Local Food

Local food is a movement of “think global, act local”. It is a “collaborative effort to build more locally based, self-reliant food economies - one in which sustainable food production, processing, distribution, and consumption is integrated to enhance the economic, environmental and social health of a particular place.” It is a preference to buy locally produced goods and services rather than those produced by corporatized institutions.

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Calculation Formula
Agriculture Farming Surface Calculation Formula

\[
\text{Need} \div \text{Ingredients} = \text{Food Eaten}
\]

\[
\text{Food Eaten} \times \text{Waste} = \text{Food Produced}
\]

\[
365 \text{ days} \times \text{Food Produced} \div \text{Yield} = \text{Area/p.p.}
\]
Local food system, which is very different from global food system, is a "collaborative effort to build more locally based, self-reliant food economies - one in which sustainable food production, processing, distribution, and consumption is integrated to enhance the economic, environmental and social health of a particular place."

Resource:

This chapter describes its characteristics, organization, and finally summarizes its three most important characteristics.
3.1 General Introduction

Think Global, Act Local
Local Food System
Advantage of Local Food System
Disadvantage of Local Food System
Local Food Organization Model
Local Food System

Local Food
Local food is a movement of "think global, act local." It is a collaborative effort to build more locally based, self-sustaining food economies - one in which sustainable food production, processing, distribution, and consumption is employed to enhance the economic, environmental, and social health of a particular place. This is a preference to buy locally produced goods and services rather than those produced by corporate institutions.

Definition to "Local"

In 2008 Congress passed H.R. 3249, which amended the "Consolidated Farm and Rural Development Act." In the amendment, "locally" and "regionally" are grouped together and are defined as:

"(i) the locality or region in which the final product is marketed, so that the total distance that the product is transported is less than 400 miles from the origin of the product, or
(ii) the State in which the product is produced." 


In May 2010 the USDA acknowledged this definition.

Resources:

Three Advantages of Local Food

Environmental Impact
Food miles are one factor used when assessing the environmental impact of food, including the impact on global warming. Local food can largely reduce the environmental impact of food miles. A low carbon diet minimizes the emissions released from the production, packaging, processing, transport, preparation and waste of food.

Economical Impact
Local food systems have a positive and potential impact on the local economic development. It is very common that the impact of local food to the economic development is in the form of income and employment growth in the researched by numbers of scholars to local foods. The most obvious and most direct way of local food systems to the local economy is through impact substitution. We can imagine that, if consumer buy food produced in the local region, rather than imported products, the economy level of local consumers and merchants are more likely to be raised.

Social and Cultural Impact
Garden-based learning is essentially an instructional strategy, which utilizes the garden as a teaching tool, in local food system. The practice of garden-based learning is a growing global phenomenon. In some settings it is the educational curriculum and in others it supports or enhances the curriculum.

The relationship between local foods and healthy food items, such as fresh fruits and vegetables, has led to claims that local food systems may provide health benefit to from improved nutrition, obesity prevention, and a reduced rate of chronic diet-related disease.

Disadvantages of Local Food System

Disadvantages of Local Food System

Disadvantages of Local Food System

However, just like the both sides of the coin, there are also disadvantages:

When we speak of local food, we are referring to products which are grown locally, or in the region where we reside. The idea of striking to local food and avoiding imported food is not a new one but something that was brought in and practiced decades ago. And still, in present times, there are many people who stick to it. And that idea sprang up for some good reasons. Main one being that buying local food supports economic growth of the nation, it improves the social health of a particular place, and are more eco-friendly. However, the bandwagon of local food also entails a few disadvantages which probably many are still unaware of.

Generally, local food system has following disadvantages:

1. One of the greatest disadvantages of buying food that is grown locally is burning holes in the pocket.
2. Sticking to buying local food may help in making the region socially and economically sound, but speaking in global terms, it might be actually disadvantageous.
3. There is no denial to the fact that locally, all varieties of food cannot be grown, and supplied to the consumers.
4. And another concern, that may surface with local food, is the subject of regulation or certification. Most farmers owing small farms are not regulated, so you may never be sure about what they label as organic fruits or vegetables, are really organic or not.
5. Buying local food and the disadvantages may make more sense to people living in colder climates like Iceland. In such cases, if people happen to support local farming, then they may not have a healthy lifestyle.

Resources:
Organization Model Of Local Food System

Urban Agriculture

Urban agriculture is the practice of cultivating, processing and distributing food in or around a village, town or city. Urban agriculture in addition can also involve animal husbandry, aquaculture, agroforestry and horticulture. These activities also occur in parts of rural areas.

Community Supported Agriculture (CSA)

A form of alternative food network, CSA is a socio-economic model of agriculture and food distribution. A CSA consists of a community of individuals who pledge support to a farming operation in exchange for a share of the crop. The goals of a CSA are to ensure food security, to make money for farmers, and to provide reliable food for members of the community.

Public Agriculture Produce

Public produce is a subset of urban agriculture. It refers to fruits, vegetables, nuts, and herbs cultivated in public spaces such as parks, plazas, or town squares, along streets, or on the grounds of public institutions, such as city halls, courthouses, libraries, and schools. And they are freely available to the public.

Urban Farming

Rooftop farming is the practice of cultivating food on the rooftops of buildings. It has the advantage of using the already present space at the rooftop, adding platforms could possibly be created between high rise buildings called “zero bridges”.

Facade Farm

Facade farming are becoming more and more common. More recently, the larger facade farming concept has been utilized with innovative horticulture technology. The vegetation for a green facade is always attached on outside walls, with being walls this is also usually the case, although some being walls can also be green walls for interior use.

Resources:

Vertical Farm Tower

Despommier's concept of “The Vertical Farm” emerged in 1999 at Columbia University. It promotes the mass cultivation of plant and animal life for commercial purposes in skyscrapers. Using advanced greenhouse technology such as hydroponics and aeroponics, the skyscrapers could theoretically produce fish, poultry, fruit and vegetables.

Vertical Farm by Jung Min Nam  
Vertical Farm by Chris Jacobs  
Vertical Farm by Blake Kurasek

Urban Roof Farm

Urban Roof Farm

Rooftop farming is the practice of cultivating food on the rooftops of buildings. It has the advantage of using the already present space at the rooftop, adding platforms could possibly be created between high rise buildings called “zero bridges.”

Roof Farm in Tokyo  
Roof Farm in New York  
Roof Farm in Chicago

Facade Farm

Facade Farm in Santiago  
Facade Farm in New York  
Facade Farm in Tokyo

Resources:
1. Vegetated OutdoorWalls research presentation on Ainslie P. Aria research website
Public Agriculture Produce

Public agricultural produce is a subset of urban agriculture. It refers to fruits, vegetables, nuts, and herbs cultivated in public space and freely available to the public. Public produce differs from traditional community gardens, as the produce from the latter is generally not for public consumption, but for those who tend the garden.

According to Danilo Mordück, public produce is a term coined in his book Public Produce: The New Urban Agriculture comprises three facets:

1. The food must be grown in true public space (parks, plazas, streets, or any space where all members of the public are welcomed);
2. The food must be freely available to all members of the public; and
3. The garden is permitted, funded, and/or maintained by public officials, as part of a broad public policy to improve the diet of citizens.

Resource:

Community Supported Agriculture

Community-supported agriculture (in Canada, community-shared agriculture) (CSA) is an alternative, locally-based socio-economic model of agriculture and food distribution. A CSA also refers to a particular network or association of individuals who have pledged to support one or more local farms, with growers and consumers sharing the risks and benefits of food production.

Similar examples worldwide:
- Association pour le maintien de l’agriculture paysanne (GAMAP) in France
- Agriculture assurée par la communauté (ASCO) in Quebec
- Teich in Japan
- Recuperarsi in Portugal
- Landwirtschaftskammer in Austria
- Hof in Germany
- Gruppo di Acquisto Solidale (GAS) in Italy

Resource:
3.2 Two Characteristics

1. Community Based Food System

Community Based Food System
Diversity Value
Community-based Food System

Some Local Economic Organizations Of Community Based Food System

Community-supported Agriculture

CSAs generally focus on the production of high-quality foods for a local community, often using organic or biodynamic farming methods, and a shared-risk membership-marketing structure. This kind of farming operates with a much greater degree of involvement of consumers and other stakeholders than usual — resulting in a stronger consumer-producer relationship. The core design includes developing a cohesive consumer group that is willing to spend a whole season’s budget in order to get quality foods. The system has many variables on how the farm budget is supported by the consumers and how the producers then deliver the foods. CSA theory suggests that the more a farm embraces whole-farm, whole-budget support, the more it can focus on quality and reduce the risk of food waste or financial loss.

Members of Economic Organizations (self-reliant food economies)

1. Farmers’ market
2. Vegetable box scheme
3. U-pick (Pick your own)
4. Community gardening / household gardening
5. Public Producing
6. Farm-to-table
7. Farm to School (Farm to Institutions)
8. Farm to restaurant
9. Farm to Retailer (Local Supermarket)
10. Consumer cooperatives
A farmers’ market or farmers market consists of individual vendors—mostly farmers—who set up booths, tables or stands, outdoors or indoors, to sell produce, meat products, fruits and sometimes prepared foods and beverages. Farmers markets add value to communities.

- Farmers/producers sell directly to consumers, minimizing profit lost by circumventing the middleman.
- Consumers can buy fresh from the farmer/producers.
- Consumers can get organic fruits and vegetables from Certified Organic farmers.
- Consumers can enjoy fresh, seasonally-grown food that was produced within a diverse distance from their homes.
- More capital remains in the consumers’ community.

