SkyFarm | Growing up sustainably

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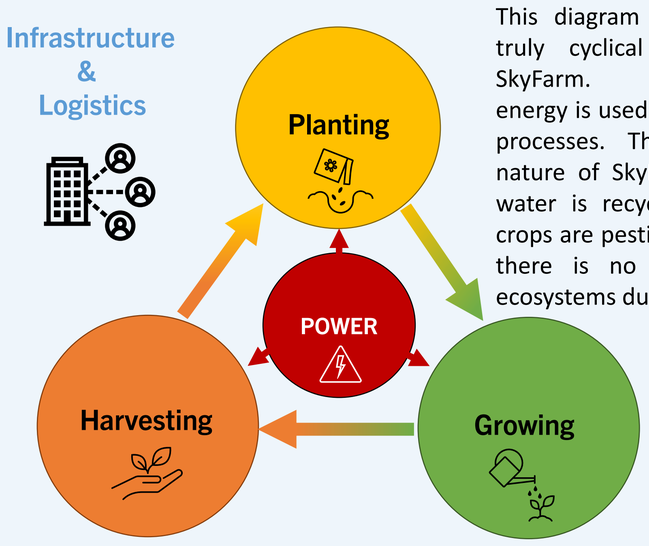
SkyFarm
GROWING UP

Traditional agricultural practices are unsustainable, putting pressure on the industry to meet the United Nations sustainability goals ‘Responsible Consumption and Production’ and ‘Zero Hunger’. This inspired the design of a novel, renewables-powered, vertical farm, ‘SkyFarm’; including a circular waste system, sustainably sourced supply chain and pesticide-free environment. SkyFarm's design enables crop growth with a greater yield than traditional farming despite consuming 95% less water, and its small footprint allows it to be in urban areas reducing product transport emissions. Whether based in an urban area or arid desert region SkyFarm can ethically and sustainably provide its customers with a balanced diet and reduce pressure on traditional farms, allowing for ecosystem recovery.

