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Aponix vertical barrel / 3D-NFT

Summary

The aponix vertical barrel system extends the de-facto standards of soil-less plant cultivation from the horizontal plane into the 3rd dimension at professional standards.

Unlike the other 2D methods like NFT (nutrient film technique) and DWC (deep water culture) no fixed elements are required to set up a farming plot. Usually vertical farming operations that like to increase plant density per sqm start to erect rack structures that cause all sorts of challenges and eventually make urban micro farming expensive and complicated.

The goal of the aponix vertical system is to enable professional vertical urban micro-farming with high plant density per sqm compared to their horizontal plane counterparts and also other standard vertical solutions (e.g. grow towers). Plant density is defined by position, the number and the height of the vertical barrels used. Everything is modular and movable. Plant density >60 plants per sqm.

Essentially vertical barrels are assembled by 1 central lego-like piece.

The main types of crop to be grown with the soil-less adapter piece for standard two 2-inch net pots are: herbs and lettuce varieties, small or leafy vegetable plants, berries or dwarf vegetables.

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History and Status as of April 2020

- The prototype phase has ended in January 2017. Prototypes have already been sold to research facilities and professional users between 2014 and 2017. User feedback has been summarized into a production version with manufacturing based in Heppenheim/Germany.
- A large series production for ring segment pieces have been created and are ready for production. Injection molded:
    - A) two 2-inch net pot inserts for max density,
    - B) one centered 2-inch net pot insert,
    - C) closed, and based on that one D) revision opening with lid
    - E) substrate-shelf for a substrate based version.
    - F) Netafim irrigation adapter to integrate pro irrigation equipment.
    - G) First substrate based City XL shelf piece for public spaces.
- There is tooling also for three variations of the base of the vertical barrels. Vacuum molded:
    - H) top/bottom lid,
    - I) closed base,
    - J) multi-barrel base,
    - K) water-buffer part to set up low-pressure irrigation,
    - L) aponix-Netafim adapter to integrate irrigation specialist Netafim's micro nozzle and tubing products,
    - M) the substrate based City XL version, vandalism and fire proof, developed with the city of Heidelberg.
    - N) a lid base that is smaller to ship and takes a lid as base. It can fix 40mm PVC draining pipes just by placing it in a location.
- Highest quality materials are used (ASA, fire-proof PA, and very hard PVC-U), all food-grade, manufactured in Germany.
- All large series tooling and patents have been invested in and is owned by aponix, self-funded by the founder (>300kEUR).
- Due to a strong social media activity and presence at major events and tradeshows since 2015, aponix is already shipping direct globally to special horticulture operations, horticulture universities and is increasing awareness for this new kind of production equipment, see: https://www.aponix.eu/locations.
- There is an initial German patent describing the abstraction of a vertical cylinder (the vertical barrel) for plant cultivation from 2015. Aponix has issued a PCT announcement (WO2016156334) in 2016 and nationalized

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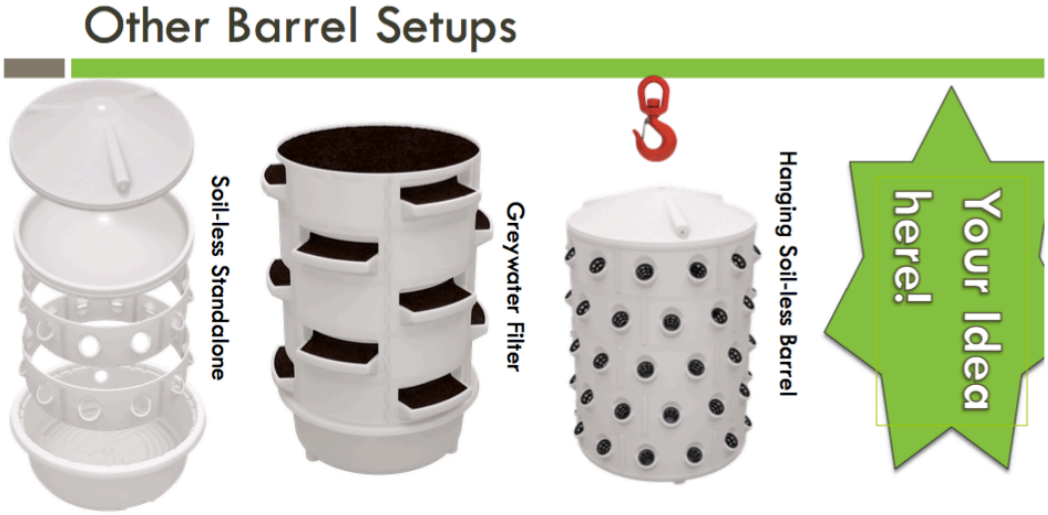
this IP into EP (to the large territories inside the EU), US, JP, CN (stopped in the meantime) and KR.

- The full versatility of the concept became visible starting September 2017, when new parts were ready for production extending the platform.