Growing Farmers’ Markets:

In the U.S. and Canada, due in part to the increased interest in healthier foods, a greater desire to preserve local types of agriculture or livestock (some of which may not be up to commercial shipping or yield standards) and an increased understanding of the importance of maintaining small, sustainable farms on the fringes of urban environments, farmers markets in the US have grown from 1,785 in 1994 to 4,382 in 2000 to 6,274 in 2009. In New York City, there are over 500 farmers markets in operation. In the Los Angeles area, 88 farmers markets exist, many of which support Hispanic and Asian farmers.

Resources:

With the continuous development of the network economy, local farmers are now co-operating to build up farmers’ market on the network in US, Europe as well as in Canada and the United State, to provide consumers with an online farmers market. Through this way, more and more consumers who now can not participate in the local farmers’ markets, could purchase online local products. This provides local farmers and producers with another market access, above the costs and lower management costs.
**Vegetable Box Scheme**

A vegetable box scheme is a delivery of fresh vegetables, usually locally grown and organic, either directly to the customer or to a local collection point.

A vegetable box scheme is usually operated by the grower or a small co-operative to add value and support the local food economy. There are approximately 600 such schemes operating in the UK in 2007, and by early 2008, according to the Soil Association, over 42,000 orders were in excess of £100 million per annum.

**Resources:**

**Community Gardening**

A community garden is a single piece of land gardened collectively by a group of people. Community gardens provide fresh produce and plants as well as satisfying labor, neighborhood improvements, sense of community and connection to the environment. They are publicly managed in terms of ownership, access, and management, as well as typically owned in trust by local governments or not-for-profit associations.

**Resources:**

**U-pick (Pick your own)**

A U-pick or pick your own farm is a type of farm where customers are allowed to harvest their own produce. Since customers are allowed and often encouraged to eat while picking, the entry fee usually covers any produce customers may eat. Despite this, the produce of U-pick farms is often lower priced than the cost of hiring farmers to harvest the produce in predescribed.

In the UK, the public is actively encouraged to pick their own. The farm can still pick for the market, while the public can enjoy themselves in the same field. This was very popular in the 1970s and 1980s, when there was a season for fruit but has declined in popularity now that the global market can provide the same fruit for most of the year.

**Public Producing**

Public produce is a subset of urban agriculture. It refers to fruits, vegetables, grain, and herbs cultivated in public space, and freely available to the public.

According to Denis Nordahl, public produce is a term he coined in his book Public Produce: The New Urban Agriculture to describe these aspects:
1. The food must be grown in true public space (like agricultural land, parks, planes, artisans, or any space where all members of the public can access).
2. The food must be freely available to all members of the public, and
3. The garden is permanently funded and/or maintained by public officials, as part of a broad public policy to improve the food of citizens.

**Resources:**
Farm To Table

Farm-to-table (or farm-to-fork) refers to, in the food safety field, the stages of the production of food, from growing to processing, packaging, sales, and consumption. Farm-to-table also refers to a movement centered on producing food locally and delivering that food to local consumers. Linked to the local food movement, the movement is promoted by some in the agriculture, food service, and restaurant communities. It may also be associated with organic farming initiatives, sustainable agriculture, and community-supported agriculture.

Resource:

Farm To School

Farm to School is broadly defined as a program that connects schools and local farms with the objective of serving healthy meals in school cafeterias, improving student nutrition, providing agriculture, health and nutrition education opportunities, and supporting local and regional farmers.

Farm to School provides a model for positively influencing children’s eating habits through school cafeteria improvements, hands-on nutrition education, and community involvement and support. Since each Farm to School program is shaped by its unique community and region, the Farm to School Program in America does not prescribe or impose a list of practices or products for the Farm to School approach.

Resource:

Farm To Local Retailer

Supermarkets are beginning to tap into the local food market as well. Walmart announced plans in 2008 to spend $400 million during that year on locally grown produce.

Walmart’s 71-store chain across the midwest, has purchased local foods for over 20 years as well. In their case, the produce manager in each store controls the influx of local foods. The relationship with the local heirs are not entirely controlled.

Resource:
Cooperative

A cooperative (also co-operative or co-op) is a business organization owned and operated by a group of individuals for their mutual benefit. In local food system, one community is a cooperative. It is composed by community farm cooperative and community consumer cooperative.

A cooperative is defined by the International Cooperative Alliance’s Statement on the Cooperative Identity as “an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through jointly owned and democratically controlled enterprises”. A cooperative may also be defined as a business owned and controlled equally by the people who use its services or by the people who work there.

2. Diversity Value
Diversity Value of Community Based Food System

1. Society And Culture
Community based food system has the ability of appreciation, acceptance or promotion of multiple cultures.
According to the different races of people, there will be different diet group even small diet community.
The culture in different communities are different, so the entertainment, activity, lifestyle and education are also very different.

2. Community Economy
The organization of economy is very different among communities.
There are many economic organization under community based food system, such as vegetable box scheme, pick your own, farm-to-table, community gardening, consumer cooperatives, farm to institute, farm to retailer… Each community can choose some of them based on their diet and the food they produce.

3. Technology and Management
Different community will produce different food. Then the economic organization outside the community could work. According to the different food farmed by communities, they will utilize different agricultural production technologies.
Local Food
Three Essential Characteristics:

1. COMMUNITY BASED FOOD SYSTEM

Community-supported agriculture is the most essential part of local food systems. It consists of the agricultural producers and consumers in the community who are committed to supporting the community's agricultural production. In this system, producers and consumers form a coalition to enjoy the benefits and risks of committing to agricultural production.

2. DIVERSITY VALUE

Diversity Value is another important aspect of local food. This feature is particularly prominent in the United States. The United States is a multi-cultural country with significant cultural differences. In the United States, according to the diverse living population in different communities, there are many different cultures. Different communities will have a variety of lifestyles, diets, habits, cooking styles, community activities. Accordingly, there will be a variety of farming practices, farming techniques, and so on.
The culture of the world is very rich, accordingly, there are a wide variety of diets. The nutrient ingredients are also very different among these diets. Except culture, there are also numbers of diets relation with medicine and weight loss. In this chapter, 10 diets are compared. Their nutrient ingredients and farming surface are also explained and illustrated by the charts and formulas.
3.1
Surface Calculation Formula

Agricultural Surface Calculation Formula
Calorie In 10 Diets
Average Calorie In Food
Food Waste
Food Print
Agriculture Farming Surface Calculation Formula

\[
\text{Need} \div \frac{\text{Ingredients}}{\text{Kcal/Kg}} = \frac{\text{Food Eaten}}{\text{Kcal/day}}
\]

\[
\frac{\text{Food Eaten}}{\text{Kg/day}} \times \frac{\text{Waste}}{\% \text{ (percentage)}} = \frac{\text{Food Produced}}{\text{Kg/day}}
\]

\[
365 \times \frac{\text{Food Produced}}{\text{Kg/day}} \div \frac{\text{Yield}}{\text{Kg/year}} = \frac{\text{Area/p.p.}}{\text{m}^2/\text{p.p.}}
\]
Agriculture Farming Surface Calculation Formula

\[
\frac{\text{Need (Kcal/day)}}{\text{Ingredients (Kcal/Kg)}} = \text{Food Eaten (Kg/day)}
\]

\[
\text{Food Eaten (Kg/day)} \times \text{Waste (% percentage)} = \text{Food Produced (Kg/day)}
\]

\[
365 \text{ days} \times \frac{\text{Food Produced (Kg/day)}}{\text{Yield (Kg/year)}} = \text{Area/p.p. (m2/p.p.)}
\]

Calorie In 10 Diets
### Calorie of 10 Diets

<table>
<thead>
<tr>
<th>Diets</th>
<th>Calorie (Kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Healthy Diet</td>
<td>2100</td>
</tr>
<tr>
<td>Japanese Healthy Diet</td>
<td>1800</td>
</tr>
<tr>
<td>Finland Healthy Diet</td>
<td>1800</td>
</tr>
<tr>
<td>Buddhist Veganism Diet</td>
<td>1800</td>
</tr>
<tr>
<td>Raw Veganism Diet</td>
<td>1250</td>
</tr>
<tr>
<td>Fruitarianism Diet</td>
<td>1250</td>
</tr>
<tr>
<td>Montignac Diet</td>
<td>2000</td>
</tr>
<tr>
<td>Atkins Diet</td>
<td>2000</td>
</tr>
<tr>
<td>Organic Food Diet</td>
<td>2100</td>
</tr>
<tr>
<td>Junk Food Diet</td>
<td>2500</td>
</tr>
</tbody>
</table>

Reference:
Agriculture Farming Surface Calculation Formula

\[
\text{Need} \div \text{Ingredients} = \text{Food Eaten}
\]

\[
\text{Food Eaten} \times \text{Waste} = \text{Food Produced}
\]

\[
365 \text{ days} \times \text{Food Produced} \div \text{Yield} = \text{Area/p.p.}
\]

