FOOD SOVEREIGNTY IN THE CITY? A METHODOLOGICAL PROPOSAL FOR EVALUATING FOOD SOVEREIGNTY IN URBAN SETTINGS.

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Abstract

Although the possibility of achieving food sovereignty in urban environments is controversial, we believe that food sovereignty is attainable. In this work we propose a methodology for evaluating it, then test that proposal using San Cristóbal de Las Casas as a case study. For this purpose, we used a participative methodology to construct a system of food-sovereignty indicators for urban settings. After review and validation by participants and a group of experts, that system consisted of 30 indicators. We tested it by using it to survey households in San Cristóbal. We found that the set of 30 indicators is coherent with the principles of food sovereignty, and that it enabled us to reveal the alimentary vulnerability of the city's families. We hope that the principles that form the basis for the proposed methodology will be applicable when designing instruments for assessing other cities' levels of food sovereignty.

Key words: Indicators, participative methodology, San Cristóbal de Las Casas, Social fabric, urban food system.

Introduction

At present, the lack a suitable system of indicators prevents researchers from making accurate measurements of the level of food sovereignty (FS) in a given territory, especially in urban zones. In this work, we propose a participative methodology for measuring the level of FS, then test that methodology in the city where most of the authors live: San Cristóbal de Las Casas, in Chiapas, Mexico, whose population of 185,917 is distributed among 40,714 households (INEGI, 2010).

FS refers to the right of a given populace to decide upon a food system of its own that is developed according to an agroecological model; follows principles of social justice; and operates within the biophysical limits of ecosystems (Declaration of Nyéléni 2007). FS is a political project that emanates from rural social movements, and is analyzed with increasing frequency by academia. However, its application to urban contexts has not been explored extensively (García-Sempere et al. 2018).

With the goal of achieving FS, urban social movements are developing and promoting (among other things) farmers' markets, consumer groups, community-supported agriculture, urban community gardens, and purchase of local products by public institutions. To know whether these alimentary initiatives contribute to FS, researchers need specific methods and tools for collecting the relevant information. That information can provide empirical support for FS at the same time that it helps establish bases for better urban planning, and aids interested parties in designing more-effective strategies for pursuing FS.

In most studies, the researchers themselves (usually scientists and engineers, exclusively) are those who select the indicators. Studies of food systems are no exception: the scope and direction of most such studies are defined by experts, without taking into account the viewpoints of consumers and producers (Kloppenburg, Jr. et al. 2000). However, the need for public participation in formulating indicators is

emphasized increasingly in the literature (Altieri and Nicholls 2013; Fraser et al. 2006; Reed, Dougill, and Baker 2008). The literature on how to how to involve the public effectively in that process is extensive, especially regarding indicators of sustainability (Bell and Morse 2008; Altieri and Nicholls 2002; Geilfus 2009). Although that literature does not treat the formulation of FS indicators specifically, it does identify the strengths and weakness of participative construction of indicators.

For example, the participative methodology is appropriate for defining a set of FS indicators in urban spaces, bearing in mind that:

- An ever-greater number of studies recognize the need for community involvement in identifying those indicators;
- The participative methodology allows citizens to be involved actively in issues related to FS; and
- The participative method is appropriate at a local scale

The challenge presented here is to define a methodological framework for evaluating the process of transition toward FS in an urban setting. We will develop that framework by using indicators contextualized to the reality of San Cristóbal de Las Casas, but with the further goal of making that framework sufficiently flexible for use in other urban contexts.

Methodological proposal

a) San Cristóbal de Las Casas

San Cristóbal de Las Casas (hereinafter "San Cristóbal") is an interesting case study for urban FS because many of its households still have backyard gardens. In addition, recent years have seen numerous initiatives aimed at marketing locally-grown products free from agrochemicals, and at sensitizing the public to the need for a new model of food consumerism. One source of those initiatives is the large number of important agroecological-research groups based in the city. Another is the emergence of

grassroots organizations that struggle for social equality and (since the 1994 Zapatista uprising) for a different world order.

The above-mentioned initiatives are promoted by NGOs, academic groups, and alternative civic movements. Examples include the Market for Safe, Locally-Grown Food[1]; the School Garden Network, the Cacao Solidario cooperative of consumers and producers[2]; the Slow Food Convivium "Jovel Kun Kun"[3]; Women and Corn[4]; and the Urban Agricultural Network "Sembrando Jovel" ("Seeding San Cristóbal)[5]. We ask ourselves whether these groups are the beginning of an agroecological movement toward FS in the city, and whether the necessary social and political conditions exist there for present small initiatives to scale up to include the majority of the residents (Parmentier 2014; Mier y Terán et al. 2018).

b) Participative development of indicators

Generally speaking, the development of indicators is a three-stage process: (1) defining the components of the concept in question; (2) assigning indicators to each component; and (3) defining scales and threshold values for each indicator (Yegbemey et al. 2014; Fraser et al. 2006; Badal et al. 2011; Mickwitz et al. 2006; Binimelis et al. 2014).

In our San Cristóbal case study, the process of developing indicators consisted of the following steps:

1. *Literature review to define food sovereignty*

   We reviewed the existing literature on the conceptual framework of FS, and on possible series of indicators.

[1] https://redcomidasanaycercana.codigosur.net/
[2] https://cacaosolidario.blogspot.com/
[3] https://es-es.facebook.com/Jovel-Kun-Kun-661753940555652/
[4] http://mujeresymaiz.blogspot.com/
[5] https://es-la.facebook.com/Sembrando-Jovel-442785302519478/

2. *Participative observation, and in-depth interviews with experts on food issues*

To familiarize ourselves with the present situation of San Cristóbal´s food system, from the point of view of those most actively involved in transforming it, we participated in food fairs, events organized by the Sembrando Jovel Urban Agricultural Network, and other activities related to agriculture and food in the city.

In the course of our observations, we interviewed 10 persons whose activities are related to those subjects. The interviewees included academics, consumers, vendors, and persons who practice urban agriculture. Through our interviews, we deepened our knowledge of San Cristóbal's specific food situation, and also gained experience in discussing that situation accurately and productively. That experience proved useful during subsequent workshops.

