDR as the share of imports in relation to domestic food utilization, excluding stock changes (FAO, 2001). Both the SSR and IDR are measurable for individual and aggregate food groups. In general, we can define SSR and IDR as follows:

$$SSR = \frac{P}{P + M - X} \cdot 100\% \quad (1)$$

$$IDR = \frac{M}{P + M - X} \cdot 100\% \quad (2)$$

where P = local production of food; M = food imports; and X = food exports.

More complex derivations are possible to account for other pertinent issues relating to food self-sufficiency, such as commodity specification, location coverage, link to nutritional need, and time frame (Staatz, 1991). A full treatment of commodity specification may include considerations such as commodity type (e.g., coffee), variety (e.g., Kona), grade (e.g., extra fancy), and date and provision place (e.g., 30 March to Honolulu). However, the inclusion of more issues lead to added complexity, and the net benefits on such an extended approach is often marginal.

A recent benchmark study estimated Hawai'i's overall food SSR at 15.7% in 2010 and its overall food IDR at 102.5% (Loke and Leung, 2013). While the IDR exceeding 100% appears counterintuitive, it actually indicates the presence of food imports into Hawai'i, which are then turned around and reexported to other markets. A more accurate set of measures is presented in a later section.

It is clear from Equation (1) that domestic food utilization is dependent on the supply sources (local production and net imports). Another important exogenous factor is real income. As citizens enjoy higher incomes, they tend to upgrade their diet to real or perceived, higher quality/healthier food products (e.g., switching from conventional to organic foods). South Korea, from the mid-1950s to the late 1970s provided a good case illustration of this phenomenon. Facing a pervasive security threat from the North, South Korea pursued a policy to increase its food self-sufficiency in rice. Hence, the government offered generous subsidies to increase rice production without differentiating varieties or quality. By the late 1970s, the government had amassed large stockpiles of rice from high-yielding but low-quality varieties, which South

Koreans did not care to consume (Staatz, 1991). As it turns out, the demand and supply disequilibrium for rice was caused by rising income in South Korea, which increased sixfold between 1960 and 1980. As South Koreans enjoyed higher income, they demanded higher quality rice; much of it was satisfied via imports, and to the detriment of the nation's self-sufficiency policy.

Likewise, a top Chinese government official announced in January 2013 that China has stopped pursuing self-sufficiency in food production as rising incomes and rapid urbanization have favored a wider selection of imported foods (SCMP, 2013). China had earlier established a self-sufficiency target of 95% in its 5-year agricultural development plan for 2011–2015. While food self-sufficiency is inconsequential from an economics perspective, nevertheless, there are compelling noneconomic objectives to supporting this concept. More discussions will follow in a later section.

Concept of Food Security

Like food self-sufficiency, the term food security can mean different things to different people. The formal definition is rather *dynamic* and has evolved in stages over time. Food security was initially used to describe if a country had access to sufficient food to meet dietary requirements; and national food security was used by some practitioners to mean self-sufficiency (Pinstrup-Andersen, 2009). The origin is probably ancient as writings in the some of the world's greatest civilizations, from the Sumerians, Indus Valley, and Mayans have indicated the desire to achieve a certain level of food security. In more recent history, multi-lateral national food security policies and plans were established following the Second World War in Europe to address food shortages caused by a combination of factors, including disruptions in food production, rationing and price controls, tight foreign exchange controls, declines in foreign trade, and interruptions to the food supply chain (FAO, 1996).

The initial, formal food security definition, accepted internationally at the World Food Conference (1974) came with a supply side focus. The statement below articulates clearly the issues of consistent food availability and price stability of basic foodstuffs at both the national and international levels:

Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices. (World Food Conference 1974)²

In subsequent years, additional works on food security have led to an increasing focus on the demand side; the inclusion of individuals and households, over and above

the national and international definitions; the introduction of temporal analysis in food insecurity; and chronic versus transitory paradigms (FAO, 2006). A more inclusive definition of food security, one which expresses the multiple dimensions of food availability, access, utilization, and stability (as well as incorporating food supply and demand), was adopted at the World Food Summit in 1996:

Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. (World Food Summit 1996)³

The four dimensions of the food security definition above are expressed as follows:

- **Availability:** Addresses the physical availability of appropriate quality food from two primary supply sources – domestic production less exports and imports;
- **Access:** Ensures individuals have adequate physical and economic resources to acquire appropriate quality food that meets their nutrition and dietary requirements. This concept includes having the economic means to grow food, to generate income streams, to trade and exchange; and access to social-political arrangements such as family, traditional rights, institutional and social services. Alternately, food access is the demand for food and is a function of food prices, functional markets, income, preferences, and demographics⁴;
- **Utilization:** Addresses nonfood inputs that are complementary to the effective utilization of food consumed to achieve nutritional well being. The inputs include knowledge of dietary requirements and access to clean water, adequate sanitation, and proper healthcare to meet the level of physiological well being of individuals; and
- **Stability:** Ensures that other dimensions of food security (availability, access, and utilization) are not lost as a consequence of sudden shocks (political, economic, or force majeure events).

The definition is further refined to include the concept of “food entitlement” in the State of Food Insecurity 2001, as follows:

Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. (State of Food Insecurity 2001) (FAO, 2003)

Beyond that, various authors have noted the many different definitions of food security as proposed over time. A decade ago, there were ~200 definitions and 450 indicators of food security (Hoddinott, 1999). Among the more widely acceptable definitions, many have origins in the United Nations and institutions within the United States government.

The US Congress and USAID define food security as follows:

Access by all people at all times to sufficient food and nutrition for a healthy and productive life. (The Agricultural Trade Development and Assistance Act of 1990 [P.L. 480]) (AID, 1992)

and

When all people at all times have both physical and economic access to sufficient food to meet their dietary needs in order to lead a healthy and productive life. (USAID Bureau for Africa, 1986) (AID, 1992)

Likewise, the United States Department of Agriculture (USDA) defines food security for a household as follows:

Access by all members at all times to enough food for an active healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods; and (2) assured ability to acquire acceptable foods in socially acceptable ways (i.e., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies). (ERS, 2013a)

Clearly, the definitions mentioned above have evolved over time, and the focus has progressively shifted from the global, regional, and national levels to the individual household and citizen. The definitions also show distinct similarities and differences. Obviously, it is the differences that may have caused the most confusion. Additionally, some of the normative terms used, such as “sufficient,” “adequate” or “enough” food; “active” versus “productive” life; and food preferences – “acceptable food” versus “nutritional needs” – lack specificity, hence making it difficult to apply in an operational setting.

Finally, justice is not served without mentioning food insecurity. This flip-side concept of food security is widely reported, and the USDA defines it as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (ERS, 2013a). Measures of food insecurity and food security in the United States are based on data collected as part of the Current Population Survey (CPS) which includes over 50,000 households at the state and national levels. The latest empirical measure on the prevalence of food insecurity shows that 14.7% of households in the United States were food insecure (85.3% food secure), compared to 13.8% of households

in Hawai‘i that were food insecure (86.2% food secure) from 2009 to 2011 (ERS, 2013b). The proportion of households with very low food security was similar, 5.6% in the same time period for both the United States and Hawai‘i. It goes to show that Hawai‘i, as a state, enjoys a moderate degree of food security. It has a functional food supply chain that sources food from local production, the continental United States and foreign countries. The fairly well-established produce wholesalers, retail grocery chain stores, wholesale discount stores, and military commissaries, located primarily in urban areas, all deliver quality foods to local residents, stationed military personnel and dependents, and tourists.

Food Sovereignty

As food security is focused on food availability, access, stability of supply, and utilization, it is neither hostile to imported food nor biased in favor of locally produced food. Rather, it promotes economic efficiency and enhanced productivity in food production, which are directly linked to specialization, mechanization, and scale of production. However, these same tenets have been criticized by disenfranchised groups as being justifications for implementing misguided policies to deliver food to consumers by any means. This dissatisfaction with the existing global, multilateral food security establishment led eventually to the formation of the food sovereignty movement.

