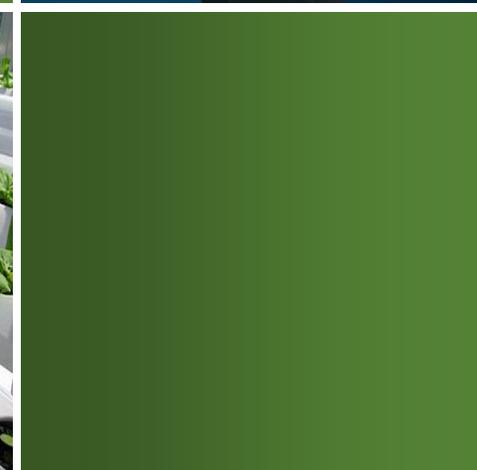


Modern Hydroponic Agriculture Farm Abstract

This abstract reflects general technical and market aspects of agriculture incubation and farming.



INTRODUCTION

Over centuries, the growth of agriculture contributed to the rise of civilizations. 2,000 years ago, much of Earth's population became dependent on agriculture. For thousands of years, agricultural development was very slow. A period of important agricultural inventions began in the early 1700s leading to a dramatically increased food production in Europe and European colonies. In the early 1800s, scientists discovered which elements are most essential for plant growth: nitrogen, phosphorus, and potassium. Now, many farmers use chemical fertilizers because they greatly increase crop yields. With the use of chemicals, crop losses and prices have declined significantly. Nowadays, agriculture

includes **hydroponics**, which is the science of growing plants in nutrient solutions. Just one acre of nutrient solution can yield more than 50 times the amount of lettuce grown on the same amount of soil.



Hydroponic grown tomatoes in a greenhouse

Food production must keep pace relative to population growth and distribution methods. Food production has to increase by 70% by 2050. This is an enormous agriculture and political challenge.

The total population of the GCC region expanded at an annual average rate of 3.3% compared to global average of 1.1% from 2000-2010. Food consumption per capita in the region is below the developed economies and is expected to grow at a relatively higher rate, catching up with the developed economies standards.

THE AGRICULTURE CENTER

The agriculture incubation project consists initially of a center with four functional areas:

1. **Seed Bank**
2. **Farming/Incubation**
3. **Greenhouses**
4. **Centralized Support Service**



View Inside the Svalbard Global Seed Vault

Seed Bank (1.) stores seeds as a source for planting, selling and as a backup in case seed reserves elsewhere are destroyed. Depending on the species, seeds are dried to a suitably low moisture content according to an appropriate protocol, typically less than 5%. The seeds are stored at -18°C or below. Because seed RNA degrades with time, the seeds need to be replanted periodically and fresh seeds collected for another round of storage when they begin to lose viability. Therefore, a **farming and incubation facility (2.)** will be constructed to plant the stored specimens regularly. After incubating the seeds, germinated seeds are planted either at the farming facility or at the

greenhouses, depending on the species.



Incubated seeds ready to be planted

Greenhouses (3.) will be constructed to plant different vegetables on site of the center. Farmers can be trained by state-of-the-art technologies adopted for this facility. The hydroponic growth of the vegetables will lead to a 50-fold increased yield compared to the growth on the same amount of soil.

The **Centralized Support Service Centre (4.)** will offer specified services towards required information/help.

THE AGRICULTURE CENTER

It will provide ultimate irrigation systems, pesticides and fertilizers. It will advise agricultural farmer on the offered products and work as a technical consulting service.

Processing

The farmed plants are harvested and can be sold either directly as fresh and unprocessed food or (after some processing steps) as processed convenience food.

The necessary processing steps are sorting, washing, packaging and freezing, as shown in the flowchart on the next side. For many vegetables, further processing steps are necessary, that are not shown in detail in the figure ("Processing"). These steps might be peeling, cutting or boiling and can be easily integrated in the food processing.

If the final product is not prepared for long-time-storage by freezing or canning, it can also be sold as fresh convenience food out of a cooling shelf. Different mixtures of vegetables lead to a wide product range.



as ready-to-use portion before freezing or cooling

Food processing means time saving to the customer who will appreciate that in the hectic times today. A further processing to a finished

meal is conceivable in future, meaning a higher investment volume.