Average Calorie In Food
### Calorie In Vegetable And Fruit

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>citrus (lemons, oranges, etc)</td>
<td>2.115</td>
</tr>
<tr>
<td>olives</td>
<td>0.685</td>
</tr>
<tr>
<td>avocados</td>
<td>0.625</td>
</tr>
<tr>
<td>plums (average yield)</td>
<td>2.170</td>
</tr>
<tr>
<td>cherries</td>
<td>1.580</td>
</tr>
<tr>
<td>apricots</td>
<td>2.090</td>
</tr>
<tr>
<td>peaches</td>
<td>2.575</td>
</tr>
<tr>
<td>bananas</td>
<td>1.125</td>
</tr>
<tr>
<td>grapes</td>
<td>1.480</td>
</tr>
<tr>
<td>apples</td>
<td>1.920</td>
</tr>
<tr>
<td>broccoli</td>
<td>2.935</td>
</tr>
<tr>
<td>apricot</td>
<td>2.080</td>
</tr>
<tr>
<td>boysenberries</td>
<td>2.000</td>
</tr>
<tr>
<td>blueberries</td>
<td>1.747</td>
</tr>
<tr>
<td>grapefruit</td>
<td>2.365</td>
</tr>
<tr>
<td>kiwi</td>
<td>1.652</td>
</tr>
<tr>
<td>melon</td>
<td>2.950</td>
</tr>
<tr>
<td>nectarine</td>
<td>2.290</td>
</tr>
<tr>
<td>pear</td>
<td>1.729</td>
</tr>
<tr>
<td>pineapple</td>
<td>1.987</td>
</tr>
<tr>
<td>raspberries</td>
<td>1.922</td>
</tr>
<tr>
<td>strawberries</td>
<td>3.102</td>
</tr>
<tr>
<td>watermelon</td>
<td>3.348</td>
</tr>
</tbody>
</table>

**Average** 2.021

### Calorie In Vegetable Per Gram

### Calorie In Fruit Per Gram

### Calorie In Other Food

<table>
<thead>
<tr>
<th>Legumes</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>peas</td>
<td>1.020</td>
</tr>
<tr>
<td>beans</td>
<td>0.860</td>
</tr>
<tr>
<td>red kidney beans</td>
<td>1.181</td>
</tr>
<tr>
<td>white beans</td>
<td>1.000</td>
</tr>
<tr>
<td>black beans</td>
<td>1.226</td>
</tr>
<tr>
<td>pinto beans</td>
<td>1.214</td>
</tr>
</tbody>
</table>

**Average** 1.086

<table>
<thead>
<tr>
<th>Carbohydrate</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>potato</td>
<td>0.963</td>
</tr>
<tr>
<td>rice</td>
<td>0.770</td>
</tr>
<tr>
<td>wheat</td>
<td>0.406</td>
</tr>
<tr>
<td>barley</td>
<td>0.283</td>
</tr>
<tr>
<td>salt</td>
<td>0.237</td>
</tr>
<tr>
<td>malt</td>
<td>0.464</td>
</tr>
<tr>
<td>buckwheat</td>
<td>0.202</td>
</tr>
</tbody>
</table>

**Average** 0.176

<table>
<thead>
<tr>
<th>Nut and Seeds</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walnuts</td>
<td>0.123</td>
</tr>
<tr>
<td>Cashew Nuts</td>
<td>0.186</td>
</tr>
<tr>
<td>Brazil Nuts</td>
<td>0.146</td>
</tr>
<tr>
<td>Coconut Meat</td>
<td>0.263</td>
</tr>
<tr>
<td>Macadamia Nuts</td>
<td>0.128</td>
</tr>
<tr>
<td>Peanuts</td>
<td>0.179</td>
</tr>
<tr>
<td>Foie gras</td>
<td>0.143</td>
</tr>
<tr>
<td>Pistachio Nuts</td>
<td>0.180</td>
</tr>
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</table>

**Average** 0.176

<table>
<thead>
<tr>
<th>Animal Oil</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>butter</td>
<td>0.595</td>
</tr>
<tr>
<td>lamb</td>
<td>0.111</td>
</tr>
<tr>
<td>fish oil</td>
<td>0.119</td>
</tr>
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</table>

**Average** 0.125

<table>
<thead>
<tr>
<th>Oil Plants</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunflower oil</td>
<td>0.117</td>
</tr>
<tr>
<td>Olive oil</td>
<td>0.114</td>
</tr>
<tr>
<td>Grape seed oil</td>
<td>0.112</td>
</tr>
<tr>
<td>Virgin Coconut oil</td>
<td>0.112</td>
</tr>
<tr>
<td>Peanut oil</td>
<td>0.113</td>
</tr>
<tr>
<td>Canola oil</td>
<td>0.125</td>
</tr>
<tr>
<td>Walnut oil</td>
<td>0.113</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>0.126</td>
</tr>
<tr>
<td>Sesame Oil</td>
<td>0.113</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>0.113</td>
</tr>
</tbody>
</table>

**Average** 0.412

<table>
<thead>
<tr>
<th>Meat</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>beef / livestock (25%)</td>
<td>0.633</td>
</tr>
<tr>
<td>pork (25%)</td>
<td>0.581</td>
</tr>
<tr>
<td>fish / aquatic products (10%)</td>
<td>0.532</td>
</tr>
<tr>
<td>chicken / poultry (30%)</td>
<td>0.426</td>
</tr>
</tbody>
</table>

**Average** 0.426

<table>
<thead>
<tr>
<th>Others</th>
<th>Gram/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar beet</td>
<td>2.243</td>
</tr>
<tr>
<td>Fat-free milk</td>
<td>4.006</td>
</tr>
<tr>
<td>Chicken egg</td>
<td>0.715</td>
</tr>
<tr>
<td>cheese</td>
<td>0.703</td>
</tr>
<tr>
<td>coffee bean</td>
<td>0.212</td>
</tr>
<tr>
<td>Cocoa beans</td>
<td>0.218</td>
</tr>
<tr>
<td>Free sugar</td>
<td>0.225</td>
</tr>
</tbody>
</table>

**Average** 0.426

<table>
<thead>
<tr>
<th>Calorie In Legumes, Meat and Others</th>
<th>Gram/Calorie</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Calorie In Carbohydrate, Oil plants, Nuts and Seeds</th>
<th>Gram/Calorie</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Calorie In Animal Oil Per Gram</th>
<th>Gram/Calorie</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Calorie In Sunflower Oil Per Gram</th>
<th>Gram/Calorie</th>
</tr>
</thead>
</table>
Calorie In Food

1. Calorie in food, online at http://www.thecaloriecounter.com/
2. Calorie in food, online at http://www.calorie-counter.net/
3. Calorie in food, online at http://www.freedieting.com/tools/calories_in_food.htm

Calorie In Fruit
Calorie in fruit, online at http://caloriecount.about.com/calories-fruits-fruit-juices-i000
Calorie in fruit, online at http://www.freedieting.com/tools/calories_in_fruit.htm

Calorie In Vegetable
Calorie in vegetable, online at http://freedieting.com/tools/calories_in_vegetables.htm
Calorie in vegetable, online at http://caloriecount.about.com/calories-vegetables-i1100

Calorie In Potato
Calorie in potato, online at http://caloriecount.about.com/calories-potatoes-yams-i1113

Calorie In Cereal
Calorie in cereal, online at http://caloriecount.about.com/calories-cold-cereals-i001
Calorie in cereal, online at http://www.freedieting.com/calories/grains_pasta_2000.htm

Calorie In Sugar
Calorie in sugar, online at http://caloriecount.about.com/calories-sugars-sweeteners-i1970

Calorie In Fork
Calorie in fork, online at http://www.freedieting.com/tools/calories_in_meat.htm

Calorie In Fish
Calorie in fish, online at http://www.freedieting.com/tools/calories_in_fish.htm

Calorie In Beef and Livestock
Calorie in beef and livestock, online at http://www.freedieting.com/tools/calories_in_meat.htm

Calorie In Chicken and Poultry
Calorie in chicken, online at http://www.freedieting.com/tools/calories_in_chicken.htm

Calorie In Egg
Calorie in egg, online at http://www.freedieting.com/tools/calories_in_eggs.htm

Calorie In Milk
Calorie in milk, online at http://www.freedieting.com/calories/milk.htm

Calorie In Cheese
Calorie in cheese, online at http://www.freedieting.com/calories/cheese.htm

Calorie In Sunflower Oil
Calorie in sunflower oil, online at http://caloriecount.about.com/calories-vegetable-oils-i29573

Calorie In Other Plant Oil
Calorie in other plant oil, online at http://www.freedieting.com/calories/oil.htm
Calorie in other plant oil, online at http://caloriecount.about.com/calories-vegetable-oil-i007

Calorie In Animal Oil
Calorie in animal oil, online at http://www.freedieting.com/calories/butter_oil.htm
Calorie in animal oil, online at http://www.freedieting.com/calories/fish_oil.htm

Calorie In Bean
Calorie in bean, online at http://caloriecount.about.com/calories-beans-legumes-products-i1500
Calorie in bean, online at http://www.freedieting.com/calories/beans_vegetarian_1930.htm

Calorie In Nuts and Seeds
Calorie in nuts and seeds, online at http://www.freedieting.com/tools/calories_in_nuts.htm
Calorie in nuts and seeds, online at http://caloriecount.about.com/calories-nut-seed-products-i1200
Agriculture Farming Surface Calculation Formula

\[
\text{Need} \div \text{Ingredients} = \text{Food Eaten}
\]

\[
\text{Food Eaten} \times \text{Waste} = \text{Food Produced}
\]

\[
365 \text{ days} \times \text{Food Produced} \div \text{Yield} = \text{Area/p.p.}
\]

Food Waste
Households produce the largest fraction of EU food waste among the four sectors considered, at about 42% of the total or about 38Mt, an average of about 76kg per capita.

Manufacturing food waste was estimated at almost 35 Mt per year in the EU27 (70kg per capita), although a lack of clarity over the definition of food waste (particularly as distinct from by-products) among MS makes this estimate fragile.

European Commission Aims to Cut Food Waste 50 Percent by 2020

Europe may be facing much larger problem than what to do with its food waste. For 2011, the average person throws away 300 kg (669 lb) per year, and of this, two thirds is still edible. MEPs are calling against what they see as unsustainable levels of waste. The resolution being passed through parliament is set to be approved. The goal is to cut food waste in half through various means. To do so will have to address the long cycle of food, from farm to fork. Cutting down on food processing is most important because it is the single largest source.


