

Assessing and Addressing the Needs of Urban Agriculture in Copenhagen



Abstract

Urban agriculture contributes to sustainability through positive environmental, economic, and social impacts. Growing Pathways aims to increase the resilience of existing urban farms and encourage the growth of new ventures in Copenhagen. This project focused on conducting research mainly through interviews to gather information about the obstacles faced by the urban agriculture community. The team created and piloted a Discord server with the aim of increasing the sharing of knowledge and resources, thereby strengthening the current urban farming community.



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October 11, 2019



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Urban agriculture has the potential to help cities fight climate change

Cities must be at the forefront of fighting climate change because the majority of the global population lives in urban areas.¹ The high populations of cities make them significant producers of pollution. Implementing innovative solutions to mitigate this pollution will be important for cities to help curb climate change. This is of direct importance to urban residents; by mitigating climate change, urban living conditions are set to vastly improve. Cities around the world can introduce positive environmental changes in a variety of ways, including urban agriculture, an often overlooked means to reduce emissions. Urban agriculture is an important grassroots solution with positive environmental impacts.

The two key forms of urban agriculture - urban farming and community gardens - are focused on different goals: production and social impact. Both have positive environmental effects, including reducing air pollution, managing runoff, recycling city waste, increasing biodiversity, increasing the productivity of unused space, and improving the efficiency of insulation within buildings when built upon rooftops. Agriculture around the world accounts for 20-30% of greenhouse gas emissions (GHG). Urban farming can cut down on the overall agricultural GHG by an average of 69% through reducing transportation and production costs.²

A network provides benefits that boost urban farm resiliency

An urban farm has three key contributing components: the farmer, the place, and the



Haven I Tingbjerg - An urban farm located in a residential area

project. Urban farms may lose one of these three main components for multiple reasons, which can cause the farm to shut down. Urban farms that are resilient are able to recover and continue operations even if one of these components is removed. Building strong relationships between urban farmers is important as it increases the resilience of farmers involved. Existing networks provide many benefits to farmers, including facilitating communication between farmers, supplying resources, and providing assistance in

navigating local laws.³ Formal, established networks can be found in various cities, including Indianapolis³, New York⁴, and Paris.⁵ These networks promote the creation and prosperity of urban farms.

Currently, urban agriculture in Copenhagen consists of more community gardens than urban farms. Community gardens are typically more focused on individual and social benefits for members.⁶ Urban farms, which focus on food production, create larger, more positive

environmental impacts.⁷ Thus, Copenhagen should encourage the growth of urban farming in addition to community gardens in its mission to become more sustainable. The organization Growing Pathways seeks to facilitate the development of urban farms by expanding upon the existing network to distribute resources and ideas within the urban farming community.⁸

To address the need for a vital urban farming network, the team first developed an understanding of the current state of the urban agriculture community in Copenhagen through interviews with its members. The team then analyzed the data collected from these interviews and created social maps to visually portray the existing connections and identify potential areas for strengthening the existing networks. Finally, based on the data collected, the team selected and piloted an online networking platform to facilitate communication, distribute resources, and foster resilience in the community.

Copenhagen is leading the fight against climate change

Denmark is at the forefront of the fight against climate change. In response to unprecedented changes in the global climate, Copenhagen has set up a climate action plan to become the world's first carbon-neutral city by the year 2025.⁹ Copenhagen has launched 165 initiatives to help achieve its goal of carbon neutrality. The city has a three-step process for implementing its policy measures in order to ensure reduced greenhouse gas emissions: planning, implementation, and impacts.⁹

Using the three-step strategy, Copenhagen has achieved an annual reduction of 4,000 tons of CO₂.¹⁰ To further improve upon these initiatives,

Copenhagen is readopting the “five-finger plan” (see Figure 1), which was introduced about 50 years ago but quickly lost the public's interest due to weak planning efforts, municipal infighting, and an antagonistic relationship between the central city and the suburbs.¹¹ The plan positions Copenhagen as the “palm” of a five-fingered hand extending outwards into Denmark. The fingers will consist of concentrated urban areas, highways, schools, and various services. Between each finger, greenspace and agriculture will help support the goal of carbon neutrality.¹² The government expects that reintroducing the plan by integrating it into the citywide climate action plan will have a greater impact than when the concept was first implemented. Currently, Copenhagen is looking for more initiatives to help strengthen this goal.