3. First round of eight workshops: collective definition of the desired food system

We invited citizens from different neighborhoods of San Cristóbal to a workshop entitled, "Who decides what we eat? Recovering the way of eating that we desire?" In combination with the interviews described earlier, and with the observations that we made while participating in food events, systematization of the FS concept helped us to design workshop activities in which the invitees could define the "desired food system" in a way that took the concept's key axes into account.

To increase potential participation in the workshops, we contacted organized groups (e.g., neighborhood assemblies, schools, churches, and civic associations) that have regularly-scheduled meetings. A total of 107 adults and young people participated, 69 of whom where women (Table 1).

The first round of workshops lasted from March to June of 2016. The data that we collected during the workshops began to repeat itself after the fifth workshop, but we continued to give them to ascertain whether the data would indeed keep repeating. Thus, we gave a total of eight workshops.

Nº	Venue	Date	Participants	Age group(s) of participants	Number of participants		
					Women	Men	Total
1	Barrio de Cutxtitali	08/03/16	Residents	Adults	18	2	20
2	UnACh*	15/03/16	Students	Young people***	5	5	10
3	COCIPED** headquarters	06/04/16	COCIDEP members	Adults	10	13	23
4	Barrio Prudencio Moscoso	08/04/16	Residents	Young people***	3	3	6
5	Barrio de Alcanfores	26/04/16	Residents	Adults	5	0	5
6	Elohim Church (Northern zone)	30/05/16	Church youth group	Young people***	11	12	23
7	Melel Xolojobal A.C.[6]	20/05/16	Mothers who are heads of household	Adults	10	0	10
8	Pequeño Sol School	14/06/16	Mothers and fathers	Adults	7	3	10
				TOTAL	69	38	**107**

Table 1.General description of the eight workshops given in the first round in San Cristóbal. *Universidad Autónoma de Chiapas. **_Comité ciudadano para la defensa popular_ (Citizens Committee for Public Defense). ***Ages 14 to 25 years.

To orient persons who are not involved in the San Cristóbal's FS movement, we began each workshop by reflecting, as a group, upon the city's current food situation. We designed activities in which participants contemplated the various axes of FS, so that all of the axes could be considered

[6] http://www.melelxojobal.org.mx/

during ensuing discussions in which attendees defined indicators. Then, we defined "the desired food system" by selecting potential attributes from a list thereof that took into account the obligation to respect humans and the environment.

4. *Analysis of data to convert attributes into indicators*

   We translated each of the attributes identified during the first round of workshops into one or more indicators. To do so, we contrasted information obtained during the workshops with that which was collected during interviews and the literature review. This procedure enabled us to combine some of the indicators, eliminate redundancies, and consider possible new attributes that, in the next workshop, were suggested to participants.

5. *Ninth workshop: validation of indicators*

   In this workshop, attendees from the first round met as a single group. We showed them results from the first round, and shared the observations and suggestions that we had derived when contrasting those results with information from interviews and the literature. We then opened a discussion of the proposed indicators, eventually agreeing upon necessary changes, and a set of 31 indicators.

The set of 31 indicators was submitted to a group of local and international experts, who validated it after slight modifications. Two indicators were combined, leaving a total of 30 indicators. We note that once a set of indicators has been agreed upon, researchers often assign a separate weight to each so that all may be reduced to a convenient common scale. For that purpose, each indicator would be assigned a threshold value and a series of intervals above and below it (Yegbemey et al. 2014). In this work, we did not weight the indicators, nor did we assign them threshold values, because both processes are complex ones that demand time and commitment from participants.

c) Testing the system of indicators by employing it in surveys to evaluate FS in San Cristóbal

Our survey instrument was a questionnaire based upon the validated set of 30 FS indicators. The level of measure was the household or family

We determined that we would need to survey 263 of San Cristóbal's 40,714 households to give a confidence level of 95% and a sample error of 6% for a simple, random sample. We then used a two-step cluster method (Scheaffer, Mendenhall, and Ott 2006) to select the specific households that would be surveyed. As clusters, we used the 51 postal codes into which San Cristóbal's urban area is divided.

In the first step of the cluster method, we selected a simple random sample of 30 clusters (postal codes). The maximum margin of error for that sample size is 11.6%, for a 95% sample error and 50% homogeneity. In the second step, we selected a sub-sample of households from each of the 30 clusters. We made those elections by numbering the blocks in each cluster, after which we chose one designated block at random from each cluster. To reach the required total of 263 households, we selected eight or nine households from each cluster's designated block.

Note that in some clusters, we needed to select more than one designated block in order to carry out the necessary eight or nine surveys. In total, we collected data on 23 of the 30 indicators (Table 3).

Results and discussion

a) Development and validation of a set of FS indicators for San Cristóbal

As components of the FS framework, the literature review identified five conceptual axes and three social variables (Ortega-Cerdà and Rivera-Ferre 2010; Binimelis et al. 2014) The conceptual axes were access to resources; production models; agricultural policies; food safety and consumption; transformation (processing); and commercialization. Gender, indigenous population, and the percentage of young people in the population were the three social variables.

Participants in the first eight workshops identified 47 attributes of the desired food system. From those attributes, the authors derived a set of 36 indicators, classified according to five dimensions that correspond (approximately) to components of the FS framework:

- I. Access and availability
- II. Production
- III. Consumption
- IV. Transformation, distribution, and commercialization
- V. Social fabric

During the ninth workshop, the authors' 36 indicators were variously modified and combined, yielding the following set of 31 indicators, organized according to the above-mentioned five dimensions:

Dimension I: Access and availability

Indicator 1. Family garden. Metric: Percentage of households that do not grow edible plants due to lack of space, time, knowledge, or access to land.

Indicator 2. Animal husbandry at home for food production. Metric: Percentage of families that do not raise animals for food due to lack of space, time, knowledge, or access to land.

Indicator 3. Affordable access to organic foods. Metric: Percentage of families that say that for economic reasons, they do not consume organic foods.

Indicator 4. Physical access to organic foods. Metric: Percentage of families that say either that they do not know where to obtain organic foods, or that they cannot get to those places.

Indicator 5. How families obtain food. Metrics: (1) For each food group, the percentage of families that acquire food from that group in local markets, the local organic market, small family stores, or supermarkets; and (2) the percentage of families that have access to food via food-aid programs.

Indicator6. Food-price volatility. Metric: Fluctuation in prices of basic foods.