The original definition of food sovereignty was coined by members of the European organization, *La Via Campesina* in 1996. The organization was founded in 1993, in response to the fear of farmers in Europe of losing their lucrative agricultural subsidies and protectionist policies in the wake of accelerating liberalization of the global agricultural trade (Aerni, 2011). Accordingly, *La Via Campesina* (2003) describes food sovereignty as follows:

... the right of peoples to define their own food and agriculture; to protect and regulate domestic agricultural production and trade in order to achieve sustainable development objectives; to determine the extent to which they want to be self-reliant; to restrict the dumping of products in their markets ... Food sovereignty does not negate trade, but rather, it promotes the formulation of trade policies and practices that serve the rights of peoples to safe, healthy and ecologically sustainable production. (Condra, 2011)

The organization further asserts the role of government to “uphold the rights of all peoples to food sovereignty and security, and adopt and implement policies that promote sustainable, family-based production rather than industry-led, high-input, and export-oriented production, including food safety.” (Condra, 2011)

More recently, the newly formed Alliance for Food Sovereignty in Africa (AFSA) defines food sovereignty more succinctly as follows:

Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems...(AFSA, 2013)

AFSA further extends the essential characteristics of the food sovereignty concept back to the site of food production as follows:

- Villages, counties, countries have control of their food production and supply;
- Food availability in sufficient quantities and quality; healthy food;
- Food that is culturally appropriate;
- Production systems that are environmentally sustainable;
- Production systems that recognize the rights – genetic resources, seeds, water, gender, land;
- The right to choose; and
- The protection of biodiversity and local knowledge systems.

The food sovereignty and food self-sufficiency concepts are arguably similar as they focus on consumption of food arising from domestic sources. The former concept has gained significant momentum since the UN Declaration of the Rights of Indigenous People (UNDRIP) was adopted by the United Nation's General Assembly in 2007. Some 144 countries supported the declaration, and only four were opposed (Australia, Canada, New Zealand, and the United States). By 2010, all four countries had reversed their initial opposition and moved to endorse the declaration.

Hawai'i, once a sovereign nation and now part of the United States, offers a unique setting that rekindles the cultural production and consumption of food of the host indigenous population. Since passage of the "Apology Resolution" by the United States Congress and President Clinton in 1993 (United States Public Law 103–150),⁵ we have witnessed a renaissance movement by various cultural groups to restore many of the self-sufficiency and sustainability practices of traditional Hawaiian agriculture. Some of the more familiar names in this Hawaiian food sovereignty movement include the Ma'ō Organic Farms, the Ka'ala Farm, and the Waihole Poi Factory and Farm on O'ahu, and the Waipa Foundation on Kaua'i. One of the rallying themes for this movement revolves around the following question "How was it that a million⁶ pre-contact native Hawaiians could rely upon finite resources on land and in the ocean to feed themselves?" The answer to this question may rest in the ancient ahupua'a land

division system in Hawai'i, which is adept at managing finite natural resources from the mountain peaks to submerged lands in the ocean (Kirch, 1985; Kamehameha Schools, 1994; and Blaisdell et al., 2005). To date, empirical measures on this concept are wanting.

Food Localization

Food localization is a concept similar to food sovereignty, and it is often lauded as a counterpoint to global industrialization of the food system. While there is disdain toward the global food conglomerates, there is even more scorn levied at the carbon footprint created by transporting food over long distances. Considering that most food items on average travel 2092 kilometers (1300 miles),⁷ consumers are quite aware that transportation of their food is dependent on fossil fuels, which are mostly imported. Reflecting this trend, one often quoted statistic offered by Joan Gussow, Professor Emerita at Columbia University and local food movement pioneer is that a 5-calorie strawberry flown to New York from California requires 435 fossil fuel calories (Gussow, 2001).

While there is no consensus on the definition of local food, a crucial marker for localization, proponents are quick to suggest optimum distances food should travel between where it is grown and the market where it is sold. Others have also suggested as limits, the state or geographic region where the food originates or, in some instances, a particular length of time that the food should travel. In the 2008 Food, Conservation, and Energy Act (2008 Farm Bill), the United States Congress adopted a definition stipulating that the total distance that a product can be transported and still be considered a "locally or regionally produced agricultural food product" is less than 644 kilometers (400 miles) from its origin, or within the state in which it is produced (Martinez et al., 2010). Stricter *locavores* (*localvores*) may define "local" as the radius of 161 kilometers (100 miles) from the where the farm grows food to where it is ultimately consumed (Roosevelt, 2006).