Definition to food waste

A 2011 study by the Swedish Institute for Food and Biotechnology (SIAB), on behalf of the Food and Agriculture Organization of the United Nations (FAO), Global Food Losses and Food Waste, distinguishes between “food lost” and “food waste”, and provides figures for both:

**Food Loss**

Food loss measures the decrease in edible food mass (excluding inedible part and seed) “throughout the part of the supply chain that specifically leads to edible food for human consumption”, that is, loss at the production, harvest and processing stages. This definition of loss includes biomass originally meant for human consumption but eventually used for some other purpose, such as fuel or animal feed.

**Food Waste**

Food waste is food loss occurring during the retail and final consumption stages due to the behavior of retailers and consumers—that is, the throwing away of food.
Agriculture Farming Surface Calculation Formula

\[
\text{Need} \div \text{Ingredients} = \text{Food Eaten}
\]

\[
\text{Food Eaten} \times \text{Waste} = \text{Food Produced}
\]

\[
365 \times \text{Food Produced} \div \text{Yield} = \text{Area/p.p.}
\]
Foodprint In Different Ingredients By Different Research

Average Foodprint Per Year By Different research

<table>
<thead>
<tr>
<th>Species</th>
<th>ZHOU Bo (m/yr/kg)</th>
<th>MVRRDV in RM3 (m/yr/kg)</th>
<th>FAO, World Bank &amp; Nationmaster (m/yr/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit, Vegetable and Carbohydrate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>1.58</td>
<td>1.76</td>
<td>1.58</td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.53</td>
<td>0.63</td>
<td>X</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potato</td>
<td>0.86</td>
<td>0.70</td>
<td>0.96</td>
</tr>
<tr>
<td>Grain</td>
<td>2.74</td>
<td>2.53</td>
<td>2.74</td>
</tr>
<tr>
<td>Sugar beets</td>
<td>0.74</td>
<td>0.53</td>
<td>X</td>
</tr>
<tr>
<td>Animal (feeding area included)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pig</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Fish and other aquatic product</td>
<td>0.34</td>
<td>0.23</td>
<td>0.34</td>
</tr>
<tr>
<td>Beef and other livestock</td>
<td>3.47</td>
<td>4.58</td>
<td>4.32</td>
</tr>
<tr>
<td>Chicken and other poultry</td>
<td>0.50</td>
<td>0.62</td>
<td>X</td>
</tr>
<tr>
<td>Egg, Milk &amp; Cheese</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg</td>
<td>0.18</td>
<td>0.31</td>
<td>X</td>
</tr>
<tr>
<td>Dairy milk</td>
<td>0.02</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>Cheese</td>
<td>0.17</td>
<td>0.28</td>
<td>0.17</td>
</tr>
<tr>
<td>Plants Oil, Legumes &amp; Nuts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower oil</td>
<td>12.81</td>
<td>11.42</td>
<td>X</td>
</tr>
<tr>
<td>Other plant oil</td>
<td>6.74</td>
<td>8.13</td>
<td>6.74</td>
</tr>
<tr>
<td>Animal oil</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Beans and related products</td>
<td>0.71</td>
<td>0.04</td>
<td>0.71</td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td>9.13</td>
<td>5.11</td>
<td>9.16</td>
</tr>
</tbody>
</table>

Selected resources:

Average Food Print per Year

- Fruit
- Vegetable
- Potato
- Grain
- Sugar beets
- Pig
- Fish and other aquatic product
- Beef and other livestock
- Chicken and other poultry
- Egg
- Dairy milk
- Cheese
- Sunflower oil
- Other plant oil
- Animal oil
- Beans and related products
- Nuts and seeds

Traditional Agricultural Technology Application

Description

Agriculture Production Technology Catalogue

- Climate
- Soil
- Water
- Land
- Technology
- Inputs
- Outputs
- Efficiency
- Sustainability
- Profitability

- Grain
- Rice
- Wheat
- Corn
- Soybean
- Maize

- Vegetable
- Tomato
- Potato
- Carrot
- Onion

- Animal
- Cattle
- Poultry
- Sheep
- Goat

- Aquatic
- Fish
- Shrimp
- Crab
Yield and Foodprint

Fruit

Vegetable

Root and Tuber Production

Potato
Sveen Marcus Federsen, Jan Erik, Luisa Dalla Costa, João Coutinho Evangelista, Dobekal and Anna Oloha, "Potato production in Europe – a gross margin analysis" online at http://www.foi.lif.lu.dk/publications/~media/foi/foi_1070/de/upload/foi/doc/publications/working%20papers/200105pdf.um

Cereal
Cereal yield in different countries, online at http://data.worldbank.org/indicator/AG.YLD.CERE.LK

Sugar Beet
Sugar Beet yield, online at http://en.wikipedia.org/wiki/Sugar_beet

Pig
Pig production in different countries, online at http://www.nationmaster.com/graphs/agr_bog_pro-agriculture-hog-production

Fish and Aquatic Products
The European Market for Seafood, online at http://www.fao.org/docrep/013/v167s/v167s01.pdf

Cow and Livestock
Cow and Livestock production, online at http://www.organicrules.info/q-node/57

Chicken and Poultry
Chicken and Poultry production, online at http://www.thepoultrytimes.com/articles/1791/european-chicken-meat-production-trends-2010

Egg
Egg production, online at http://www.thepoultrytimes.com/articles/1576/eu-egg-production-beyond-the-2012-cage-ban

Dairy

Choose

Sunflower
Sunflower yield, online at http://wiki.answers.com/Q/What_is_the_yield_per_acre_of_sunflower_seeds

Other Oil Plant
"Total Collected Area, Yield and Production in the World and Selected Countries and Regions", online at http://www.fao.org/docrep/016/v9550e/v9550e00.pdf

Bean
Bean production, online at http://www.nationmaster.com/graphs/agr_soy_agriculture-arey-soy-bean

Nuts and Seeds
In this section, 10 diets are introduced: European healthy diet, Japanese healthy diet, Finland healthy diet, raw veganism diet, buddhist diet, fruitarianism diet, Atkins diet, montignac diet, organic food diet and junk food diet. There are many more detailed information in the table including the simple description for each diet, the calorie intake and so on. And from the pie chart and bar chart, you can clearly see the difference of the nutrient ingredients and farming surface between different diets.
## Diets Catalogue

### Diets In The World

#### Diets A-G
1. Alkaline diet
2. Atkins diet
3. Best Bet Diet
4. Blood Type Diet
5. Bretharian diet
6. Buddhist diet
7. Cabbage Soup Diet
8. Cookie diet
9. Crash diet
10. Detox diet
11. Diabetic diet
12. Diet for a New America
13. DASH Diet
14. Dr. Hay diet
15. Dukan Diet
16. Eat Clean Diet
17. Earth Diet
18. Edenic diet
19. Elemental diet
20. Elimination diet
21. Failfield Diet
22. Feingold diet
23. Fit for Life diet
24. Flexitarian diet
25. Food combining diet
26. F-plan diet
27. Fruitarian diet
28. Fat diet
29. Gerson diet
30. Gluten-free diet
31. Casein-free diet
32. The Graham Diet
33. Grapefruit diet

#### Diets H-N
1. Hacker’s diet
2. Hay diet
3. Herbalife
4. Halal diet
5. Hallelujah diet
6. High-protein diet
7. High residue diet
8. Healthy Six diet
9. Inuit diet
10. Israeli Army diet
11. Jenny Craig diet
12. Joel Fuhrman diet
13. Junk food diet
14. Juice diet
15. Kangatarian diet
16. Kosher diet
17. Ketogenic diet
18. Lacto vegetarianism
19. Liquid diet
20. Low-carbohydrate diet
21. Low-fat diet
22. Low glycemic index diet
23. Low-protein diet
24. Low sodium diet
25. Lutein-free diet
26. Lemonade diet
27. Macrobiotic diet
28. Master Cleanse
29. McDougall diet
30. Medifast Diet
31. Mediterranean diet
32. Montignac diet
33. Natural Foods Diet
34. Negative calorie diet
35. Nutrisystems Diet

#### Diets O-Z
1. Okinawa diet
2. Omnivore
3. Organic food diet
4. Ornish Diet
5. Ovo vegetarian diet
6. Paleolithic diet
7. Perricone diet
8. Pescetarian diet
9. Plant-based diet
10. Prison loaf
11. Rastafarian diet
12. Raw foodism
13. Scarsdale Medical Diet
14. Shangri-La Diet
15. Slimming World diet
16. Smart For Life
17. Sonoma diet
18. South Beach diet
19. SparkPeople diet
20. Stillman diet
21. Subway diet
22. Swank diet
23. Sugar Busters diet
24. Vegan diet
25. Vegetarian diet
26. Very low calorie diet
27. Weight Down diet
28. Weight Watchers
29. Western pattern diet
30. Word of Wisdom
31. Zone diet
Table of European Healthy Dine

<table>
<thead>
<tr>
<th>Component</th>
<th>Population goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Activity Levels (PAL)</td>
<td>PAL &gt; 1.75</td>
</tr>
<tr>
<td>Adult Body Weight as BMI</td>
<td>BMI 21-22</td>
</tr>
<tr>
<td>Dietary Fat % E</td>
<td>&lt;30</td>
</tr>
<tr>
<td>Fatty Acids % total E</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Saturated</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Trans</td>
<td></td>
</tr>
<tr>
<td>Polyunsaturated (PUFA) n-6, n-3</td>
<td>4-8</td>
</tr>
<tr>
<td>2 g linolenic + 200 mg very long</td>
<td></td>
</tr>
<tr>
<td>Chain</td>
<td></td>
</tr>
<tr>
<td>Carbohydrates Total % E</td>
<td>&gt;55</td>
</tr>
<tr>
<td>Sugary food consumption, occasions</td>
<td>&lt;=4</td>
</tr>
<tr>
<td>per day</td>
<td></td>
</tr>
<tr>
<td>Fruit and Vegetables (g.d⁻¹)</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Folate from food (µg.d⁻¹)</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Dietary Fibre (g.d⁻¹)</td>
<td>&gt;25 (or 3g MJ)</td>
</tr>
<tr>
<td>Sodium (expressed as sodium</td>
<td>&lt;6</td>
</tr>
<tr>
<td>chloride) (g.d⁻¹)</td>
<td></td>
</tr>
<tr>
<td>Iodine (µg/d)</td>
<td>150 (infants – 50)</td>
</tr>
<tr>
<td>(pregnancy – 200)</td>
<td></td>
</tr>
<tr>
<td>Exclusive Breast Feeding</td>
<td>About 6 months</td>
</tr>
</tbody>
</table>

Japanese Healthy Diet

Food Pyramid of Japanese Healthy Diet

Calorie compare per capita per day (%)

Surface compare per capita per year (m²)

Description
The Food Guide from Japan's Health and Agriculture ministry, is depicted as a spinning top with a wide upper layer tapering to a narrow bottom.