Indicator 7. School gardens. Metric: Percentage of families with at least one child enrolled in a school that has a garden.

Indicator 8. Information about foods. Metric: Families' degree of satisfaction with the information available to them about the origins, production and processing methods, transgenics content, and nutritional value of their food.

Dimension II. Production

Indicator 9. Organic and agroecological production. Metric: Of the total surface area of region's agricultural land, the percentage that is devoted to organic and agroecological agriculture

Indicator 10. Use of agrochemicals. Metric: Percentage of families that use some type of agrochemical in their family garden.

Indicator 11. Reutilization of organic wastes. Metric: Percentage of families that use organic household waste for compost or earthworm compost.

Indicator 12. Safety and hygiene in the production of foods. Metric: Qualitative analysis of norms and their compliance.

Indicator 13. Irrigation water. Metric: Percentage of households that use clean water for irrigation.

Dimension III. Consumption

Indicator 14. Consumption of processed foods. Metric: How often highly processed foods are consumed (Examples: cookies, sausages, and snack foods such as chips)

Indicator 15. How well the diet follows nutritional recommendations. Metric: How often food from the following groups is consumed: fruits, vegetables, grains, beverages, dairy products, meat, fish, and legumes.

Indicator 16. Consumption of organic foods.[7] Metric: Percentage of families that consume organic foods.

Indicator 17. Sharing of responsibilities between men and women. Metric: Percentages of households in which tasks related to feeding the family (purchasing, preparation, and cleanup) are the women's responsibility exclusively; the men's responsibility exclusively; or are shared.

Indicator 18. How well the diet fits local cultural preferences. Metric: How often hand-made tortillas are consumed.

Indicator 19. Consumption of food outside the home. Metric: How often foods of different types are eaten outside of the home.

Indicator 20. Consumption of local products. Metric: Percentage of homes that consider place of origin as a criterion when deciding which foods to buy.

Dimension IV. Transformation, distribution, and commercialization

Indicator 21. Food containers. Metric: Weekly volume of food containers discarded by the household.

Indicator 22. Wasted food. Metric: Volume of food wasted each week by supermarkets.

Indicator 23. Safe transport of foods. Metric: Qualitative analysis of norms for transporting food, and of the compliance with those norms.

[7] Here, we use the term "organic" instead of "agroecological", because the latter is unfamiliar to many San Cristóbal residents.

Indicator 24. Safe, hygienic handling of foods. Metric: Qualitative analysis of norms for handling food, and of the compliance with those norms.

Indicator 25. Points or channels for commercializing agroecological products in the city. Metric: Relation between said routes, and those for conventional commercialization.

Dimension V. Social fabric

Indicator 26. Cooperatives for production and consumption of foods. Metric: Percentage of families that are part of or participate in a network for the production and consumption of food.

Indicator 27. Civil agroalimentary associations. Metric: Percentage of families linked to agroalimentary associations or organizations.

Indicator 28. Community gardens. Metric: Percentage of families that share a cultivation space with other persons.

Indicator 29. Trading of foods. Metric: Percentage of families that trade foods with family members or neighbors.

Indicator 30. Practices of cooperation. Metric: Percentage of families that give and receive food.

Indicator 31. Food-policy councils. Metrics: (1) Existence of venues where citizens participate in decision-making about food-related issues, and (2) characteristics and degrees of participation.

The experts who validated the 31 indicators suggested slight changes to names and descriptions. We incorporated those suggestions as follows:

- The name of Indicator 1 was changed from *Family garden* to *Home cultivation of edible plants*, in order to include all types of food-cultivation at home, including spices grown in flower pots for use in the kitchen.

- The name of Indicator 14 was changed from *Consumption of processed foods* to *Consumption of highly-processed foods*.
- The name of Indicator 15, "*How well the diet follows nutritional recommendations"* modified by adding *"given by independent sources"* because the definition of nutritional requirements can be influenced by political and commercial interests.
- The name of Indicator 16 was changed from *Consumption of organic food* to *Consumption of agroecological foods.*
- The name of Indicator 26 was changed from *Cooperatives for production and consumption of foods* to the more-general *Networks for production and consumption of foods*.
- The name of Indicator 27 was changed from *Civil agroalimentary associations* to *Agroalimentary associations* in order to include additional types of associations.
- Indicators 12, 23, and 24 were modified in response to the experts' belief that the wordings and metrics of those indicators were not sufficiently clear, and did not give adequate consideration to the situation of small-scale producers. The purpose of Indicators 12, 23, and 24 is to determine the extent to which norms for safe, hygienic production, handling, and transport of food exist and are followed. However, the experts considered that the indicators' implied focus upon the letter of official norms might cause these three indicators to give a false impression that small-scale producers are failing to meet the norms' intent. Therefore, we modified the three indicators as follows, so that they would not exclude norms that are adapted to different forms of production and commercialization.
    - The metric for Indicator 12, *Safety and hygiene in the production of foods*, was changed to "Qualitative analysis of applicable food-production norms and their compliance, giving special attention to the adaptation of those norms to different types of production and

commercialization, so that small-scale producers and processors whose food is safe and hygienic are not barred from the marketplace".

- The metric for Indicator 23, *Safe transport of foods*, was changed to "Qualitative analysis of applicable food-transport norms and their compliance, giving special attention to the adaptation of those norms to different types of production and commercialization, so that small-scale producers and processors whose food is safe and hygienic are not barred from the marketplace".
- The metric for Indicator 24, *Safe, hygienic handling of foods*, was changed to "Qualitative analysis of applicable food-handling norms and their compliance, giving special attention to the adaptation of those norms to different types of production and commercialization, so that small-scale producers and processors whose food is safe and hygienic are not barred from the marketplace".

- Because the experts observed that Indicators 29 and 30 are redundant measures of essentially the same practices, we combined these indicators under the single name "*Practices of cooperation"*, with the metric "Percentage of families that give and receive food".

The revised and validated system of 30 indicators is presented in Table 3.