- There are still more additions currently being developed such as:
  - A rotation base for the soil-less barrel to facilitate artificial/supplemental lighting.
  - A roller base triangle (dolly) for the substrate based or the standalone setup.
  - A modular inner column of flexible height that will help to save a considerable amount of substrate on soil based operations. Using this central column only the space between the barrel outside and the column itself needs to be filled with substrate. It saves 50% of the substrate and makes each barrel much lighter and easier to move. The inner column can be used for technical equipment (pump) or a vermiculture or irrigation area.
  - And many more that come through the co-operation with product partners. N) above represents one such extension.
- Many more applications are possible from here and might be realized at a later time. Examples: Use it as integral part of buildings (material: ceramics), as bio-filter for ponds or as urban grey water filter, as standalone soil-less or soil-based version. Make it usable for other types of crop like micro-greens (design for transparent microgreen machine on integrated ‘pizza trays’), fruits, edible flowers and berries, cannabis, ornamental or special purpose plants to clean air in smart cities. The barrel can also be used as a hanging version adding stainless steel ring hooks to the lid part (hidden feature). Use as living plant dispenser at the point-of-sales as low-tech alternative to the Infarm solution. All based on

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the patented vertical barrel concept which is in the end just a way to 'configure' a vertical cylinder shaped solution. This is an important aspect of the innovation making it a component usable in multiple interesting applications.

Sales 2017 – 2020

Aponix started shipping via direct sales from Heidelberg/Germany to a mix of end-consumers, commercial users and city councils/regions. As a German company aponix has been granted authorization to sign preferential goods (origin in Germany) by the German customs and can make full use of EU free-trade agreements globally. With increasing awareness demand and sales also increased gradually. Goods shipped: 2017 38kEUR; 2018 60kEURs; 2019 80kEUR; 2020 will be >200kEUR.

Learnings, selling direct from Germany

1) Aponix parts based products (different areas of application) require local presence, consulting and supplemental materials and additional services (seedling subscriptions etc), which can not be delivered remotely by aponix-DE. 2) There is no large enough existing customer base. Demand and market need to addressed individually for every application area. Access to external customer bases is needed for faster growth. 3) Shipping on a commission base or by single consignments makes the actual product artificially expensive by adding logistics and freight cost for individual shipments. 4) Customer engineering and services are required.

Next steps

Aponix is looking for strong value adding product partners for each field of application so it can focus on R&D and shipping in bulk to resellers covering certain territories and target groups. Ideal partners would be already established players from the horticulture field that already operate successfully on an existing customer base and already understand and see the urban farming niche.

Aponix has created a sales strategy in the form of a simple ready-to-use product partner term sheet including some common rules, a branding strategy to distinguish product partner and manufacturer (aponix-DE) clearly and a commercial price list. The main conditions of the strategy are structured like this:

- The partner always covers a certain territory and field of application. Materials need to stay within this territory and markets and sells his unique value proposition using aponix parts on his own account.

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- Partner margins for the materials are ~40% on the aponix parts plus independent margin for external parts and own services.
- Own engineering is compulsory: There are plenty of additional opportunities to provide added value to existing customers apart from the bare pieces. Each market will be slightly different and aponix likes to give the individual product partner the freedom to make creative and unique use of the concept. Examples: Support professional planning, building integration and installation of setups; maintenance schemes; education and workshops; individual packages for example for schools; subscriptions for seedlings for home and office use; coaching for beginners to set up their first commercial setup; sales of additional supplemental materials and technology.
- There is no exclusivity possible for a territory (would be legally more complicated). Aponix considers the aponix parts 'infrastructure' pieces and it makes no sense to have them exclusively. Special territories that require dedicated address like India or China might be used to partner on a license/royalty basis.
- Materials are shipped on palettes as material lots. Testing materials is sent in smaller individual amounts via air-freight.
- After setting up the partner's solutions (his products) and their branding and marketing strategy and an explorative phase, the product partner provides a business plan for aponix-DE's production planning based on a monthly template once sales start to become predictable.
- Own marketing and communication as official product partner is required based on simple rules respecting the aponix trademark and appearance.

Active Assets as of April 2020

- Large series production tooling is in place for large series production of pieces containing improvements (iterations and tooling replacements) from 3 years of own productive use and user feedback. See list on page 2.
- Patents granted, published and held: DE, EP (IT, FR, ES, UK, NL, DE), US, JP, KR.
- Social media presence with global reach:
  - >9500 individually collected newsletter recipients since 2015 all signaled interest in the product; sent once/twice a year.
  - >6500 followers on https://www.facebook.com/aponix.eu showing the progress since the early prototype showing practical growing examples. Plus a new technical user group on Facebook.