Figure 1: Greater Copenhagen Areas covered by the Finger Plan¹³

In the past decade, Copenhagen has taken an interest in urban agriculture. Government interest in urban farming was piqued by the 2009 United Nations Climate Change Conference. In 2010, the city of Copenhagen adopted a green roof policy that requires all new buildings with rooftops at a slant of less than 30° to have vegetation.¹⁴ The University of Copenhagen started a program called Urban Farming SCIENCE, which “collects and visualizes the various resources, knowledge, and initiatives present within urban farming.”¹⁵ Increasing the number of successful urban farming initiatives will enable Copenhagen to encourage environmental sustainability.

Urban farms and gardens have different environmental, economic, and social impacts

Urban agriculture involves the cultivation of crops and animal husbandry in or near an urban environment.⁷ There are several types of urban agriculture, most notably urban farms and community gardens. Community gardens are often smaller in operation, acting as a space for community development and individual cultivation. Urban farms are typically focused on higher production for a more commercialized presence in the community. These farms repurpose mostly wasted city spaces like rooftops and abandoned lots. In all its forms, urban agriculture's goal is to contribute positively to the city's environment, economy, and community.

Urban farms create a greater positive environmental impact compared to community gardens. Rooftop farms repurpose an unused area and contribute to sustainability in several key



ØsterGRO - A rooftop farm and CSA

ways. Petroleum-based roofs are unsustainable in their material choice, contribute to the heat island effect within cities, and release toxic chemicals into the air through deterioration.¹⁶ Rooftop farms do a good job of mitigating runoff water and reducing the burden of wastewater on cities.¹⁷ Excessive rain in cities, combined with normal septic waste, can cause wastewater management pipes and treatment centers to overflow into city streets and surrounding bodies of water.¹⁸ Green roofs collect rainwater through the natural processes of plants, curtailing runoff.

Similarly, processed and treated organic waste can be used as fertilizer in urban farms, which helps cities manage organic waste.¹⁹ Roofs that are completely or partially covered by vegetation conserve energy by providing insulation, keeping buildings cool in hot weather and warm in cold weather, thus requiring less energy for HVAC systems.²⁰ Creating urban farms

on rooftops offers increased efficiency when compared to smaller projects.

Urban agriculture leads to a more prosperous local economy. Urban farms grow and sell fresh grains, vegetables, and fruits to members of the surrounding community. The introduction of a sustainable food source into a local economy can improve the financial situation of nearby related businesses. This ability to obtain locally sourced food can increase the traffic of pedestrians in the area, creating opportunities for employment throughout the community. Community gardens typically raise surrounding property values, generating greater tax revenue for local government, which can be used to better neighborhoods through increased community investment.²¹ Though this type of growth and development is often linked to gentrification, carefully focusing on supporting pre-existing communities surrounding new farming initiatives

can ultimately create significant positive impacts without leading to the displacement of current residents.²²

Access to agriculture introduces the positive effects of nature to urban communities. From a social perspective, community gardens are an integral addition to urban communities. They provide places for children and adults to experience the positive effects of nature, which are generally lacking in cities. Community gardens can serve as a hub for environmental activism and, as demonstrated in New York, can truly change the conversation around the lack of environmentally positive practices.²² Additionally, urban farms and community gardens can act as educational centers for the community, serving to increase knowledge of the food eaten by residents. The existence of a nearby urban farm can create opportunities for volunteering and increase access to healthier food.

An effective network requires cooperation for urban agriculture to flourish

Creating a network for urban farmers enables farmers to share ideas, supplies, and collaborate on work.²³ A network of urban farms consists of farm owners, farmers, community members, and local business owners who are in contact with each other. The network enables farmers to learn farming practices and techniques to improve their farms. It also involves local businesses where urban farmers might sell their products. These benefits increase farmers' resilience while allowing them to streamline operations. The process of creating an urban farm can be difficult, but access to a network can ease prospective farmers into the field. Through collaboration between farms, a network helps farmers transition from a community garden to a self-sufficient and sustainable urban farm.