DIMENSION	**NAME OF INDICATOR**
I. Access and availability	1. Home cultivation of edible plants 2. Animal husbandry at home for food production 3. Affordable access to organic foods 4. Physical access to organic foods 5. How families obtain food 6. Food-price volatility*

	7. School gardens 8. Information about foods
II. Production	9. Organic and agroecological production* 10. Use of agrochemicals 11. Reutilization of organic wastes 12. Safety and hygiene in the production of foods* 13. Irrigation water
III. Consumption	14. Consumption of highly-processed foods 15. How well the diet follows nutritional recommendations given by independent sources 16. Consumption of agroecological foods 17. Sharing of responsibilities between men and women 18. How well the diet fits local cultural preferences 19. Consumption of food outside the home 20. Consumption of local products
IV. Transformation, distribution, and commercialization	21. Food containers 22. Wasted food* 23. Safe transport of foods* 24. Safe, hygienic handling of foods* 25. Points or channels for commercializing agroecological products in the city*
V. Social fabric	26. Networks for production and consumption of foods 27. Agroalimentary associations 28. Community gardens 29. Practices of cooperation 30. Food-policy councils

Table 3. The validated system of 30 FS indicators for urban spaces, developed participatively in San Cristóbal. *Indicators that were not evaluated in this study.

According to the experts who validated this system of indicators, it does provide measures of the extent to which key elements of FS are present in San Cristóbal. The experts also believe that the system can be adapted to other urban contexts. However, the experts also noted the absence of indices for municipal public policies, and for the connection between San Cristóbal and its rural surroundings.

A priori, we could attribute those absences to the workshop participants' unfamiliarity with the concept of FS. According to our survey, 89% of San Cristóbal residents had never heard the term. Perhaps we (the authors) did not do enough during workshops to ensure that all axes of FS were given the necessary attention. Another possible explanation for the absences is that residents do not believe that municipal public policies and connection with rural surroundings are essential to progress toward FS. That possibility is discussed later in this article.

b) Thermometer for FS in San Cristóbal

Below, we present the results from our survey, grouped according to the five FS dimensions. Results were obtained for 23 of the 30 indicators.

Dimension I. Access and availability

Lazcano-Torres (2014) documented the reasons why some San Cristóbal residents do produce food at home, but we had not known, before this study, the reasons why the majority of residents do not. Clearly, those reasons should be a subject for future work on FS. We need to know whether families that do wish to produce food at home are indeed able to do so. That is, we need to know more about the availability and accessibility of the necessary resources.

Similar observations apply to consumption of organic foods: how many of the families that do not consume them would like to, but have found them either unavailable or inaccessible?

Our survey results do provide answers to such question regarding the 70% of households that do not cultivate edible plants at home. Forty-eight percent say that they lack the necessary space; 5% are not interested; 5% do not have time; 5% cultivate in some other space that they own; and 2% are renters. An additional 2% respond that they are unwell, too old, or lack economic resources, while 1.5% say they lack the necessary knowledge. The remaining households (1.5%) either did not respond to the question, or said that they did not know why they do not cultivate edible plants at home.

The prevalence of families (48%) who responded that they lack space causes us to wonder whether San Cristóbal residents are aware of the possibility of cultivating in small spaces such as patios, rooftops, exterior walls of houses, and even in flower pots or other recipients. Those spaces can be a solution for persons who wish to grow small quantities of food. Although this type of cultivation cannot provide more than a fraction of a whole family's food needs, it has the added benefit of meeting needs that are related to physical and emotional wellbeing, or to following a way of life according to one's ideals (Lazcano-Torres 2014).

The attractiveness of small-space cultivation notwithstanding, San Cristóbal residents would be well advised to begin searching for cultivatable spaces that might be available within the city and its surroundings. Possibilities include abandoned lots, as well as privately- or jointly-owned properties that could be cultivated with the owners' permission. Experiences in many parts of the world during recent years have shown that cities can grow significant portions of their food in such spaces (Dion 2017).

Many of the observations and results presented above, for cultivation of edible plants at home, apply as well to raising animals at home for food. Sixteen percent of the surveyed households do so, while

64% say they lack space; 8% are not interested; 5% do not have time; 2% are renters; and 1% lack the necessary knowledge. Two percent of the households either did not respond to the question, or did not know why they do not raise animals for food. Another 2% were either unwell, too old, lack economic resources, travel too much, are concerned about hygiene, or have neighbors who would object.

Again, lack of space is the primary impediment, and a search for suitable available venues is advisable. In addition, San Cristóbal residents might let competent authorities know of the need for an urban planning that is compatible with the population's desire for food-production spaces. Special attention could be given to the poorest neighborhoods, since those are where many of the most-vulnerable persons live.

The next indicator in the Access and Availability dimension is affordable access to organic food. That indicator addresses whether factors exist that make organic foods either difficult or impossible for San Cristóbal residents to obtain; and if so, for how many people. Twenty-two percent of the surveyed households affirm that the majority of the foods they eat are organic, while 42% say that they eat only foods of this type. The remaining 36% percent do not consume organic foods because they either do not know what those foods are (16%), do not know where they are sold (10%), consider them too expensive (5%), or cannot get to the locations where they are sold (5%).

Thus, the principle reasons are that the respondents either do not know what organic foods are, or else do not know where to buy them.

No significant differences in the consumption of organic foods were found among families from different postal codes or socioeconomic classes. These data should be interpreted with caution because many respondents assumed that all products sold in local public food markets are organic. In

fact, when asked whether they eat organic foods, many replied, “Yes, because I buy them in the market.” In view of this situation, we offer two possible scenarios:

- San Cristóbal residents know how the food available in the markets is grown, but misunderstand what “organic food” means, and for that reason are mistaken in believing that the food they buy in the markets is organic; and
- San Cristóbal residents do know what “organic food” means, but are mistaken in believing that the food that they buy in the markets is produced organically.

Under both scenarios, our survey results would overestimate the percentage of San Cristóbal residents who eat organic foods.

Although only 5% of the surveyed households said that organic foods are too expensive, consumption of organic foods had no significant correlation with socioeconomic level. However, we cannot guarantee the accuracy of these data. Taking into account, as well, the public’s confusion as to what organic foods are, we cannot state whether economic factors impede the public’s access to organic food in San Cristóbal.

By contrasting the respondent’s answers about their consumption of organic foods with their responses regarding where they usually purchase food, we found an interesting incongruity: 85% of the respondents purchase legumes, fruit, and vegetables in the public markets, where we do not know with certainty which of the foods really are organic.