At the large upper level, carbohydrates, including rice, bread, and noodles (6 to 7 servings a day), followed by a side dish of vegetables, potatoes, beans, mushrooms, and seaweed (5 to 6); then a smaller main course of protein, including meat, fish, eggs, and soy (3 to 5 servings), finally the narrow point, divided between dairy (2) and fruit (1 servings).

Cooking rice is the main source of carbohydrates. Other materials such as bread, noodles, eggs, etc. Approximately 40g carbohydrate derived from the main materials.

The main ingredients are vegetables (except soy), which is a source of vitamins, minerals, dietary fiber vegetables, potatoes, beans, mushrooms, seaweed, etc mainly.

Mainly contains a source of calcium, milk, yogurt, and cheese.

Mainly contains fruit which contains a source of vitamin C, such as potassium, watermelon, and apple fruit, such as orange, and strawberries.
### Finland Healthy Diet

**Description**
The weather of Finland has a significant impact on the country’s cuisine, although Western-style fast food has become a common element of the Finnish diet in recent decades. The country’s climate limits the production of plant-based foods. Pansu have grown increasingly dependent on pasta, hamburgers, fish, rice, and other Western fast food law.

**Surface compare per capita per year (m²)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Fruit</th>
<th>Vegetables</th>
<th>Fish &amp; fishery</th>
<th>Grains and other carbohydrates</th>
<th>Processed meats</th>
<th>Milk and milk products</th>
<th>Egg</th>
<th>Other products</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of total diet</td>
<td>4%</td>
<td>3%</td>
<td>7%</td>
<td>10%</td>
<td>12%</td>
<td>4%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Calories per capita</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kcal) per day</td>
<td>18%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Description           | The weather of Finland has a significant impact on the country’s cuisine, although Western-style fast food has become a common element of the Finnish diet in recent decades. Because the country’s climate limits the production of plant-based foods, Pansu have grown increasingly dependent on pasta, hamburgers, fish, rice, and other Western fast food law. Bread has been a staple of Finnish food for centuries.

### Buddhist Vegetarian Diet

**Description**

**Surface compare per capita per year (m²)**

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Vegetables</th>
<th>Potato</th>
<th>Grains and other carbohydrates</th>
<th>Processed meats</th>
<th>Milk and milk products</th>
<th>Egg</th>
<th>Other products</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>10%</td>
<td>12%</td>
<td>7%</td>
<td>3%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Calories per capita</td>
<td>18%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kcal) per day</td>
<td>18%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Description           | Culture of Buddhist Diet: It is a kind of religious diet. In Buddhism, what is most important is to recognize that being alive, by its very nature, is the cause of direct or indirect suffering and death to other beings (samma). One should avoid gluttony and greedy consumption, while maintaining a healthy diet and lifestyle which is conducive to attaining enlightenment. Some buddhist vegetarianism exclude all animal products, as well as a vegetable in the allium, like onion, garlic.
**Raw Veganism Diet**

*Description of Raw Veganism Diet*

A raw vegan diet includes raw vegetables and fruits, nuts and nut pastes, grains and legume sprouts, seeds, plant oil, sea vegetables, herbs, and fresh juices.

1. It excludes all food of animal origin.
2. It excludes all food cooked at a temperature above 45 degrees Celsius (110 degrees Fahrenheit).
3. The definition of a raw vegan diet can be loosened to include vegan diets with at least 75% raw foods.

There are many different versions of the diet. In addition to the ethics of eating meat, dairy, eggs and honey, raw vegans may be motivated by health, spiritual or environmental reasons, or a combination thereof.

The definition of a raw vegan diet can be loosened to include vegan diets with at least 75% raw foods.

**Food Pyramid of Raw Veganism Diet**

- Sea Weed
- **Nutritional Yeast**
- Herbs, Microgreens and Wheat Grass Juice
- **Nuts and Seeds**
- Pine, Hemp Seeds
- Sprouts and Legumes
- Fruits and Vegetables
- Leaky Greens
- **Medicinal Foods**
- **Proteins, Amino Acids**
  - Eat Moderately
- **Foundation Foods**
  - Eat Generously

**Surplus compare per capita per year (m2)**

**Calories compare per capita per day (%)**
**Atkins Diet**

**Description**

It is a low-carbohydrate high protein diet created by Robert Atkins.

The diet is based on the theory that overweight people eat too many carbohydrates. Our bodies burn both fat and carbohydrates for energy, but carbs are used first. By drastically reducing carbs and eating more protein and fat, our bodies naturally lose weight by burning stored fat more efficiently.

**Calorie compare per capita per day (%)**

- 12%: Meat
- 5%: Fish
- 5%: Dairy
- 2%: Fats
- 2%: Alcohol
- 14%: Vegetables
- 14%: Fruit
- 15%: Grains
- 15%: Other

**Surface compare per capita per year ft²**

- 300.00: Main course
- 200.00: Side dish
- 100.00: Snack
- 50.00: Dessert
- 0.00: Beverage

---

**Food Pyramid of Atkins Diet**

- Whole Grain Products: Wheat Flour, Oat Meal, Sprouted Grains, Brown rice, Wheat Bread
- Vegetables & Seed Oil Sources: Dairy Products, Nuts, legumes, Olive
- Fruits Sources: Blueberry, Avocado, Peers,
- Vegetables Sources: Salad greens, Broccoli, Cauliflower, Spinach
- Protein Sources: Sea Foods, Egg, Meat, Soy, Products,
### Organic Food Diet

The organic food diet is designed to be healthy and nutritious, focusing on whole, unprocessed foods. It avoids the use of synthetic additives and chemical fertilizers, promoting natural growth and health. Below is a breakdown of the daily caloric and nutrient intake:

<table>
<thead>
<tr>
<th>Food Category</th>
<th>Calories %</th>
<th>Carbohydrate %</th>
<th>Protein %</th>
<th>Fat %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits强壮</td>
<td>14%</td>
<td>30%</td>
<td>2%</td>
<td>41%</td>
</tr>
<tr>
<td>Vegetables强壮</td>
<td>3%</td>
<td>41%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Grains和其他碳水化合物强壮</td>
<td>3%</td>
<td>41%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Fish and other seafood</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
<td>41%</td>
</tr>
</tbody>
</table>

### Junk Food Diet

The junk food diet is high in calories and low in nutrients. It is typically consumed for pleasure rather than health benefits. Below is a breakdown of the daily caloric and nutrient intake:

<table>
<thead>
<tr>
<th>Food Category</th>
<th>Calories %</th>
<th>Carbohydrate %</th>
<th>Protein %</th>
<th>Fat %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fats and oils强壮</td>
<td>14%</td>
<td>30%</td>
<td>2%</td>
<td>41%</td>
</tr>
<tr>
<td>Sweets强壮</td>
<td>3%</td>
<td>41%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Meat强壮</td>
<td>3%</td>
<td>41%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Beer强壮</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
<td>41%</td>
</tr>
</tbody>
</table>

### Calorie Count

- **Calories per capita per day (%):**
  - Organic Food Diet: 14% (Fruits), 3% (Vegetables), 3% (Grains), 4% (Fish and other seafood)
  - Junk Food Diet: 14% (Fats and oils), 3% (Sweets), 3% (Meat), 4% (Beer)

- **Surface Area per capita per year (m²):**
  - Organic Food Diet: 3% (Fruits), 4% (Vegetables), 3% (Grains), 4% (Fish and other seafood)
  - Junk Food Diet: 3% (Fats and oils), 3% (Sweets), 3% (Meat), 4% (Beer)
10 diets agricultural surface per person per year are compared with Berlin and Barcelona based on the same population density. From these diagrams, we can clearly see how many agricultural surface do we need for different diets to feed the whole Berlin and Barcelona.
The current agricultural production technologies are introduced in this chapter. Because the nutrient ingredients are different between each cult, the technology applied in them are varied. Some applying these technologies, the agricultural surface are largely reduced.
4.1 Technology Overview
Plants Farming Production Technology

Soil cultivation
- Cultivator
- Cultipacker
- Subsoiler

Planting
- Seed drill
- Broadcast seeder
- Planter (x row planter)

Succession planting
- Monoculture
- Polyculture

Growing
- Fertilizing & Peat Control
  - Manure spreader
  - Sprayer

Plants
- Irrigation
- Harvesting
  - Corn harvester
  - Bean harvester
  - Combine harvester

Produce sorter
- Weight Sorter
- Color Sorter
- Diameter Sorter
- Shape Sorter
- Blemish Sorter

Light / Heat
- Grow Light
- Heat

Broadcast seeder
1. A sowing device
2. Not precise
3. Not high crop yield

Planter (x row planter)
1. Big machine for plant (4x row planter)
2. High efficiency

Succession planting
1. Increase crop availability during a growing season by making efficient use of space and timing.
2. After one crop is harvested, another is planted in the same space. (The length of the growing season, climate, and crop selection are key factors.)
3. The plants mature at staggered dates, establishing a continuous harvest over an extended period.
4. Intercropping is one pattern approach; companion planting is a related, complementary practice.
5. The varieties mature one after the other over the season.