In the retail world, many of the leading national grocery chains also have different definitions of "local." Whole Foods considers as local products that have traveled less than a day (7 or fewer hours), but many stores have established shorter maximum distances (Whole Foods, 2013). Chris Morran, writer for the *Consumerist* provided a succinct summary of the definition of "local" given by various national chain stores:

Wal-Mart defines "local" as grown and sold in the same state. Safeway (including Dominick's, Genuardi's, Von's and Randall's) states produce isn't "local" if it requires more than 8 hours on the road to reach the store. Kroger (including Ralphs, Fred Meyer and Fry's) says "local" can refer to

produce grown in the same state or within the same region of the country. Supervalu (including Albertsons, Acme, Shaw's and Jewel-Osco) says "local" can mean something different at each of the company's subsidiary brands. (Morran, 2011)

The term "food localization" has grown beyond geographic boundaries. This simple paradigm of food from a neighboring farm is now linked to sustainable local production, processing, marketing, and consumption methods that are parts of sustainable agriculture. In turn, sustainable agriculture may be defined as food production that does not harm the environment, humane treatment of animals, respect and fair wages for farm workers, and support for farming communities. Some of these concerns (justified or not) have been linked to the undesirable effects of food globalization, involving the increasing integration of local and national economies into the global economy through privatization, lowering transborder trade and investment restrictions, and complemented by technological advances. Food localization is viewed as the process that counteracts the trend. It highlights the virtues of regionalism – including culture and history, fewer "food kilometers (miles)," fresher and tastier (quality) products, small farms with more environmental stewardship, biodiversity, and community well being.

While presenting the concepts of food globalization and localization in a bipolar module is problematic, perhaps an oversimplification of the concepts – there is nonetheless no mistake that the local food movement has become an important social phenomenon in the United States. In May 2007, the cover of *TIME* magazine proclaimed, "Forget Organic, Eat Local" (Cloud, 2007). Likewise, the *Oxford Dictionary* identified "locavore" as one of its important new words in 2007 (Masi et al., 2010). "Buying local" has become one of the hottest trends in food marketing. A recent online survey by the *Wall Street Journal* indicated 76.7% of readers expressed strong or significant interest in buying local food regardless of cost or when handy. Another 14.8% expressed mild interest with intermittent purchase, and only 8.5% expressed no interest in buying local food (WSJ, 2012).

In Hawai'i, a similarly expressed preference study on local food was conducted by the Omnitrak Group Inc. in 2011. When asked about their perception of food grown in Hawai'i, 81% of respondents indicated too little was grown locally, while 18% felt it was about the right amount, and the remaining 1% was of the opinion that too much was grown (Ulupono Initiative, 2011). Another study by the College of Tropical Agriculture and Human Resources (CTAHR) on the economic impacts of locally sourced food estimated that replacing 10% of current food imports with local products could generate an economy-wide impact of an additional \$188 million in sales,

Table 1. Count and per capita farmers' market in select states, USA 2012

State	Number of registered farmers' markets	Population (2009)	Farmers' markets per million population
California	823	36,962,000	22
New York	648	19,541,000	33
Massachusetts	272	6,594,000	41
Hawai'i	88	1,295,000	68

Sources: U.S. Census Bureau, Statistical Abstract of the United States: 2012, Table 12. Intercensal Resident Population-States: 2001 to 2009; and AMS-USDA Website: Farmers Markets Search.

\$47 million in earnings, \$6 million in state tax revenues, and more than 2300 jobs for Hawai'i (Leung and Loke, 2008). As the demand for locally grown produce (fresh fruits and vegetables) increases, so too has the number of farmers' markets and community-supported agriculture (CSA) ventures emerging across the state and nationwide. While the metrics on CSAs are not apparent, the measures on farmers markets are more readily available. According to the USDA National Farmers' Market Directory, the number of farmers' markets registered with the agency has more than quadrupled to 7864 in August 2012 (FMS, 2013). California, the leading agriculture-producing state in the nation, had 823 farmers' markets in 2012, followed by New York and Massachusetts with 648 and 272 markets, respectively. Hawai'i has 88 farmers' markets spread across the state. While the count of farmers' markets in Hawai'i is not as impressive as in other states, the measure of market access (reach), as represented by the number of farmers' markets per million population is significantly higher for Hawai'i. Table 1 shows that Hawai'i has 68 farmers' markets for every million residents, while the three states with the highest number of registered farmers' markets have significantly lower measures, ranging from 22 to 41 per million residents. This result indicates that consumers in Hawai'i, on average, may have greater access to fresh fruits and vegetables from farmers' markets than their counterparts in other states.