Table 4 shows the percentages of families that procure foods in the following ways in San Cristóbal: in public markets; from small family stores, in supermarkets, at the *Tianguis de Comida Sana y Cercana*, from family gardens; from vendors who sell door-to-door; and from food groups. Another 3% of the respondents receive food from food-aid programs.

To date, most San Cristóbal residents still prefer to buy fresh foods in the markets or in small family stores despite the arrival of supermarkets. To have a more-accurate idea of residents' food-buying habits, researchers would also need to ask where families buy highly-processed foods-a considerable part of their diets.

It is telling that supermarkets are the places in which residents purchase most of the dairy products that they consume. The land on which the supermarkets were constructed, as well as much of the land now covered by San Cristóbal's urban zone, was formerly pastureland for milk cows.

The majority of dairy products sold in San Cristóbal's supermarkets come from other states, even though Chiapas is still an important milk producer. Therefore, we might say that regarding production and consumption of dairy products within the region, the arrival of supermarkets in San Cristóbal has opened a metabolic breach whose repair would benefit producers and consumers alike.

Type of food	Local public markets	Small family stores	Supermarkets	Tianguis Comida Sana y Cercana	Family gardens	Dorr-to-door vendors	Not eaten by respondent
Fruits and vegetables	90%	2%	5%	2%	1%	1%	0%
Legumes	85%	4%	6%	2%	1%	0%	0%
Tortillas	13%	81%	3%	2%	0%	0%	1%
Bread	10%	76%	6%	0%	0%	0%	7%
Dairy products	27%	24%	39%	1%	0%	0%	8%
Meat and fish	70%	11%	13%	1%	0%	0%	4%

Table 4. Principal ways in which San Cristóbal residents obtain foods from each food group. Entries are percentages of responding families who obtain the indicated food as specified.

The respondents' level of dissatisfaction with information that is available to them about the food they buy (Table 5) is striking. Note the high percentage (38%) of respondents who are unfamiliar with the term "transgenics".

Type of information	Unfamiliar with the term	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
Origin of the food	2%	11%	46%	34%	6%
Method of production	2%	12%	51%	29%	7%
Processing	2%	14%	48%	29%	8%
Nutritional value	2%	11%	48%	32%	7%
Transgenic content	38%	14%	26%	10%	12%

Table 5. Respondents' degrees of satisfaction with different types of information available to them about their foods.

For many persons, especially the poorest and most vulnerable to manipulative publicity (Bertran 2016), television is their principal source of information about food. FS requires the public to be skeptical of nutritional information from sources that have financial interests in consumers' food-buying decisions. Therefore, FS may well require passage of regulations about food advertising, particularly that which is directed at children (Hawkes 2004; Hawkes 2007).

Only 11% of surveyed households have children enrolled in schools with gardens-a valuable educational resource as well as one for promoting healthy eating habits.

Dimension II. Production

In most cities, food production is a symbolic activity. Our results indicate that San Cristóbal is no exception: the majority of respondents' family gardens consist of flower pots in which condiments and small edible plants are grown. For that reason, the production indicators that we present and discuss below (i.e., use of agrochemicals, source of irrigation water, and composting of organic wastes) are for quantifiable practices relevant to just that sort of gardening (Table 6).

Ninety-two percent of surveyed families do not use agrochemicals, mainly for health reasons: they want their families' food to be "natural". (Which to most San Cristóbal residents means "raised without chemicals".) Rather than use herbicides, respondents remove weeds by hand. Diseased food plants are uprooted, pruned, or treated with solutions containing garlic, peppers, or soap. The respondents' awareness of the dangers of agrochemicals (especially pesticides) is an opportunity to promote FS.

The majority of respondents do reutilize organic waste by making compost or earthworm compost. In the respondents' own words, they do so in order to "make use of the organic material", and because it is "good for the soil and the plants". Almost all of the respondents irrigate with clean water.

INDICATOR	SURVEY RESULT
Use of agrochemicals	
Metric: Percentage of families that use some type of agrochemical in their family garden.	8% use some type of agrochemical
Reutilization of organic wastes	
Metric: Percentage of families that use organic household waste for compost or earthworm compost.	71% reutilize organic wastes for compost or earthworm compost.
Irrigation water	
Percentage of households that use clean water for irrigation.	93% irrigate with clean water.

Table 6. Survey results for FS indicators in the Production dimension.

The survey results are not in themselves sufficient to determine whether the ways in which families manage their gardens are agroecological. However, the practices mentioned by respondents do suggest a preference for low-input, chemical-free agriculture that provides their families with healthy, nutritious food. In this sense, the families' management of the gardens is consistent with principles of FS. Determining whether their management is based upon ecological principles as well would require evaluation of practices such as crop rotation and association, nutrient recycling, soil management, types of inputs used, and promotion of species diversity.

Dimension III. Consumption

Before presenting in detail our survey results for this dimension, we note that there is an inequitable sharing of consumption-related tasks between male and female members of a household. This is not only contrary to the principles of justice that FS recognizes as necessary for society at large, but is also

an obstacle to FS's implementation and subsequent functioning. An inequitable sharing of consumption-related tasks in the home reduces the amount of time that women could devote to other aspects of FS. Those aspects include such important ones as participation in public decision-making about food-related policies.

Our survey results show that of the three consumption-related tasks included in this indicator's metric, only dishwashing is shared more or less equally between men and women. In contrast, the women (many of whom also work outside the home) do almost all of the cooking and food-purchasing (Table 7). We also found that women are the ones who do most of the work of caring for home gardens.

	TASK		
PERSON(S) RESPONSIBLE	Purchasing food	Cooking	Dishwashing
One or more men	10%	5%	3%
One or more women	75%	85%	51%
Shared between women and men	15%	15%	45%

Table 7. Percentage of homes in which responsibilities for food-purchasing, cooking, and dishwashing are shared between men or women, or borne exclusively by members of one or the other gender.

Regarding the types of food that are consumed, half of the surveyed families eat cookies at least twice a week; 24% eat them daily (Table 8). Soft drinks and snack foods (chips) are eaten only occasionally. Respondents indicated a strong preference for fresh foods. According to the survey results, half of the households

- Consume fruits, vegetables, tortillas, coffee, and *agua fresca* (diluted fresh fruit juice) daily;
- Consume meat daily (frequently chicken, but also beef and pork); and
- Consume beans several times a week, or even daily.