Polyculture
- Crop rotation
- Intercropping
- Companion planting
- Beneficial weeds, alley cropping

Irrigation
- Aeroponic
- Hydroponic
- Drip (Plastic mulch)
- Sprinkler system
- Center pivot system
- Sub-irrigation system
- Xericaping

Produce sorting
- Incandescent lights
- Fluorescent lights
- High-intensity discharge lights (HID)
- High pressure sodium (HPS/SON)
- Metal halide (MH)
- HID lights
- Green House
- Plastic mulch

Fish farming
- Fish farming is the principal form of aquaculture, while other methods may fall under mariculture. Fish farming involves raising fish commercially in tanks and ponds, usually for food.
1. Intensive aquaculture
2. Intensive aquaculture systems: fish production per unit of surface can be increased at will, as long as sufficient oxygen, fresh water and food are provided. Because of the requirement of sufficient fresh water, a massive water purification system must be integrated in the fish farm.
3. Irrigation ditch or pond systems
   - The system produces more edible protein per unit area than any other. A wide variety of plants can grow well in the hydroponic beds. Since the system lives in a greenhouse, it adapts to almost all temperate climates.
Animal Farming Production Technology

- Aquaculture
  - Shrimp farming
    - Penaeus monodon
  - Oyster farming
    - Subsistence
  - Algae farming
    - Algae
- Poultry
  - Chickens
    - Intensive farming
  - Turkeys
  - Ducks
  - Geese
  - Livestock
    - Pig
      - Intensive farming
    - Sheep
      - Range band flocks
      - Merino flocks
      - Ewe/rams flocks
      - Boar flocks
- Cattle
  - Milking machines
  - Automatic Milking (AMS)
- Horse
  - Embryo transfer
  - Rotary Milking sheds
  - Automatic Milking sheds

Greenwater Hatcheries
Greenwater hatcheries are medium-sized hatcheries using large tanks with low animal densities. To feed the shrimp larvae, an algal bloom is induced in the tanks. The survival rate is about 40%.

Galveston Hatcheries
Galveston hatcheries (named after Galveston, Texas, where they were developed) are large-scale, industrial hatcheries using a closed and tightly controlled environment. They breed the shrimp at high densities in large (15 to 30 ton) tanks. Survival rates vary between zero and 80%, but typically achieve 50%.

Intensive Poultry Farming
The vast majority of poultry are raised using intensive farming techniques. According to the Worldwatch Institute, 74 percent of the world’s poultry meat, and 69 percent of eggs are produced this way. One alternative to intensive poultry farming is free range farming.

Artificial Incubation
Incubation can successfully occur artificially in machines that provide the correct, controlled environment for the developing chicks. Many commercial incubators are industrial-sized with shelves holding tens of thousands of eggs at a time, with rotation of the eggs in a fully automated process.

Embryo Transfer
Embryo transfer refers to a step in the process of assisted reproduction in which one or several embryos are placed into the uterus of a female with the intent to establish a pregnancy. Embryo transfer is widely used for livestock breeding, especially for dairy cattle and pigs. Techniques developed for livestock have been adapted for use in humans.

Automatic Milking (AMS)
Advantages:
1. Elimination of labour
2. Milking consistency
3. Increased milking frequency
   - Milking frequency may increase to three times per day, however typically 2.5 times per day is achieved.
Some agricultural technologies have special forms. After using these technologies, the space will be changed accordingly. In this section, some technologies are introduced by simple 3d diagrams as toolboxes. They are center pivot irrigation system, hydroponics, drip irrigation, artificial light, automatic milk machine, integrated fish farming and so on. Some important datas such as the size and the minimal surface are explained for each toolbox. And the photos show what it is like after applying this technology.
Agricultural Technology Toolbox Logo
**Drip Irrigation**

Outdoor Farm size: 1 Hectare

Innovations like greenhouses, vertical gardening, or hydroponics, are tragedies which are never understand or overlooked. In our form, each unit is surrounded and ventilated by allowing water to drip down to the roots of plants, collect onto the soil surfaces, or directly onto the root zones, through a network of valves, pipes, filters, and controllers.

Drip irrigation:
http://agrihealth-farmers-guide-irrigation-systems.html

---

**Aquaponics**

Size of grow beds: ≥ 100 m²

Size of fish tanks: 4-1200 gal fish tanks

Aquaponics is a sustainable food production system that combines traditional aquaculture (growing aquatic animals such as fish, shrimp, or prawns in tanks) with hydroponics (cultivating plants in water) to create an efficient ecosystem. In the aquaponics system, effluents from the fish tanks are filtered out by the plants as key nutrients, after which the cleaned water is recirculated back to the fish. This wastewater is then used in the hydroponics system, where the by-products from the plants are filtered out for the fish to consume. The term aquaponics is a combination of the terms aquaculture and hydroponics.

Aquaponics:
https://aquaponics.com/paper_specifications_and_pricing_for_commercial_systems
Hydroponics

Hydroponics is a method of growing plants using mineral nutrient solutions in water, without soil. The roots of the plants are grown with their roots in the mineral nutrient solution, either in water or in an inert medium, such as pebbles, gravel, mineral wool, or coconut husk.

Hydroponics
http://www.comercialhydroponics.com.hydro.html

Crop Rotation

Outdoor farm size: 1 species / 1 Hectare
Number of species: 2-6 even larger
Rotation Time: depend on the number of species

Hydroponics is a subset of hydroculture and is a method of growing plants using mineral nutrient solutions in water, without soil. The roots of the plants are grown with their roots in the mineral nutrient solution, either in water or in an inert medium, such as pebbles, gravel, mineral wool, or coconut husk.

Crop rotation
http://en.wikipedia.org/wiki/Crop_rotation

Crop Rotation

Crop rotation is the practice of growing a series of dissimilar types of crops in the same area in sequential seasons. It is one of the most important principles of sustainable agriculture and can help to prevent soil degradation and nutrient depletion. A typical example is the rotation of corn, soybeans, and a non-legume each year. Crop rotation also reduces the build-up of pathogens and pests that often occur when the same species or continuously cropped, and can also improve soil structure and fertility by alternating deep-rooted and shallow-rooted plants.
**Farming Machine**

Wide: 10–30 m  
Farming Size: > 5 Hectares  
Farming machines can greatly increase the yield. For example, a seed drill is a seeding device that previously plant the seeds in the soil and then cover them. The use of a seed drill can improve the ratio of crop yield by 30% to 40% more.

**Grow Wall**

Height: 1.5 m – 2 m  
One Unit: > 100 m²  
Grow walls are used vertically with watering methods such as drip irrigation and nutrient supply. Combined with the natural walls of plants, this growing method provides the perfect size of nutrients and moisture needed for robust growing plants.


**Intercropping**

Raw Spacing: 1–2 m  
Farming Size: > 5 Hectares  
It is recommended in the practice of growing two or more crops in proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop. Careful planning is required, taking into account the soil, climate, crops, and varieties. It is particularly important to choose crops that complement each other for physical space, nutrients, water, and sunlight. Examples of intercropping scenarios are planting a deep-rooted crop with a shallow-rooted crop, or planting a tall crop with a shorter crop that requires partial shade.
**Integrated Fish Farming**

- **Tank Diameter**: 1.5-2.5 m
- **Outdoor Farming Size**: 2 Hectares
- **Indoor Farming Size**: 0.5 Hectares

If the system is in a greenhouse, it adapts to almost all temperate climates, and may also adapt to tropical climates. The main environmental impact is discharge of water that must be added to maintain the fish’s electrolyte balance.

**Intensive Pig Farming**

- **Space per Pig**: 2-3 m²
- **Number of Pigs**: 1000 pigs

Intensive pig farms are a type of factory farm specialized in the rearing of domestic pigs up to slaughter weight. In this system, pigs are reared indoors in group feeding or straw-laid cells, while pregnant sows are housed sow-stall (gestation crate), or pen and given free access to feeding stations.

**Organic Chicken Farming**

- **Number of Chickens**: 4 chickens / m²
- **Indoor Farming Size**: 6-16 chickens / m²
- **Chicken Number**: > 10000 chickens

Organic chicken farming involves practices that meet agricultural standards set by organic certification bodies in the EU and other regions. It promotes sustainability and animal well-being.

**Organic Pig Farming**

- **Space per Pig**: > 5 m²
- **Number of Pigs**: 1000 pigs

Organic pig farming practices focus on animal welfare, sustainability, and environmental considerations, ensuring pigs have access to a sufficient quantity of fresh air and room to move, play, and express normal behavior.

Sources:
**Automatic Milking Machine**

**Number of cows:** 30 - 70 cows

**Radius of Machine:** 10 - 20

*Typical capacity for a AMM is 55-75 cows per milking unit. AMM actually achieve milking frequencies between 2 and 3 times per day, on a single milking unit handling 40 cows and milking each over 3 times per day to a capacity of 75 cows per hour.*

Automatic Milking
http://en.wikipedia.org/wiki/Automatic_milking

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**Egg Incubator Machine**

**Number of eggs:** > 1000 eggs

An egg incubator is a device to hatch eggs from reptiles. The incubator keeps the eggs warm, allowing the temperate scale of them to grow and hatch without the necessity of eggs. The incubator is set at 97°F (37°C), and the eggs are placed inside. Chicks' eggs usually hatch after 21 days, while other bird eggs hatch in less time than this.