There are several requirements for creating an effective network of urban farms. Most important of these are responsibility and accessibility. Responsibility is important because the livelihood of urban farmers will be dependent upon each member doing their part and lending support to others. It is necessary that members of a network trust each other in order to be brought together by the network.²³ Accessibility to one another is important to maintain efficiency within the network. Similarly, a network's resources must be accessible to its members. Members have no obligation to stay in a network, and when incentives to remain deteriorate, membership declines.

The formation of a network typically stems from individual needs. Strong networks

find their success in a constant structure where commitment is simple for all parties. This can be done through the creation of a core group and periodic scheduled meetings to share news, ideas or relevant information for the immediate needs of members.²³ These meetings are essential because they give the network its initial structure, as illustrated in Figure 2.

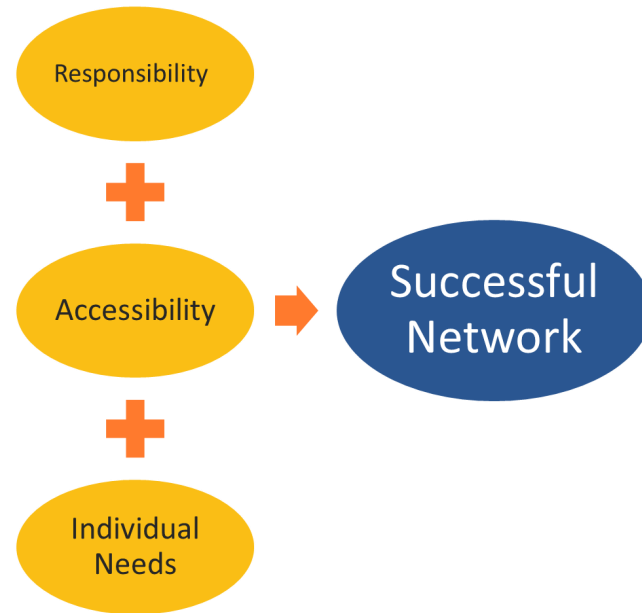


Figure 2: Foundation for a successful network

Successful urban farming networks exist in several places around the world

Networks have proven successful in the past by connecting farmers throughout a geographical region. One instance of this is in

Indianapolis, Indiana. The Indy Urban Farm Incubator Network finds success through the opportunities made available to members, including courses, new landowner connections, and increased connectivity within the farming community.³ Creating an urban farm can seem daunting at first but having the support of a network can increase the success rate for a new farm. New farmers get an opportunity to learn hands-on from experienced farmers.²³

Another example of an urban farm network is the Saint Louis Urban Farm and Sustainable Backyard Network. This network operates through the website Meetup, allowing individuals to join by creating an account. Through Meetup, discussion boards are available where members can set up events of interest or initiate discussions about matters of mutual concern. The easy accessibility of this network has kept it operational. The organizers do not need to manage the group because the individual members keep the discussions active, which is what allows it to live on.²⁴ These networks function differently, one being designed around scheduled meetings and the other around farmers' willingness to communicate either in person or online.

Copenhagen is currently home to several urban agricultural sites

Gårdlaug Alderstrøst is an example of a community garden focused on allowing residents in its vicinity to grow their own crops. Other sites, like Bioteket, serve as educational facilities to showcase complex and diverse methods of farming, including aquaponics, hydroponics, and mushroom farming. Gårdhaver og Gnavere i

Murergården is a larger site committed to repurposing open space to become a community center concentrated around food production and consumption.²⁵ The map displayed in Figure 3 shows several community gardens already present in Copenhagen. Communities in Copenhagen are interested in developing urban agriculture initiatives, but there remains a lack of connection between existing initiatives.⁸ This lack of connection could be solved in part by a networking tool for urban farmers.