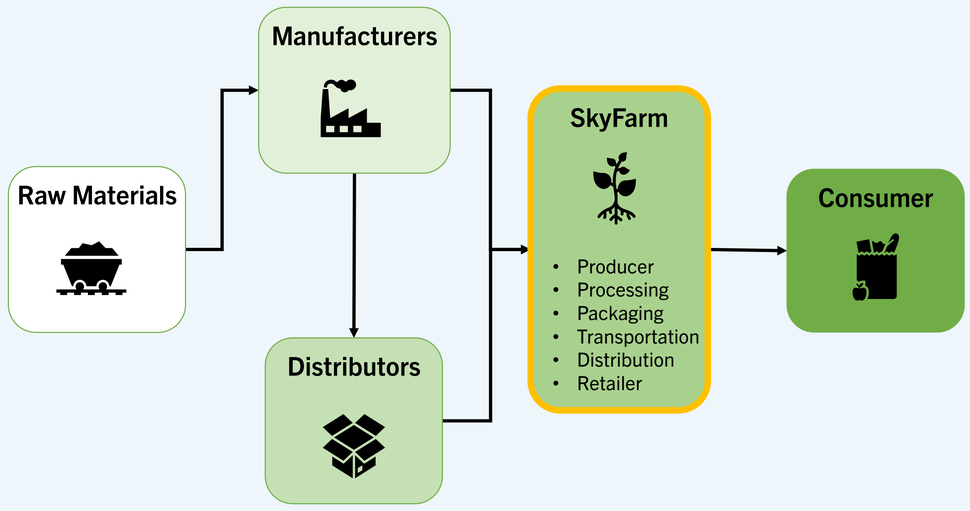


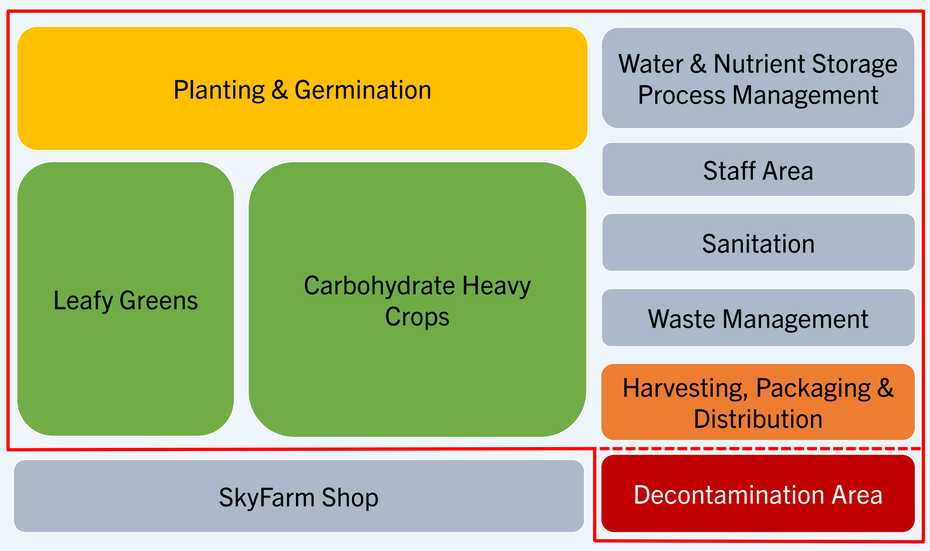
This diagram depicts the truly cyclical nature of SkyFarm. Renewable energy is used to power all processes. The enclosed nature of SkyFarm means water is recycled and all crops are pesticide-free, so there is no damage to ecosystems due to run-off.

The diagram to the right depicts the highly efficient supply chain of SkyFarm. Contrary to traditional farms which use convoluted supply chains to get produce into stores, SkyFarm houses all processes under one roof which creates fewer emissions and a smaller price point for customers.

Parts and consumables for SkyFarm are only purchased from suppliers with transparent and ethical supply chains.

SkyFarm’s supply chain ethics and sustainability permeate right up to the point of sale. Its climate controlled growing environment means SkyFarm customers can be provided with produce usually sourced from abroad without needing to transport it over long distances. Any produce not sold onsite is delivered to customers using an outsourced electric vehicle fleet.





This sketch shows the floor-level design of a SkyFarm site. On the lowest floor of the site is the SkyFarm shop where customers can buy produce just metres away from where it was grown. This gives them the freshest produce with negligible emissions from transportation.

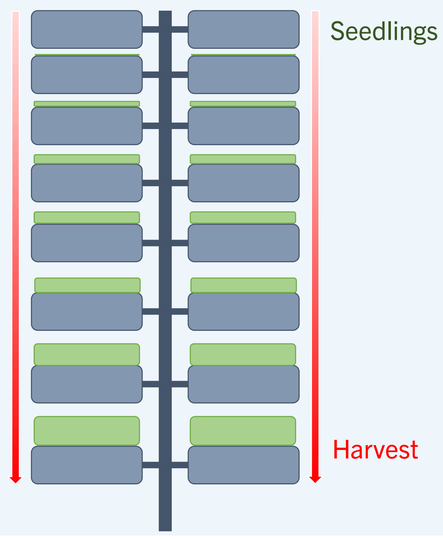
Next to the SkyFarm shop, staff can go to the decontamination area to ensure they are pest-free before entering the farm. Inside the farm: planting and germination take place on the upper levels, moving down through levels of the vertical farm before finally being harvested, packaged and moved to the SkyFarm shop.