---

**Grow Light 1**

**Radius:** 0.3 - 0.5 m

**Height:** 1.5 m - 2 m

90 W LED Light; for 4' x 4' Square foot

A grow light is placed light a light bulb that generates an electric light, designed to simulate plant growth by matching the characteristics of sunlight appropriate for photomorphosis.

Grow Light
grow-light-02.html

---

**Grow Light 2**

**Radius:** 0.5 - 2.5 m

**Height:** 1.5 m - 2 m

Grow lights allow attempts to provide a light spectrum similar to that from the sun, or to provide a spectrum that is more tailored to the needs of the plant being cultivated.

Grow Light
**Automatic Picking Robot / Egg Collector Machine**

**Automatic Picking Robot**

Image of a robot picking fruit from trees.

**Egg Collector Machine**

Image of a machine collecting eggs from a farm.

---

**Turning Radious: 1.5 - 3 m (depend on the robot and the size of Fruit Tree)**

As labor costs are still quite expensive in vegetable and fruit picking, robots are being designed that can replace humans for this kind of work. The research is still in full progress, especially as the robots need to be carefully designed so that they do not bruise the fruit while picking.

[Robot Picking](http://en.wikipedia.org/wiki/Fruit_picking)

---

**Greenhouse / Building Integrated Agriculture**

**Greenhouse**

Image of different greenhouses.

**Industrial Size: 1.5 Hectares**

A greenhouse (also called a plantation) is a building in which plants are grown. These structures range in size from small sheds to very large buildings. Greenhouses can be divided into glass greenhouses and plastic greenhouses.

---

**Building Integrated Agriculture**

Image of a building integrated agriculture system.

Building integrated agriculture (BIA) is the practice of locating high performance horticultural greenhouses, farming systems on and in mixed use buildings to exploit synergies between the built environment and agriculture.

[Building Integrated Agriculture](http://en.wikipedia.org/wiki/Building_integrated_agriculture)

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*Texts are extracted from the images and are indicative of the content.*

---

*Footnotes*

1. [Building Integrated Agriculture](http://en.wikipedia.org/wiki/Building_integrated_agriculture)
3. [Wind Energy](http://en.wikipedia.org/wiki/Wind_energy)
Vertical Farm is a concept that argues that it is economically and environmentally viable to cultivate plant and animal life within greenhouses, or vertically oriented facilities. This concept, which was initially developed at the University of Columbia, aims to harness the resources of urban areas to support agriculture and food production. The idea is to create a self-sufficient ecosystem where crops and livestock can be grown within a closed environment, reducing the need for large-scale farming and transportation. This concept has been further explored and refined, leading to the development of vertical farming systems that incorporate advanced technologies and sustainable practices. The potential benefits of vertical farming include reduced water and space requirements, lower carbon emissions, and increased food security for urban populations.
Modular design shows after using these toolboxes into different ingredients farming, what the forms are like in the vertical farm and the outside farm. We can see the agricultural farming forms are very different with each other.
### Indoor Farming

- **Drip Irrigation**
  - Size: 500 m²
  - Application: All the plants farming could use drip irrigation technology.

- **Aquaponics**
  - Size: 500 m²
  - Application: Generally used for small plants especially vegetable with fish.

- **Hydroponics**
  - Size: 100 x 5 ~ 500 m²
  - Application: Generally used for small plants.

- **Crop Rotation**
  - Size: 100 x 2 ~ 1500 m²
  - Application: More than 3 plants species which has large different characters.

- **Intercropping**
  - Size: 500 m²
  - Application: A deep-rooted crop with a shallow-rooted crop, or planting a tall crop with a shorter crop.

- **Grow Well**
  - Size: 180 x 5 ~ 500 m²
  - Application: Especially used for small vegetables.

- **Integrated Fish Farming**
  - Size: 500 m²
  - Application: Generally in greenhouse.

- **Integrated Pig Farming**
  - Size: 1000 m²
  - Application: Net welfare for pig.

- **Organic Pig Farming**
  - Size: 1000 m²
  - Application: Welfare for pig.

- **Organic Chicken Farming**
  - Size: 500 m²

### Outdoor Farming

- **Egg Incubator**
  - Size: 100 x 1 ~ 200 m²
  - Application: Instead of hen, more efficient.

- **Organic Cow Farming**
  - Size: 1000 m²

- **Grow Light 1**
  - Size: 569 m²
  - Application: Suitable for all the plants.

- **Grow Light 2**
  - Size: 569 m²
  - Application: Especially suitable for small plants.

- **Automatic Picking Robot**
  - Size: 569 m²
  - Application: Especially used for trees, such as fruit trees and oil trees.

- **Green House**
  - Size: 110 m²
  - Application: Suitable for all the plants and fish farming.

- **Drip Irrigation + Intercropping**
  - Size: 569 m²
  - Application: A deep-rooted crop with a shallow-rooted crop, or planting a tall crop with a shorter crop.

- **Auto-Picking Robot**
  - Size: 569 m²
  - Application: All the plants farming could use drip irrigation technology.

- **Drip Irrigation + Intercropping + Crop Rotation + Farming Machine**
  - Size: 569 m²
  - Application: Especially used for trees, such as fruit trees and oil tree and in combination with drip irrigation.

- **Drip Irrigation + Intercropping + Crop Rotation + Farming Machine**
  - Size: 569 m²
  - Application: Especially used for grain and other plants which have very large farmland.
Because the nutrient ingredients are different between each diet, the technology applied in them are varied. In the table, different signs express different technologies applied in each diet. After applying these technologies, the agricultural surface are largely reduced.

5.4 Surface After Technology
6. Design Proposal
6.1 Distribution Model (Supermarket)
R = 1/2 Edge

Not Optimal

The gray area are not served.

R = 1/2 Diagonal

Optimal

The farthest point just included.

R > 1/2 Diagonal

Not Optimal

The block area are too small, it can be bigger.
Three Geometry Shapes Which Could Seamlessly Put Together With Each Other

Find the Optimal Shape

Triangle

Block Percentage:
= Triangle Area / Round Area
41.35%
Number of the supermarkets:
= City Area ÷ (0.75 × 3 × R²)

Square

Block Percentage:
= Square Area / Round Area
63.66%
Number of the supermarkets:
= City Area ÷ (2 × R²)

Regular Hexagon

Block Percentage:
= Hexagon Area / Round Area
82.70%
Number of the supermarkets:
= City Area ÷ (1.5 × 3 × R²)

If the area of the city is the same, it means that the hexagonal urban structure need the least supermarkets. The triangle urban structure need the largest number of supermarkets.
Block Farming According To The Nutrient Ingredient

- Fruit
- Vegetable
- Grain
- Livestock
- Pig
- Fish and Poultry
- Oil Plant
- Bean
- Nuts and Seeds

Disadvantage:
1. Food transportation distance is very large
2. Difficult to show diversity value

Block Farming According To Diet But People Are Largely Mixed

- Diet 1
- Diet 2
- Diet 3
- Diet 4
- Diet 5
- Diet 6
- Diet 7
- Diet 8
- Diet 9

Disadvantage:
1. The distance for people to buy the food is very large
2. Difficult to generate the unique community culture

1 Block, 1 Diet Farming, 1 Supermarket

- Diet 1
- Diet 2
- Diet 3
- Diet 4
- Diet 5
- Diet 6
- Diet 7
- Diet 8
- Diet 9

- Vertical Farm Area
- Urban Facility Area
- Food Storage, Processing, Supermarket

Advantage:
1. Food transportation distance is small
2. Largest Diversity Value (1 block, 1 diet)
3. Convenient for people to buy food, the distance to buy the food is small
4. Easy to generate the unique community culture
5. Easy to generate unique community agritourism

Autarkic Production

- Vertical Farm Area
- Urban Facility Area
- Food Storage, Processing, Supermarket

1 Block, 1 Diet, 1 Supermarket. Food storage, processing and supermarket in the center of block, most of people in this block belong to this diet.
Optimal City Unit

Large Supermarket

Serve radius $R = 3000m$
Serve People = 100,000 People

Medium Supermarket

Serve radius $R = 2000m$
Serve People = 66,000 People

Small Supermarket

Serve radius $R = 1000m$
Serve People = 33,000 People

Optimal Unit (the most compact model)

Length = 8485 m ($6000/2$ m)
Width = 8865 m ($6500/2$ m)

Size of This Unit = 8485m x 8865m
Serve People = 800,000 People
Population density: 5555.55 People/km$^2$
- 36 Diets Blocks
- 4 Cooperative groups
- 1 Cooperative Union
- 36 Small Supermarkets
- 9 Medium Supermarkets
- 4 Large Supermarkets
The products sold by three supermarkets.

Small supermarket.

- The whole supermarket area: 160000 m²
- Supermarket: 0.4m²/person
- Each block:
  - Sell 50% of the food produced by itself; 25% food sent to the medium supermarket nearby; 25% food sent to the large supermarket.
- Small supermarket area: 2222.22 m²

Small supermarket sells products produced by the block itself.

Medium supermarket.

- Supermarket: 0.4m²/person
- Medium Supermarket:
  - Sell food from 4 block nearby.
  - 25% x 4 = 100%
- Medium supermarket area: 4444.44 m²

Medium supermarket sells products from 4 blocks nearby.

Largest supermarket.