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  - >7000 active contacts/followers on founder's LinkedIn profile (https://www.linkedin.com/in/marco-tidona-a305a313/). 1000+ impressions on product posts.
- Regular international trade show presence since 2016: GreenTech Amsterdam, HortiContact GO, spoga+gafa Cologne, IPM Essen, Seeds & Chips Milan. Presence also in Asia and the US through meanwhile failed cooperation with a Korean company.
- Regular (daily) requests for quotation from a global audience via https://www.aponix.eu/shop.
- Co-operation with product partners who are engineering complex individual solutions since 2020.
- Steadily increasing direct sales of individual parts evenly distributed across the globe. Market potential is much larger.
- Existing inventory to be able to ship, materials for ~50 units any time. Storage space at the manufacturer materials with deferred payment with on-demand pickup (=unique partnership since 2017).
- Aponix is very active in the planning of future city projects in Heidelberg and beyond to exhibit and promote vertical farming as 'City Pilots' and in planning of development of local conversion areas.
- Aponix GmbH qualified as authorized entity to declare EU preferential goods on international imports since March 2018 by German customs authority.
- Distributor strategy incl. product partner term sheet, brand policy, commercial price list and templates for partners in place/use since 2019.
- Examples for closer co-operations ongoing or in negotiation with...
  - Universities/education: Staatliche Lehr- und Versuchsanstalt für Gartenbau Heidelberg (LVG), Technische Universität München (TUM), Weihenstephan/Triesdorf, Universität Bonn, GO Atheneum Heist, Astredhor Seine-Manche Arexhor.
  - Large players example: Two large Dutch greenhouse project companies to set up a test to compare table production (standard in hectar operations) to vertical barrels in order to get some 'research' and ROI KPIs. Negotiations with many others all signaling openness to evaluate or present internally on executive level.

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Objectives 2020 - 2021

Sales: Find and bind product partners and develop their unique aponix-based products selling to their existing customer base.

Visibility and Projects: Integration into a) larger projects (20-100 units) and b) lighthouse urban projects with high visibility. Be present at the large horticulture trade shows and sustainability/innovation events in the EU.

Credibility: Create more KPIs. Show real alternative to the competitors and other vertical farming approaches. Co-exhibit with larger established partners.

People, Office, Warehouse: Build a team and organization. Set up a representative location and home base for logistics and engineering.

Product: Extend into a more advanced commercial version with a larger Dutch partner - ‘Version 3’ of the soilless barrel (until end of 2020), which will be large commercial ready and is already used in larger planned production plants. It will incorporate all collected improvements and also some new features to make it a real viable pro horticulture product.

Competitors

ZipGrow Towers - Plenty/Bright Agrotech, USA (https://zipgrow.com): Fixed height vertical gutter. Complicated to operate, needs multi-layered internal fabric. Tends to drip on plants during operations. Strong marketing and reach by Plenty.

TowerGarden - Juice+, USA (https://www.towergarden.com): Hobby solution with MLM sales scheme. Many pieces, hard to maintain, despite there are multiple medium sized operations. Strong and established. Juice+ sells millions of units per year. Very poor engineering and actually the main motivation to build the aponix vertical barrel the way it is.

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V-Farm - SME UK (http://www.v-farm.co.uk): Very usable and well engineered rack systems with grow lights on each level. Ideal for medium sized operations and indoor urban use.

Saturn Bioponics - Individual UK (http://www.saturnbioponics.com): Small alternative tower solution like multiple others. These kinds of solutions tend to not scale or appear in a meaningful context on the market.

Impilo Aero - Startup ZA (https://impiloprojects.com): Low quality hobby solution. Unclear whether the aponix patent is infringed. Targets home use, tries to set up medium sized operations.

There are multiple wall and indoor/kitchen systems. Most larger funded farms (like AeroFarms NJ/USA) are using custom proprietary rack based setups. Profitability unclear, very complex, human unfriendly working conditions.

Key competitive advantages

All based on one piece. Compact to ship and store. Simple to handle and clean. Variable height and capacity for each unit. Variable plant spacing for different crops for each unit. Can use external reservoir for larger setups. Can use closed base as integrated nutrient reservoir. Highest quality material (ASA with double the UV resistance compared to ABS as usual best standard and food safe). Uses globally available standard 2-inch netpots for plant cultivation. Can be run with any medium or netpot-medium combo (for example jute sheet only, no plastic net pot). Can be run with pressure line using one inverted sprinkler on larger operations or on low-pressure irrigation using the water-buffer piece. Even a custom irrigation can be integrated easily into the vessel. Different setups possible: Substrate based or use as water filter. Multiple future purposes possible covered by patent (e.g. mushroom cultivation). Automation missing but possible for autonomous operations by plant robots. Lower CapEx per grow space compared to competition (Aponix=4 to 5EURs, ZipGrow=7EURs, TowerGarden=11EURs).

Current Team

Marco Tidona (LinkedIn: https://www.linkedin.com/in/marco-tidona-a305a313/), founder and player of all roles so far in co-operation with the manufacturer and the designer (all external). MT has been working as freelance software developer and entrepreneur since 1999.

Marco was founder and CEO of an IT company that grew from the 3 founders to a 15 employee agency between 2009 and 2013.

The internal aponix team still needs to be formed and built for the growth phase adding an experienced sales manager/sparring partner. The team will also need assistance in finance/organization and logistics.