Successful urban farms have been established in Copenhagen

One of the most prominent urban farms in Copenhagen is ØsterGRO, which grows food in order to help supply the restaurant Gro Spiseri. While the restaurant uses ØsterGRO as its main source of food, the rooftop farm cannot provide everything. Meats and certain produce are locally sourced from nearby farms and companies.²⁷ ØsterGRO is an established and successful example of urban farming, and it relies on an informal network to fully supply Gro Spiseri. This demonstrates the need for connections and collaboration within the agricultural community in Copenhagen to ensure the success of farming initiatives.

Creating a networking tool will guide community gardens towards becoming urban farms

Urban gardens facilitate a high level of community involvement and have several positive

impacts outside environmental sustainability. Environmental activists in Copenhagen are interested in doing more, specifically by pursuing the transformation of community gardens into urban farms because farms offer more economic, social, and environmental city-wide benefits, as discussed above. The current goal of Growing Pathways is to examine local initiatives and to work with current urban agriculture contributors to increase the chance of the farmers' success by enabling them to share knowledge, resources, and practices with each other. Through this collaboration, Growing Pathways will guide the transition to urban farming.

Growing Pathways is working in collaboration with EVM Landskab on

Bydyrkerne, which is a project aimed at improving the impact and success of urban farming in Copenhagen. There are three strands to the project in its first phase: creating partnerships between land-owners and urban farmers, facilitating collaboration through a shared platform, and developing urban farming labs in several locations in the city. Increasing collaboration between land-owners and farmers is important because secure land access is crucial to the success of a farm. Bydyrkerne now involves a range of public, private, and civil sector partners, including Ny Valby Udvikling, Områdeløft Sydhavnen, Miljøpunkt Amager, Tinkertank Amager, and a number of growers across the city.

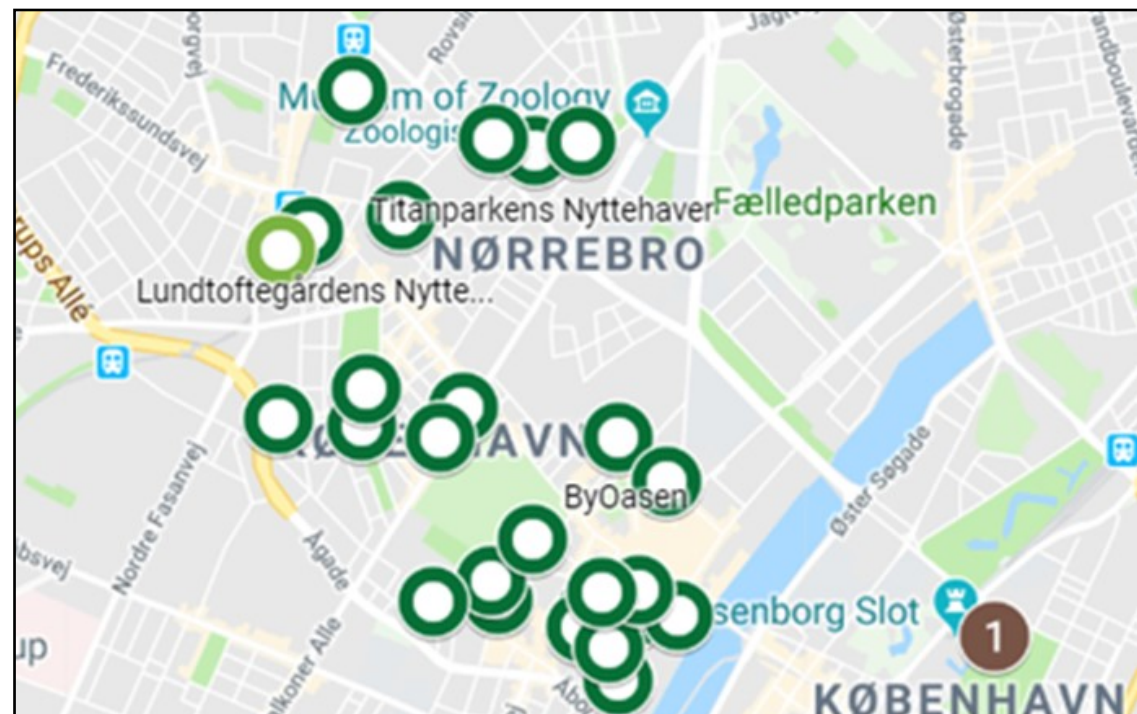


Figure 3: Map of urban farms and community gardens in central Copenhagen

Research and analysis of urban farmers' needs in Copenhagen led to the recommendation and implementation of an online networking tool