PROCESSING

Local processing of the produced vegetables means shortening of storage and transport times during the processing. This leads to higher content of vitamins and other important ingredients in the finished product compared to a sale of the unprocessed food on a market the next day. This more healthy products will meet the future market expectations and lead to satisfied customer.



Pre-cut and processed vegetables as convenience food in a supermarket

Market

Qatar heavily depends on imports of cereals, vegetables and fruits for over 75% of their total consumption. Disruption in food imports has always affected the region significantly. It is important to achieve food security in order to reduce the dependence on imports. Qatar is seeking to lease 400,000 hectares of land in Kenya and in the process of acquiring farm land in countries such as Argentina, Ukraine and Turkey. This move is intended to ensure food security and hedge risks related to food price volatility.

Demand for processed food is growing along several categories, including canned & frozen food, health/functional foods as well as

bakery and cereals. It accounts for half of the total food market in the GCC region. With growing urbanization and lack of time cooking processed food is expected to increase.

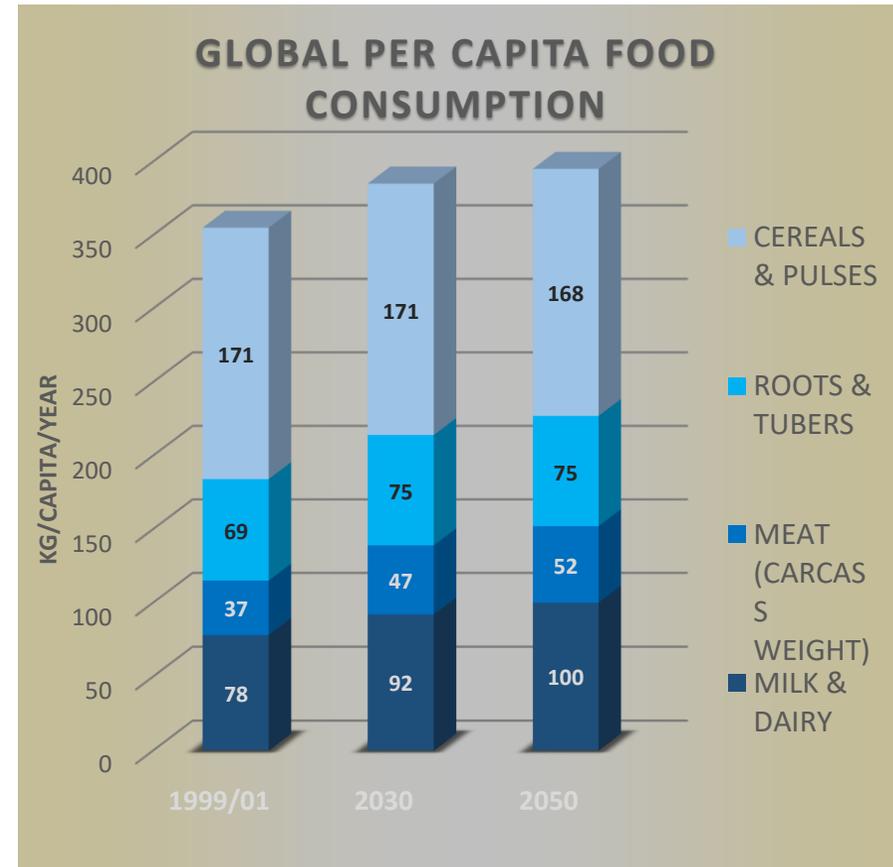
Table 1: CAGR of the different segments of the global food consumption per capita

	CAGR (1999/01-2030)	CAGR (2030-2050)
MILK & DAIRY	0.54%	0.28%
MEAT (CARCASS WEIGHT)	0.76%	0.34%
ROOTS & TUBERS	0.26%	0.00%
CEREALS & PULSES	-0.01%	-0.06%