These data reveal a varied diet in which fresh foods predominate over highly-processed ones, but further work would be necessary to know whether the diet is balanced.

Our survey was not designed to capture data on a phenomenon that we discovered during workshops: compared to adults, the children and young people in San Cristóbal consume a greater amount of nationally-marketed processed foods, and fewer of the local culture's nutritious traditional foods (e.g. beans). That phenomenon could be investigated further by following the evolution of eating habits of different age groups and socioeconomic classes. The arrival of supermarkets since 2004 may be one cause of the possible incipient shift in food preferences, but we also note that many of the same brands of processed, nationally-marketed foods are available in the small family stores that are found on almost every block.

The possible oncoming shift in eating habits notwithstanding, most surveyed families still prefer local products when they can be identified as such. For example, the majority of families who eat in restaurants opt for Mexican foods (tacos, huaraches, chilaquiles, empanadas, and tamales) even though San Cristóbal has a wide variety of establishments that serve international foods (hamburgers, pizzas, hot dogs, and Chinese food).

That finding supplements and is consistent with the data which we collected for consumption of tortillas: our primary indicator of fit between families' diets and traditional local cultural preferences. The majority of surveyed families eat them daily. However, commercial tortillas made from simple corn meal have replaced, to a great degree, the more-nutritious hand-made ones made with nixtamalized corn. Even though families prefer the hand-made tortillas "because they are natural and taste better", the commercial ones are consumed more frequently because they are cheaper and more readily available.

Too, the families are not dissatisfied with the commercial tortillas. More than half of the families said that they are either satisfied or very satisfied with the tortillas that they consume. However, San Cristóbal residents in general are probably unaware that the differences between commercial tortillas made with cornmeal, and handmade ones made with nixtamalized corn, are not limited to taste, texture, and the means of production. Commercial tortillas have a higher glycemic index, which increases the risk of obesity and diabetes for those who consume them (Mariscal et al. 2015). In addition, the substitution of commercial tortillas for handmade ones has had socioeconomic consequences.

Government policies and programs have figured prominently in the shift to consumption of commercial tortillas, and also to changes in eating habits generally. Professor Micaela Álvarez of the *Universidad Intercultural de Chiapas* (UNICH) confirms that supermarkets and government food-aid programs favor the presence of processed, packaged foods in local diets, and are "supplanting the enjoyment" of fresh, more-nutritious foods to the point where "one looks at the content of the food aid packages, and feels pain".

Type of food	**Frequency of consumption**					
	Daily	**2-3 times per week**	**Once per week**	**Twice per month**	**Once per month**	**Never**
Natural *agua fresca**	83%	11%	2%	1%	2%	2%
Coffee	82%	10%	2%	1%	0%	5%
Beans	51%	33%	8%	4%	2%	2%
Fruit	72%	21%	5%	0%	0%	1%

Cookies	24%	27%	21%	8%	6%	13%
Milk	41%	24%	11%	4%	7%	12%
White bread	11%	22%	16%	9%	13%	29%
Whole-grain bread	8%	21%	14%	10%	15%	33%
Snacks (chips)	5%	15%	19%	8%	16%	37%
Fish	2%	13%	21%	22%	28%	14%
Chicken	6%	49%	31%	8%	3%	3%
Pork	1%	23%	24%	13%	18%	21%
Cheese	32%	34%	18%	6%	5%	5%
Soft drinks	8%	18%	16%	11%	17%	31%
Beef	2%	33%	33%	14%	8%	10%
Sausages	3%	16%	14%	12%	17%	38%
Wheat tortillas	0%	15%	10%	9%	18%	48%
Commercial corn tortillas	74%	12%	4%	1%	1%	8%
Hand-made corn tortillas	15%	24%	18%	8%	18%	18%
Vegetables	70%	26%	3%	0%	0%	0%
Yogurt	19%	28%	16%	8%	9%	20%

Table 8. Frequency of survey respondents' consumption of foods commonly found in diets of San Cristóbal residents. *Diluted fresh fruit juice

Dimension IV. Transformation, distribution, and commercialization

Of the five indicators listed in Table 3 for this dimension, we collected data for Number 21: Food containers. The metric for that indicator is the volume of food containers (e.g. bottles, jars, and cans) that households discard each week. This metric is a useful measure of San Cristóbal's participation in regional and global systems of transformation, distribution, and commercialization because most packaged food is not only processed, but must contain preservatives in order to remain edible while

being transported over long distance to warehouses, then to points of sale where it may remain for months before its eventual consumption. Therefore, the greater the volume of food containers that a family discards each week, the greater the degree (probably) to which that family's diet supports and is dependent upon networks of transformation, distribution, and commercialization.

To aid respondents in estimating the volume of food containers that it discards each week, we referred the families to volumes of standard trash bags: small (35 liters), medium (35 to 70 liters) and large (>70 liters). Fifty-three percent of surveyed households discarded less than 35 liters per week; 28% discarded between 35 and 70 liters; and 19% discarded more than 70 liters. Some respondents added that they consider most of the containers necessary, while other respondents believed that although some containers are necessary, the amount overall is excessive.

V. Social fabric

FS activists see a strong, resilient, and dynamic social fabric not only as a good that should be pursued for its own sake, but also as something indispensable to the collective actions that will make transition to FS possible.

Our survey results indicate that in general, respondents are aware of the current food system's worrisome socioeconomic and public-health implications. However, few respondents join together with fellow citizens who share the same concerns, or even mention the possibility of undertaking collective actions to transform the food system. Only 6% of surveyed households participate in or belong to a food-related group or network of consumers (Table 9). Even fewer (3%) are connected with some organization that works on agroalimenary issues. Food sharing, which according to respondents was once common among neighbors and family members, is now practiced by only 11% of households.

These data reveal a fragmented society that will have difficulty shouldering the responsibility for making necessary and profound changes to the present food system. However, the survey results do contain some positive signs. For example, 87% of the respondents believe that San Cristóbal residents should organize themselves to demand better public policies from the government. Although no forums exist at present in which citizens may participate in decision-making about food issues, 87% of those surveyed affirm that they would participate if those forums did exist. Some residents, perhaps, have not yet been reached by a message that would motivate them to unite and mobilize despite the dearth of suitable venues.