- Supermarket: 0.4m²/person
- Large Supermarket:
  - Sell food from all the blocks: 225%
  - Large supermarket area: 9999.99 m²
- Each Block:
  - Possible Mixed People: 50%
  - 25% from 3 blocks nearby, 25% from any diet block.

Largest supermarket sells all the products of each block.

Optimal Local Food City

- Length = 16,970 m (1200m/2 m)

Size of the City = 16,970m x 16,970m
Serve People=1,600,000 People
Population density: 5555.55 People/km²
- 144 Diets Blocks
- 4 Cooperative groups
- 1 Cooperative Union
- 16 Consumer cooperative groups
- 144 Small Supermarkets
- 36 Medium Supermarkets
- 16 Large Supermarkets

In general, large supermarkets apply to the city which population are more than one million.
6.2 Optimal Sunlight Model
Sunlight Analysis

Sunlight Angle In Different Time

90° (12 noon)
45° (2-3 pm)
45° (9-10 am)
180°
0°

Average Sunlight Angle: 45°

Basic Form and Insunlight Area

Basic form: cube
Insunlight Area: 2A
### Optimal structure: Homogeneous cube structure

<table>
<thead>
<tr>
<th>Insunlight Area (side)</th>
<th>Cube Number</th>
<th>Insunlight Area / Cube</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td><strong>Less than 32</strong></td>
<td><strong>16</strong></td>
<td><strong>Less than 2</strong></td>
</tr>
<tr>
<td><strong>Less than 32</strong></td>
<td><strong>16</strong></td>
<td><strong>Less than 2</strong></td>
</tr>
</tbody>
</table>
Homogeneous cube structure

Block Image

Insunlight area: 32 A  Cube Number: 16

Insunlight area: 32 A  Cube Number: 32
Test insunlight area and volume of different size of cubes.

These models prove that:
1. Although the size of the cube is different, the insunlight area are all the same.
2. The larger the cube structure, the smaller the insunlight area per cube.
6.3

10 Diet Block Organization
**Greenhouse**

**Average Industrial Farm Size**

- **1 Hectare**
  - 1 Hectare: Pig House
  - 4 Hectare: Feeding Area

- **5 Hectare**
  - 1 Hectare: Pig House
  - 4 Hectare: Feeding Area

- **4 Hectare**
  - 1 Hectare: Chicken House
  - 3 Hectare: Feeding Area

- **37 Hectare**
  - 1.2 Hectare: Cow House
  - 35.8 Hectare: Feeding Area

**Pig Farm**

- **1 Hectare Pig House** + **4** + 1 Hectare Feeding Area

**Chicken and Poultry Farm**

- **1 Hectare Cow House** + **3** + 1 Hectare Feeding Area

**Cow and Livestock Farm**

- **1 Hectare Cow House** + **36** + 1 Hectare Feeding Area
Optimal sunlight organization in a block

1414 m

1414 m

1414 m

1414 m
Floor Height of food tower:

**Fruit Farming:** 6m  
**Vegetable and fish:** 5m  
**Potato and Sunflower:** 5m  
**Pig farm:** 8m

Cow and livestock: 10m  
Chicken and poultry: 5m  
Oil plant: 5m  
Bean: 5m  
Nuts and seeds: 5m

- **Green:** Fruit  
- **Red:** Vegetable and fish  
- **Orange:** Potato, sugar beet, sunflower  
- **Gray:** Grain and carbohydrate  
- **Black:** Cow, livestock, milk, cheese  
- **Brown:** Chicken and egg  
- **Beige:** Oil plant  
- **Yellow:** Bean  
- **Pink:** Nuts and seeds
Abstract City programme for a self reliant city

City Other Items
Housing in each block:
surface=330,000 m², Volum= 1,650,000 m³;

Office in each block:
surface=250,000 m², Volum= 1,250,000 m³;

Commercial in each block:
surface=150,000 m², Volum= 750,000 m³;

Public facility and Institutions in each block:
surface=180,000 m², Volum= 900,000 m³;

Industrial in each block:
surface=100,000 m², Volum= 1,000,000 m³;

Parks and Squares in each block:
surface=150,000 m²,
Public surface in each block= 1,300,000 m² (enough)

Total volum is about 6 cubes(100m) in each block, if calculation by average.
6.4 Distribution Model
(Transportation)
Surface researched by MSC2

For 1 million city 1 year:

Supermarket:
- Small: 3,500 m²
- Medium: 7,000 m²
- Large: 15,000 m²

Processing:
- 30,000 m²
- Storage: 50,000 m²
- Each tower: 1,000 m²
- Central tower: 10,000 m²

Best Location of supermarket, storage and processing

Supermarket in the center of the block. Food storage and processing are also in the center of block, this makes food storage, processing and supermarket have the most convenient context.
Number of people in each community: 11,111
Consume per person per day: 2 kg (include food waste)
Total weight: 22,222 kg/day
Average density of food: 650 kg/m³
Total volum consume: 35 m³/day
Towers in Japanese diet community: 36 towers
Transportation of each tower: 1 m³ / per day

Transportation: 1 m³ per time
Working time: 10 hours
Receive food for the center tower: 18 minutes / 1 package

So Electricified monorail system is the best transpor tool.

Largest speed: 120km/h (35m/s)
Acceleration time: 24 second
Deceleration time: 24 second
Turning radius for the largest speed: 90m (less than 100m)
Largest transportation time (in 1 block): 95 seconds
Safe interval: 5 seconds
Largest transportation volum in 10 hours: 7200 m³
Transportation volum needed for 1 year: 35x365=12775 m³
It means that in 1 day (24 hours) can transport 1 year’s food.

So 1 lane is enough!
It is also proved that build up large infrastructure to transport food to everyhouse is not economic.
Transportation Tool Typology:

Skytrain: for large container

Electrified monorail system (medium size)

Montech Montrac (small size)
Plan of Japanese Diet block food transportation

Turn radius: R=100M
Plan of 9 Diet Communities

- Small Supermarket
- Medium Supermarket (Underground)
- Large Supermarket
Suitable For Real Condition
6.5.1

Diet
Changing
(Add Surface)
Largest farming surface (not add cube)

People number: 11,111
Farming surface: 9,800,000 m²
Number of cubes: 49
Farming surface per person: 980 m²/year
Larger than 10 diets surface
Line shape compare

4 sides  4 sides

"L" shape compare

6 sides  5.5 sides

Block Image
Largest farming surface based on "Line" model (after adding cube)

People in block: 11,111
Farming surface: 18,200,000 m²
Number of cubes: 91
Farming surface per person: 1,820 m²/year
Farming surface larger than diet 70% calorie by eating beef
Largest farming surface based on "Line" model (after adding cube)

People in block: 11,111
Farming surface: 24,200,000 m²
Number of cubes: 121
Farming surface per person: 2,420 m²/year
Farming surface larger than diet 100% calorie by eating beef

People in block: 11,111
Farming surface: 24,200,000 m²
Number of cubes: 121
Farming surface per person: 2,420 m²/year
Farming surface larger than diet 100% calorie by eating beef
Diverse Block Typology
Research to the edge block of the city

Corner Block Zoom In
Corner tower at corner Block

Research to the inner block of the city
Tower could be higher at large void space
**Diverse Block Typology**

**Condition 1:** Optimal Homogeneous cube structure is enough for farming
- City item fill in cube structure
- City item separate in the shade of block
- Last row at the edge block of the city
- Corner tower at the corner of the city
- Higher tower in the large area inner city
- Largest farming condition

**Condition 2:** Cubes not enough, need add
- Line shape structure
- "L" shape structure
- "C" shape structure
- "O" shape structure
- Largest line shape farming
- Largest "L" shape farming
- Largest "C" shape farming
- Largest "O" shape farming
Complex Site
Generate cube structure

Generate blocks

Calculate the percentage of people

Generate the real farming surface according to diet
6.6

Ingredients
Farm Tower
Modular Construction
Ingredients
Farm Tower
Storage Plan (in the middle of tower)

Food storage space

Housing second floor

Vegetable and Fish Farm Typical Section
Detail

Vegetable and fish farm section detail

Roof equipment

Water purification equipment

Electricity machine and equipment
Organic pig farming

Sketch of a dairy cow urinating at a slatted floor in a dairy cow house, and metal grid floor.
Intercropping is the practice of growing two or more crops together in proximity. The most elementary form of intercropping is to produce a double yield on a given piece of land by making wise use of resources that would otherwise not be utilized by a single crop.

If the system lives in a greenhouse, it adapts to almost all temperate climates and may also adapt to tropical climates. The main environmental impact is discharge of waste that must be adjusted to maintain the worker’s electrolyte balance.

Organic pig farming requires that pigs be given environmental enrichment, specifically they must have at least 10% of the floor area covered with a sufficient quantity of material to enable proper manipulation and realization.

Pig Farming Principle Flow Chart
- Anaerobic reactor
- Anoxic reactor
- Aerobic reactors
- Filter and clarifier

Water purification
- Hydrolysis
- Acidogenesis
- Acetogenesis
- Methanogenesis

Anaerobic digestion principle flow chart
- Hydrolysis
- Aciagenesis
- Acetogenesis
- Methanogenesis

Organic pig farming tower
Energy analysis (include waste)

The rest used for nutrient

Eaten by fish

Pig Waste

4. Methanogenesis

Water analysis

Gray water for farming, black water for water purification

1. Anaerobic reactor
2. Anoxic reactor
3. Aerobic reactors
4. Filter and clarifier

Gray water (nutrient include)
Animal Feeding Farm Typical Plan

Cow and Livestock Farm Typical Section
Two Community And City Image
Japanese Diet Community
<table>
<thead>
<tr>
<th>Junk Food Diet Community</th>
</tr>
</thead>
</table>

![Diagram of a community layout](image-url)
Thanks!