Additionally, both state and county agencies have sponsored local branding programs. The Hawai'i Department of Agriculture (HDOA) has two statewide branding programs (*Island Fresh* and *Hawai'i Seals of Quality*) and a call-to-action campaign, *Buy Local, It Matters*. Kaua'i County sponsors its *Kaua'i Grown* program and Maui County has its *Grown on Maui* program. Not to be left out, many local grocery stores now have their own generic *Hawai'i Grown* labels. The popularity of local food has also prompted KANU Hawai'i, a community movement to sponsor an annual Eat Local Challenge,

where the public is challenged to eat locally grown food exclusively for a week or an entire month.

Other Food Concepts

There are other food concepts that have not been included for discussion in this paper. Some of the significant concepts emerging include food safety, food sustainability, and food resiliency. The Food Safety and Inspection Service (FSIS) defines food safety as a suitable product which when consumed orally either by a human or an animal does not cause health risk to the consumer (FSIS, 2013). In general, food safety involves scientific protocols in growing, handling, preparing, distributing, and storing of food in a reasonable, safe fashion to prevent foodborne illnesses. It covers producers, processors, intermediaries, and consumers and includes practices from pesticide use, handling hygiene, certification, packaging, labeling, additive use, refrigeration, and appropriate cooking.

Food sustainability, also known as sustainable agriculture has many definitions. The USDA views sustainable agriculture as an integrated system of plant and animal production practices that meet food and fiber needs and enhance the quality of the environmental and the natural resources that food growing depends upon (AFSIC, 2007). These practices also include efficient use of nonrenewable resources and on-farm resources, keeping agricultural production economically viable, and enhancing both farmers' and society's quality of life. Likewise, food sustainability deals with a food system's ability to produce food into the foreseeable future within the realms of economics, society, and ecology. Food resiliency is defined as the ability of a food system to persist through continuous development in face of change and to innovate and transform into more desirable configurations (Folke, 2006). Alternately, it can be construed as the ability of a food system to recover from a disturbance.

Discussion

A report issued by the Japanese Statistics Bureau indicated that Japan's food self-sufficiency (based on calories consumed) was only 39% in fiscal 2010 (SBJ, 2010). In comparison, Australia had a calorie-based food self-sufficiency of 173%, Canada 168%, and the United States 124%. Japan's fortress (protectionist) model has resulted in high domestic food prices due to following a policy of food self-sufficiency to ensure its food security. With declining farm productivity, waning food production, and rapidly changing dietary habits, this national policy does not appear to be working. An increasing number of private corporations have begun to invest in farmlands

abroad and to acquire foreign food companies to ensure Japan's continuing food security.⁸

Furthermore, the measurement of food self-sufficiency as an accurate indicator of food security is diminishing in developed countries. The three countries with the highest levels of food self-sufficiency, Australia, Canada, and the United States, have all witnessed increasingly higher levels of food insecurity. A recent survey conducted by the Australian National University (ANU) showed that 8% of survey respondents in Australia indicated that their food had often or sometimes run out and they did not have enough money to buy more food. Another 4% of respondents stated that they needed emergency food assistance from a charity, food bank, soup kitchen, or some other source (Lockie and Pietsch, 2012). A separate ERS study benchmarked the proportion of households classified as food insecure in Canada at 7% and the United States at 12.6% (Nord and Hopwood 2008). Evidently, all three countries with some of the highest measured food self-sufficiency also have their nontrivial share of food insecurity.