MARKET

Table2: Consumption of food divided into different segments in the GCC and Qatar

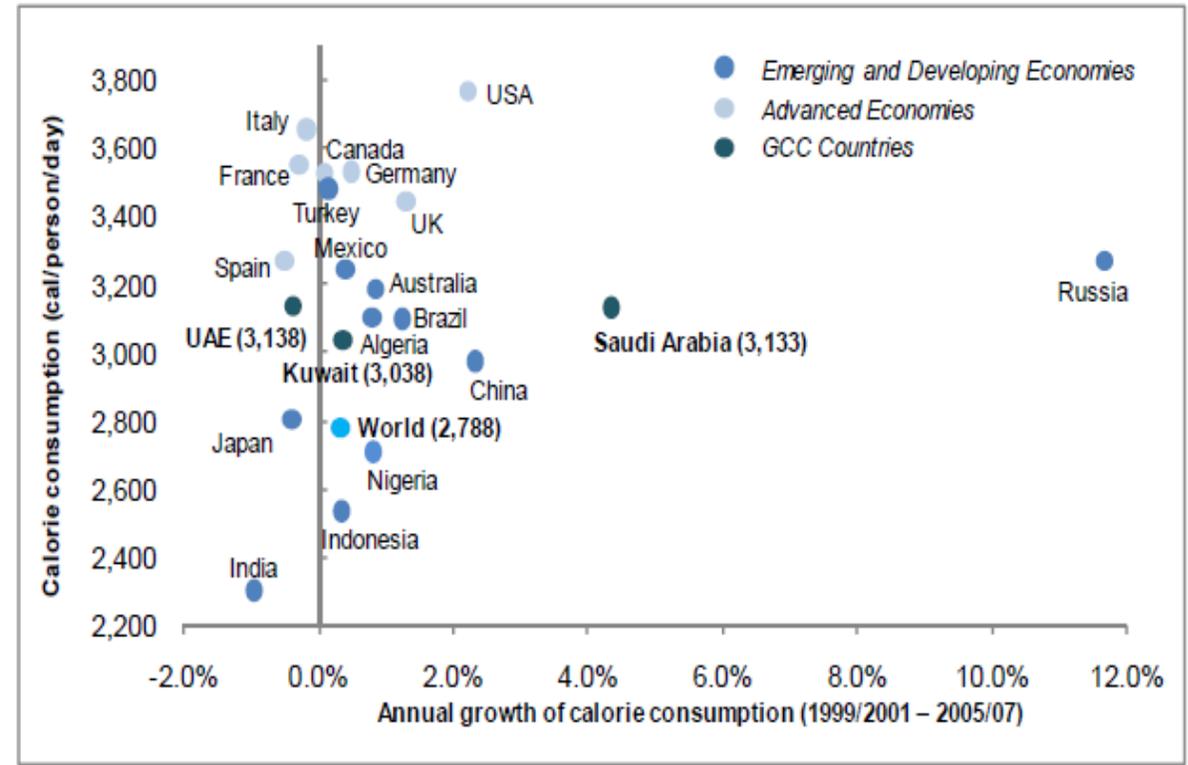
Segment	Consumption (%) of total food consumption at GCC level			Consumption (%) of total food consumption in Qatar			
	2011	2013	2015	2011	2013	2015	CAGR (2011-15)
Cereals	43.7%	42.7%	41.6%	29.6 %	29.1 %	28.4%	5.2%
Milk & milk products	14.9%	15.0%	15.0%	29.4 %	29.0 %	28.6%	5.6%
Vegetables	13.1%	13.2%	13.2%	11.9 %	12.1 %	12.4%	7.4%
Fruits	12.4%	12.6%	12.8%	10.3 %	10.6 %	10.9%	7.8%
Meat	5.6%	5.8%	6.0%	7.7%	7.9%	8.2%	8.0%
Others	10.3%	10.7%	11.4%	11.1 %	11.3 %	11.6%	7.5%
Total	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0%	6.3%



Prediction of the change of the global food consumption per capita (kg per year) divided into different segments in the future

MARKET

Obesity rates in the GCC region have more than trebled since 1980. The adult obesity rate in Saudi Arabia and the UAE, as measured by the Body Mass Index, stood at 35.6% and 33.7% of the total population. This placed Saudi Arabia at the 7th position globally and the UAE at the 10th. Consequently, people are now becoming more conscious towards healthiness and are focusing on healthy and diet foods. Diabetes is another concern in the GCC region increasing the shift to healthy foods. Demand for healthy alternatives such as meal replacement products and low-fat dairy is expected to increase as public awareness about healthier eating habits grows.



Per capita calorie consumption per day across the world

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For further inquiries and quotes, please contact:

ensymm UG & Co.KG

Life Science Center Dusseldorf
Merowingerplatz 1
40225 Dusseldorf
Germany

Tel: 0049 2113367527

Project_assistant@ensymm.com

www.ensymm.com