The goal of this project was to assess and address the needs of the urban agriculture community in Copenhagen. Based on the collected data, the team developed a networking tool focused on the exchange of knowledge and skills while working to encourage the spread of resilient urban farming initiatives. Copenhagen is home to a variety of community-operated gardens; however, urban farms have found difficulty taking root. In the interest of developing urban farms, the team outlined the following research objectives:

Objective 1: Develop an understanding of urban agriculture communities;

Objective 2: Assess the connections, interests, and needs of those involved in Copenhagen's urban agriculture;

Objective 3: Research and analyze networking tools to be used by the urban agriculture community in Copenhagen;

Objective 4: Provide and pilot a networking tool and establish recommendations for the continuation of the tool's use in Copenhagen.

Figure 4 shows the steps that the team completed to accomplish these objectives and deliver recommendations.

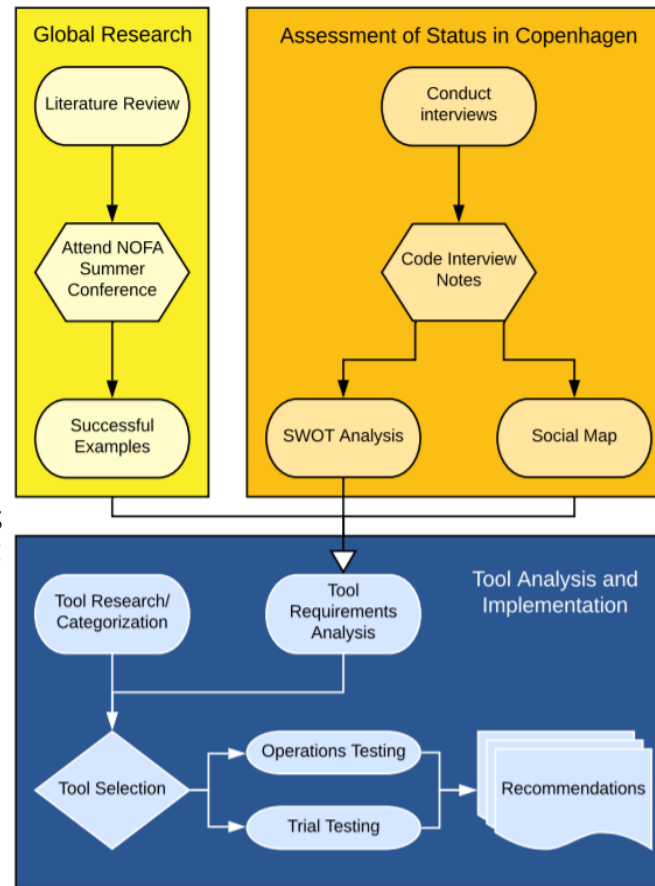


Figure 4: Project Methods and Procedure

Established networks are built upon strong community investment

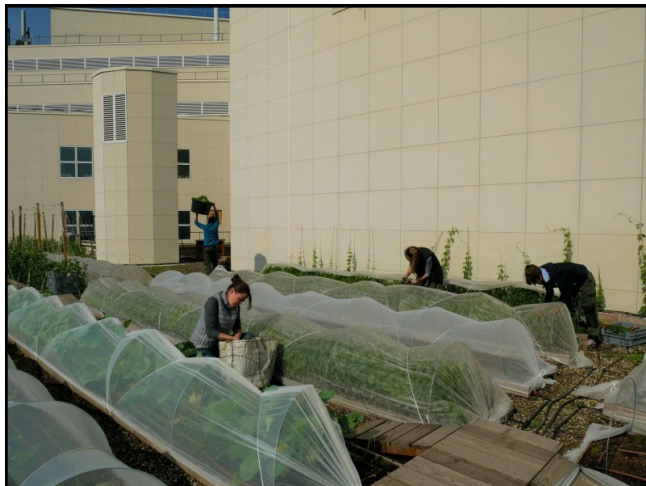
To gain an understanding of a network and how it operates, the team completed a literature review of urban farming networks around the world. The team used this review to gather information about global cities that have successfully developed urban farming enterprises.