As indicated earlier, food self-sufficiency is often measured by the SSR and its complementary measure, IDR. In Hawai'i, the SSR and IDR measures were found to be 15.7% and 102.5%, respectively, in 2010. Clearly, the SSR is not the complement of the IDR as the two figures do not sum to 100%. The IDR exceeding 100% is biased upwards due to reexports present in the dataset. Likewise, the SSR is biased upwards due to exports present in the dataset. In this instance, the SSR serves as a better measure of "potential" local production to satisfy local food consumption. To assess food self-sufficiency and import dependency in Hawai'i more accurately, modified SSR and IDR measures were proposed. The study on these issues by Loke and Leung (2013) concludes that only 11.6% of available food for consumption in Hawai'i is sourced from local production, and the remaining 88.4% is sourced from imports.

While available food self-sufficiency measures are an important first step in assessing Hawai'i's overall food consumption and requirements, the state faces the immediate challenge to lessen its incidence of households with very low food security⁹ (5.6%) and low or very low food security¹⁰ (13.8%). According to the U.S. Census Bureau, Hawai'i ranks seventh among states with the highest poverty rate in the United States with 17.4% of its population living in poverty during 2009–2011 (Short, 2012). The concept of food self-sufficiency cannot address adequately this challenge, at least in the short run, and an alternate concept, such as food security may be employed as needed to effect immediate change.

It may make better sense to pursue food self-sufficiency, food sovereignty, and food localization to address food policy objectives in the medium- to long term. From

the outset, we have pointed out that the concept of food self-sufficiency is a less desirable policy objective in terms of economic efficiency and gains from trade perspectives. However, it does not preclude its possible usefulness for noneconomic (nonmarket) policy objectives. In Hawai'i and elsewhere, free trade has opened a pathway for the introduction of invasive species that have proven destructive to local agriculture, native species, and the host ecosystem (Loope, 2010; Lovell et al. 2006; McAusland and Costello, 2004). Some of the more harmful invasive species found in Hawai'i, in recent memory include the coffee berry borer, varroa mite, red fire ants, coqui frog, miconia, papaya ring spot virus, banana bunchy top virus, and 'ohi'a rust. Increasing the level of food self-sufficiency may reduce the impact on the integrity of Hawai'i's ecosystem and natural habitat due to the associated invasive species, although the extent to which this may happen is not fully clear.

Additionally, an increasing societal preference toward environmental stewardship (e.g., protecting open spaces, ensuring green landscape, and recharging the aquifer system) also points to a higher level of land preservation and local food production. While a higher degree of food self-sufficiency is perhaps desirable, it is perhaps impractical or impossible to achieve 100% food self-sufficiency, as it imposes too high a cost for society (Leung and Loke, 2008). Food self-sufficiency usually requires government subsidies to encourage local farmers to produce more commodities which are paid for by consumers in the form of higher income and/or sales taxes. All too often, the increase in income to farmers is offset by an even higher tax burden to all citizens (consumers and farmers), resulting in net welfare losses.

The experience in sub-Saharan Africa further demonstrates that agricultural protectionism, which often goes hand in hand with food self-sufficiency, actually causes more people to go hungry (Southgate, 2011). More recently, China has reconsidered its food self-sufficiency policy in favor of market forces to freely allocate food to the masses. There is little argument that the increasingly market-oriented economy in China has lifted the income levels and accompanying living standards for most of its citizens. For the Chinese people in general, their level of food security has increased as a direct consequence of freer markets. By the same token, highly trade-dependent city states such as Singapore and Hong Kong have demonstrated that the absence of food self-sufficiency is neither a handicap nor a losing proposition to their continuing high standards of living.

Lastly, due to the Islands' geographic isolation and cultural diversity, many residents in Hawai'i will continue to support the concepts of food self-sufficiency, food sovereignty, and food localization. The common theme of

"local production for local consumption, under local control" is shared across these three food concepts. The theme itself provides a rallying point for many local communities and empowers involved political, social, cultural, economic, and other interest groups. Likewise, the concepts of food safety, food sustainability, and food resiliency are unique and, as a group, incorporate action-based strategies for preserving existing island food systems. All told, each of the food concepts discussed may have a contribution toward achieving a higher degree of food security in Hawai'i.