INDICATOR	RESULT
Networks for production and consumption of foods	
Metric: Percentage of families that are part of or participate in a network for the production and consumption of food	**6%**
Agroalimentary associations	
Metric: Percentage of families linked to agroalimentary associations or organizations.	**2%**
Community gardens	
Metric: Percentage of families that share a cultivation space with other persons.	**3%**
Practices of cooperation	
Metric: Percentage of families that give and receive food	**11%**
Food-policy councils	
Metrics: (1) Existence of venues where citizens participate in decision-making about food-related issues, and (2) characteristics and degrees of participation	**Do not exist in San Cristóbal**

Table 9. Survey results for indicators of the Social fabric dimension of FS in San Cristóbal.

Summary of the results

The indicators have revealed aspects of the food system that investigations with an institutional focus tend to not consider. Among those aspects are good fit between diet and cultural preferences; production of food at home; origin of the food that is consumed; and condition of the social fabric.

Several indicators are signs that FS in San Cristóbal is at risk. Especially concerning are the indicators of weak social fabric and the insufficient or inaccurate information available to residents about their food.

The public's freedom of choice, and therefore the public's FS, requires that such information be available and accessible. For example, knowing their food's nutritional value and origin, what transgenics are, and whether their food is organic is fundamental to the public's exercise of its right to food that is safe, and that respects persons, the environment, and cultural preferences.

However, the survey results do have positive aspects that point to a great opportunity to promote FS in SCLC. Most families consume fresh foods daily, purchasing those foods primarily in public markets and small, family-owned stores. Residents are not only aware of the health risks of agrochemicals, but would like to produce their own food.

Thus, we see a challenge and opportunity for civil organizations in San Cristóbal to reconnect the city's persons and collectives, thereby recovering the notion of community (Emaús 2015) and leading a critical mass of citizens to contribute to democratizing the food system and advancing toward FS.

Conclusions

a) Findings regarding the methodology

In this work, we have proposed a participative methodology for constructing a system of indicators of FS in urban spaces. The indicators that we obtained via that methodology are (1) coherent with the discourse regarding FS, (2) congruent with the specific characteristics of San Cristóbal, and (3) flexible enough to be adapted to other urban contexts.

The above is relevant, taking into account that the persons who constructed the indicators had previously been unfamiliar with the concept of FS. That fact constitutes an argument in favor of the public's participation in making binding decisions about issues related to the food system.

Participative methodologies have the additional virtue of generating contextualized lists of indicators. In the system of indicators constructed during this study, we can see reflected the particular characteristics of San Cristóbal and its inhabitants:

- In all of our workshops, participants expressed their desire to produce food at home, considering such production a priority objective for achieving greater control over their food. Moreover, urban agriculture is still present in San Cristóbal despite the city's demographic explosion and unplanned urban sprawl, and would be even more important if the public had more space available for that purpose. According to some of the experts who validated the system of indicators, San Cristóbal residents' emphasis upon urban agriculture is not shared by inhabitants of all other cities. Thus, the indicators that refer to raising plants and animals for food at home illustrate contextualization of the system to San Cristóbal. Indeed, they are the best illustrations of that contextualization.
- The indicators that refer to measures for ensuring safety and hygiene during production, transport, and handling of foods reflect the concerns that SCLS resident themselves expressed, perhaps because the residents are aware that much of the produce sold in San Cristóbal is grown on lands irrigated with sewage.

Ideally, the list of indicators should be flexible enough to be adapted to other urban contexts. The experts agreed that the list of indicators presented in this work can be adapted with only a few additions, deletions, and modifications. For example, those needed to adapt the list to the cultural food preferences of the area of study.

Another virtue of the participative process is that it yields a more-complete list of indicators. However, experts noted, especially, the absence of indicators for the political aspects of FS in the list generated by San Cristóbal residents. That omission may owe itself to the workshop participants' unfamiliarity with the

term “food sovereignty” (and its political significance), and to the participants’ lack of confidence in the possibility of transforming the food system via political activism.

During the workshops, facilitators asked participants to define the food system that they desired, using as a premise that the system must be one that respects people and the environment. Among the attributes that the participants mentioned, spontaneously, were those that dealt with health, environment, and culture-but not politics. That omission is significant, given that the formulation and implementation of municipal public policies via “bottom-up” processes can contribute to transformation of food systems, and thereby to advancement toward the objectives of FS (García-Sempere et al. 2018).

However, the survey that we conducted gave different results: the great majority of respondents (87%) believe that in order to change the food system, the public must organize itself and demand better policies from the government. This contradiction may be due to differences between the methods used to obtain information: that is, between workshops and surveys. In the workshops, participants maintained a rich exchange of information and experiences, whereas most of the questions in the survey were direct ones that elicited short answers which the respondents did not have the opportunity to nuance. Also, the sample size for the survey (263 households) greatly exceeded the number of participants in the workshops (107). Researchers may find further exploration of the omission of political indicators worthwhile, such as via in-depth interviews, to reveal whether San Cristóbal residents have sufficient will and confidence to transform the food system through collective actions.

The system of indicators should also evaluate the city’s connection with its rural surrounds, through indicators such as continuity of the city with its landscape; distance between points of origin and consumption of the city’s food; and the degree to which residents are familiar with how food is grown in the region. The absence of this sort of indicators in the list that we presented may be due to the public’s

unawareness of the importance of establishing relations with the nearest rural surroundings, in order to establish sustainable food systems (Mattheisen 2015).

The participative methodology has demonstrated its virtues, but also its difficulties. The process is lengthy, and demands considerable commitment from participants. Developing a system of FS in urban contexts starting from scratch is not always possible, nor is it necessary, according to results from our consultations. The indicators that we present can be adapted to other urban contexts, although those indicators might, with benefit, be weighted and reduced to a common scale. Those steps would enable the indicators to be used within a single framework, to provide an overall evaluation of FS. In addition, weighting and scaling is a good way to adapt the indicators to the area of study, since each community could assign to those indicators context-specific weightings and limiting values according to the cultural, environmental, and social characteristics of the community's region.