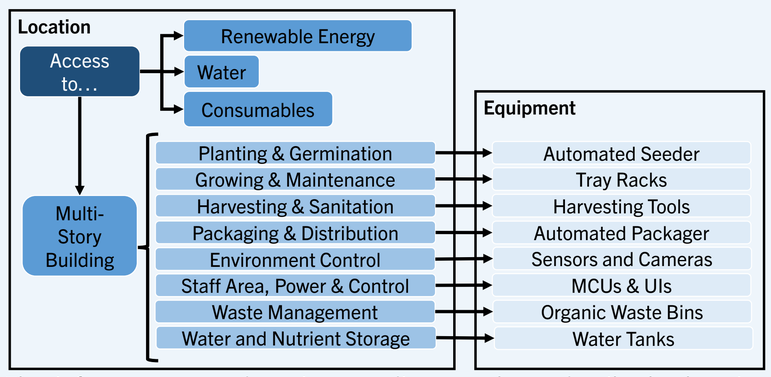
Processes that are required through all areas of the farm, like nutrient supply and waste management, can be found at the side of the farm.

SkyFarm’s vertical conveyer shifts plant growth trays down through the farm’s floors as they grow. The conveyer works with the gravitational potential to ensure energy consumption is optimised.

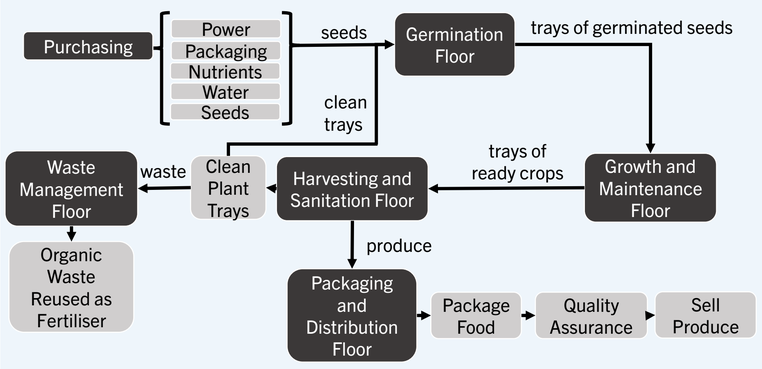
As the crops increase in size, the gap between each layer of the stack increases to allow for growth and ensure space optimisation.

Once plants are fully grown, they will be at the bottom of the stack and are removed by harvesters.

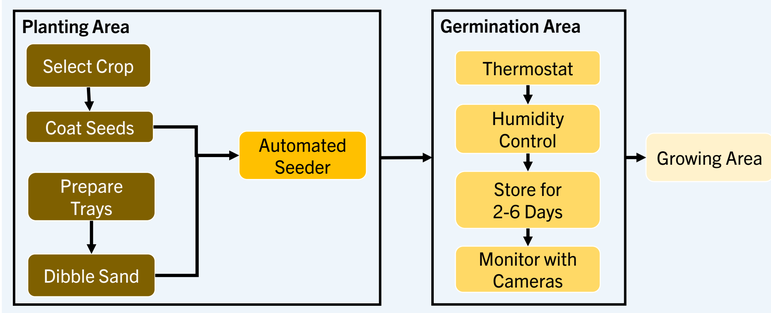




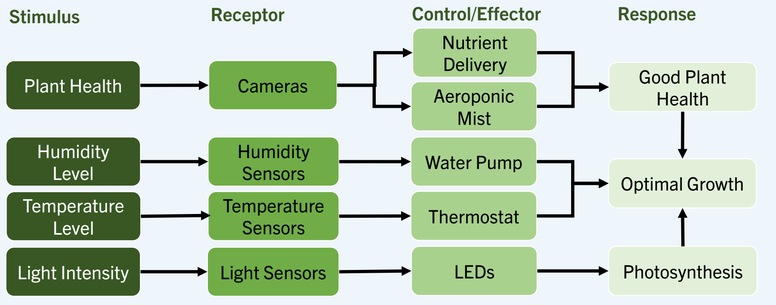
The infrastructure and equipment diagram above details the location requirements of SkyFarm sites including access to energy and sufficient space for the housing of SkyFarm’s functional equipment. SkyFarm’s small footprint makes it ideal for situating in urban, densely populated areas where customers can access it easily. The location of SkyFarm sites is also dependent on access to fresh water.