Conclusions

Food is a complex subject. Spread across many academic disciplines, the study of food is evolving continuously, with new directions, methodologies, models, and hypotheses. Hence, the confusion over competing food concepts should not come as a surprise. Arguably, the evolution of food concepts can be narrowed down to four popular ones – food self-sufficiency, food security, food sovereignty, and food localization. All four food concepts have some level of geographic reach. For example, food security is applicable to the global, national, regional, county, and district levels. Both food self-sufficiency and food sovereignty are applicable to the national, regional, county, and district levels. Food localization is restricted to the regional, county, and district levels.

Within this geographic hierarchy, it is apparent that food security impacts more people in more places than the other food concepts. Food security as a concept is also far more inclusive and addresses varying issues from economics (market influences of demand and supply); to the rights of individuals, households, countries, and the world; to adequate foods and sufficient access to nutrition and dietary health maintenance. The other food concepts also contribute to food security while emphasizing more narrow societal objectives, which perhaps come at a higher societal cost.

We have seen that while food-exporting countries can have high food self-sufficiency measures, above 100%, and at the same time have moderately high food insecurity metrics of 15%; this goes to show that the former measure may no longer be an accurate indicator of food security, particularly in developed food-exporting countries. In the case of Hawai'i, a policy of food self-sufficiency may be justified for noneconomic objectives, such as to mitigate the introduction of harmful invasive species into its fragile environment and to minimize the effects of transportation disruption (dock strikes). Likewise, food sovereignty may be applicable to native and other Polynesian citizens with a preference for growing indigenous crops and consuming them within a unique cultural

setting. Finally, the concept of food localization is dear to the heart on many people in Hawai'i, considering the geographic isolation of the Islands in the central Pacific Ocean. All food items imported into Hawai'i must travel at least 4023 kilometers (2500 miles), almost twice the distance that most food items travel on average in the continental United States.

With the various food concepts under consideration, we could perhaps agree on a convenient approach to lessen the incidence of chronic and transitory food insecurity facing 13.8% of households in Hawai'i. The prevalence of food insecurity is likely higher in the neighbor islands as compared to urban O'ahu. The problems of food availability and accessibility are especially challenging to economically disadvantaged households with young children, disabled members, and the elderly. The school lunch program has effectively become a "safety net" for many affected school children, particularly in rural areas. Beyond this fundamental right to access basic food requirements, individuals and interest groups in Hawai'i should have the right to pursue any food concept of their choosing, and to shoulder their own costs and benefits.

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Notes

¹Smith wrote the *Wealth of Nations* in 1776, arguing in favor of specialization and against mercantilist principles while Ricardo published his *Essay on the Influence of a Low Price of Corn on the Profits of Stock* in 1815, arguing against protectionist policies which increase the price of imported corn and redistribute income to the landed aristocracy as the expense of the working class.

²UN (1975). Report of the World Food Conference, Rome 5–16 November 1974, New York: United Nations.

³FAO (1996). Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit 13–17 November 1996. Rome: Food and Agriculture Organization.

⁴Some authors have called this affordability – food being available at prices people can afford to pay given their income.

⁵United States Public Law 103–105, informally known as the Apology Resolution, is a joint resolution passed by

the U.S. Congress and signed by President Clinton in 1993 to acknowledge and apologize for the illegal overthrow of the Kingdom of Hawai'i in 1893.

⁶According to Cordy (2007), p. 111), higher population estimates of 800,000 to 1 million was proposed by Stannard (1989). Prior to that, much lower population estimates of 250,000 to 300,000 as forwarded by Schmitt (1968) was the convention.

⁷See Michael Pollan's FAQ and Useful Links. Available online at <http://michaelpollan.com/resources/>. Accessed on 19 February 2013.

⁸Recent examples of large-scale acquisitions include Kirin's purchase of National Foods, the leading dairy and beverage producer in Australia, for \$1 billion in 2007 and Itochu Corporation's recent purchase of two business lines of Dole Food USA, worldwide packaged foods and Asia fresh, for \$1.7 billion in 2013.

⁹According to ERS, very low food security refers food-insecure households, in which normal eating patterns of one or more household members were disrupted and food intake was reduced at times during the year because they had insufficient money or other resources for food. Before 2006, these households were defined as "food insecure with hunger."

¹⁰This is also known as "food insecurity" as defined by ERS.

Conflict of Interest

None declared.

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