The survey did not reveal problems with San Cristóbal residents' economical access to organic foods, but that result should not be taken as meaning that those problems do not exist. The difficulties that poverty and social inequality pose to obtaining those foods are clear. Good reason exists for believing that access should be more difficult to higher-quality, more-expensive foods (e.g. organic ones). The absence (in our survey results) of a significant correlation between social class and access to food may owe itself to San Cristóbal residents' confusion about the meanings of terms such as local and organic foods. To avoid errors, the meanings of those terms would need to be made clear to respondents. An additional reason for the lack of correlation may be that impoverished respondents may be too embarrassed to admit that they cannot afford food.

b) Empirical findings

Because we did not weight the indicators and reduce them to a single scale, they cannot be used readily to give a quantitative overall diagnosis of FS in San Cristóbal. However, a qualitative evaluation of FS in

the city can be obtained by interpreting the indicators both individually and collectively. We find that the FS of San Cristóbal families is infringed in several ways:

a) Inadequate access and availability of land for food production for families' own consumption.

As a remedy, the city needs an urban planning that reserves and protects land for green areas and urban agriculture. That planning should integrate the urban, periurban, and nearby rural areas to create alliances among municipalities that favor development of food systems that rebuild the region's social metabolism.

b) Women have a crucial role in driving FS. Most of them bear a double burden: they continue to do all of the work of purchasing or growing food, then cooking it and cleaning up afterward, even as they also work outside the home.

It is important to pay attention to the women's excessive workload, so that it is not perpetuated within the new alimentary paradigm. This issue is debated frequently in forums on women and feminism held by diverse campesino institutions; for example, those of CLOC (*Coordinadora Latinoamericana de Organizaciones Campesinas*) and MST (*Movimiento dos Sim Terra*). We must not forget that to a large degree, the advances in feminist thought during the last 25 years had their origins in debates-academic as well as within social movements-that were related in one way or another to FS. Such is the case for the crucial contributions by authors such as María Mies and Vandana Shiva (Mies & Shiva, 2016; Pérez Orozco, 2014; Shiva, 2018) to the concept of ecofeminism.

Illich (2008) maintains that the social polarity between men and women has always existed, albeit in forms distinct to each culture, and has served to organize society. He terms this historical duality "vernacular gender", referring to that which is homemade. The problem, according to Illich, is that industrialization abolishes vernacular gender, making room instead for a regime of "economic sex" in which economic growth occurs at the cost of exploitation of women.

The double workload of most women in San Cristóbal is a sample of the discrimination to which they are subjected. For that reason, the food-related tasks performed by women must be valued and given greater availability. At the same time, the public must be made conscious of the women's excessive workload.

Agroecology, as a convivial organizational form that offers an alternative to the dominant social order, can recover "the vernacular" and preserve its modes of life with gender equality. Clearly, no universal solution exists that will work in all cultures and communities, or even in all homes. Therefore, urban municipal administrations should undertake campaigns to sensitize the public, and should also offer spaces where the public can debate the issue and offer its own proposals for advancing toward an equitable sharing of work between women and men.

Going beyond this reflection, we believe that future works should treat this issue in depth, to complete the proposal of indicators for FS. It is, without a doubt, an unfinished business that should be given priority.

c) The information available to the public about the origins, production and processing modes, nutritional value, and transgenics content of is food creates confusion, and does not enable the public to exercise its right to choose foods that are nutritious as well as respectful of persons, the environment, and cultural preferences.

Food sovereignty speaks to the right of peoples to choose their own food systems. However, for that right to be made freely, people need information that is clear, truthful, and available and accessible to all. As we have seen, in San Cristóbal commercial tortillas made with corn flour are replacing those made with nixtamalized corn, against cultural preferences and to the detriment of the health of most of the population. To be able to enjoy a sustainable urban food system, people should be informed clearly and truthfully of the social, environmental, and health impacts of the present food system, as well as of the importance of protecting campesinos culture and the gastronomic culture of the region.

As a response to present-day urban societies' lack of information and awareness regarding their food system, school gardens are a valuable and necessary educational tools for fostering a critical attitude among consumers. Municipal governments can articulate consciousness-raising campaigns to be implemented in the school gardens, and staff those campaigns with personnel who are specialized in that area. The school garden could contribute to better eating habits of future generations (Blair, 2010) by:

- helping reduce San Cristóbal residents' elevated consumption of sweetened *aguas frescas*, industrial cookies, and dairy products;
- facilitating reflections about social and environmental problems related to the food system, in addition to reflections about health, wasted food, and the excess of food containers; and
- fostering consumption, at home and elsewhere, of food that is a good fit to local culture.

In addition, urban municipal governments should undertake educational campaigns and projects about healthy diets, and about the health repercussions of increased consumption of highly-processed foods. The campaigns should be publicized via local radio and the state television station.

d) The present model of transforming, distributing, and commercializing foods generates an increased amount of food-container waste.

Campaigns to raise public awareness of the excess of food containers, as well as of the concomitant environmental and health consequences, are relatively frequent in San Cristóbal. However, these campaigns tend to omit the relationship between that excess and the current model of distribution and commercialization. Consciousness-raising campaigns, with an FS viewpoint, should highlight that intrinsic relationship and present, as a solution, the city's agroecological markets that sell local and seasonal products.

e) Neighbors are not organized socially to obtain the food system that they desire.

Food sovereignty requires a strong social fabric that allows agroecological experiences to grow, and to continue transforming the food system "from the bottom up". The necessary structural changes are profound, and must be undertaken collectively (Patel 2009). While the public remains atomized, it cannot advance in other dimensions of FS except with difficulty.

In any case, neighbors in San Cristóbal have not lost interest, nor have they lost confidence in the community's power as an agent of change, as evidenced by our finding that 87% believe it is necessary to organize themselves and demand better public policies from the government. Residents are probably in need of a motivating discourse that will invite them to mobilize themselves to promote (for example) the organization of publicity campaigns, and to rehabilitate parcels of municipal property for urban gardens.

At present, the percentage of families that participate in agroecological initiatives is very low (6%), but sufficient to drive the development of leadership, and to empower the city's incipient agroecological movement.

At times such as these, the role of NGOs, academia, schools, and San Cristóbal's social movements is fundamental to the spread of agroecology and the concept of FS; to raising the visibility of alternatives; and to channeling citizens' discontent toward the undertaking of collective, transformative actions.

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