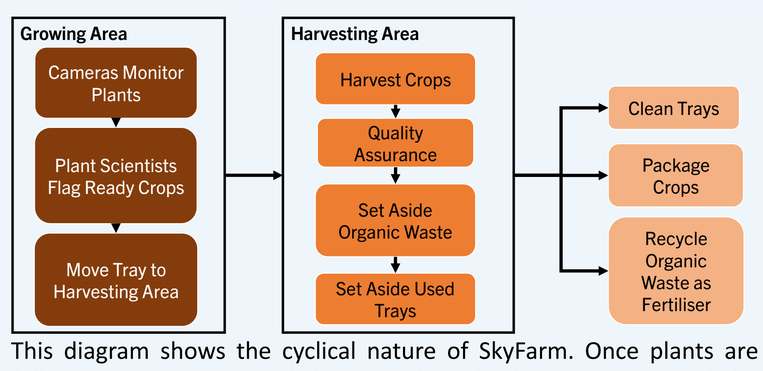
From purchasing raw materials all the way to crop distribution and waste recycling, SkyFarm’s processes have been optimised to provide sustainable produce to consumers, as shown in the high-level process diagram above. This diagram shows the order and movements of processes and goods around the warehouse which are similar to traditional farming but all under one roof.



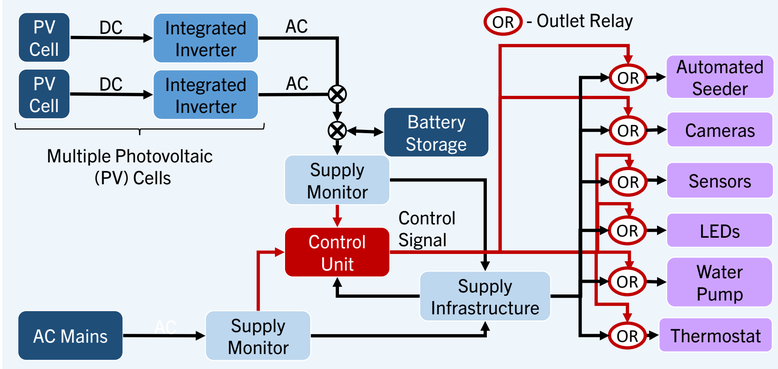
This process diagram demonstrates what occurs on the planting and germination level of SkyFarm. After seed selection, based on market purchasing trend projections, seeds are coated and trays are prepared in parallel. Both seeds and trays are pushed to the automated seeder where seeds are inserted into a germination friendly environment. The trays are then moved to the germination area where they are kept in an automated, controlled environment for their required germination cycle before moving to the appropriate growth area.



The above system diagram shows the growing area of SkyFarm. Different stimuli impacting plant growth are monitored by sensors around each tray. Nutrients, light and heat are adjusted according to data analysis and classification. In the earliest months of SkyFarm’s first site plant scientists will need to manually analyse data and determine plant requirements. As data is accrued, machine learning can be implemented to automate this process and data can be shared between sites to improve classification accuracy.



This diagram shows the cyclical nature of SkyFarm. Once plants are fully grown, the crops will be moved to the harvesting area of the farm. Crops are inspected for quality assurance and moved to the packaging area accordingly. Once crops have been harvested the organic waste left in the trays is recycled and used as fertiliser for future plant growth nutrients. The trays are cleaned and moved back to the germination area of the farm, ready for a new round of growth.



SkyFarm’s smart power management system, shown above, facilitates sustainable power delivery to its subsystems. SkyFarm is largely powered by photovoltaic cells and any excess energy generated is stored in batteries. SkyFarm is reliant on electricity so has a backup mains supply. In the event of a major power disruption, outlet relays shut down non-priority subsystems for the duration of the interruption.