These initiatives can be used as a model for other countries and cities. A consistent aspect included in these examples is a network that not only connects urban farmers but also connects farmers with local community members and business partners.

GreenThumb in New York City has created a strong interconnected network of urban farms based around community partners. New York City is a well-known site of successful urban farming, specifically as a method of urban renewal. Because of the city's economic downturn in the 1970s, many lots were vacated, leaving public and private land neglected. GreenThumb (GT) was established in 1978 and has worked towards renovating lots and creating public gardens. GT provides workshops, supplies, and support to over 550 community gardens in all five boroughs of NYC. Through these efforts, GT has become the largest urban gardening program in the US. GT has created a network that has over 75 affiliated partners who actively support the local gardeners and their over 2.8 million square feet (about 26 hectares) of urban gardens located throughout NYC. This network has resulted in a combined 39,500 kg of fresh food produced per year thanks to connections and community involvement.⁴

The Parisian government has incentivized and supported the establishment and growth of urban agriculture through policy and programs. Paris is an excellent example of a city that incorporates farms into its urban landscape. In 2003, Paris adopted *Programme Main Verte* to promote the creation of "jardins partagés," or shared gardens, which function identically to community gardens. In order to help initiate the creation of community gardens, local authorities provide neighborhood

associations with public plots.²⁸ In 2016, the 100 Hectare (247 acres) Target Charter was signed into action. This charter was created to reach the goals set by the Paris Climate Agreement by converting roofs, facades, and walls into green spaces and urban gardens. This movement calls for the development of 30 hectares (74 acres) of public gardens, the planting of 20,000 trees, 200 revegetation projects, and the development of educational farms, orchards, and vegetable gardens in schools.²⁹ With help from 74 local companies and organizations, 75 projects have been approved by the city so far. These projects cover approximately 15.4 hectares (38 acres) of space within Paris. From these projects and tools, numerous farms have emerged: most notably, a rooftop garden on the Bastille Opera House and



HOP'era BATAVIA (Rooftop Garden on the Bastille Opera House)³⁰

the Chapel International Project, which will be the largest rooftop farm in Paris once completed.⁵ The support of local government in the early and continuing stages of urban agriculture in Paris has proved invaluable to the development of interest within the community.

NOFA is a stable network based around community involvement that is supported by a central organization

The team attended the Northeast Organic Farming Association (NOFA) Summer Conference on August 10, 2019. NOFA is composed of seven self-sustaining state chapters supported by a centralized, interstate council. This council is focused on supporting state chapters through dual objectives: political action on a national and international scale as well as the dissemination of relevant information to members in a variety of ways. Political action includes formulating group positions on policies of concern to members, recommending actions based on those positions, and participating in national and international meetings and conferences relevant to NOFA. The council shares information with members by publishing a quarterly newspaper, organizing biannual Summer and Winter conferences, and managing the NOFA website.³¹

The Summer Conference is a three-day event consisting of workshops, speakers, casual programs, and food. The conference draws attendees from the Northeast as well as other areas in the United States. The event provided an opportunity for the team to participate in educational workshops regarding urban agricultural justice, soil cultures, and the benefits



NOFA Summer Conference³⁰

of using natural processes. It also allowed for a more casual dialogue with other attendees of the conference regarding community outreach and networking ideas. One major discovery from the conference was a general consensus that connections and collaboration grow most fluidly from face-to-face introductions, but are frequently sustained with online communication, including email, phone calls, texts, and online groups. Additionally, organization and consistency in planning of these face-to-face events is important to retaining attendance and interest.³²

At the conference, the team was able to speak to several individuals involved in agriculture to gain insight into the experience of a NOFA member. Some of these individuals also shared contact information for future interviews. Mike Hollis, the Urban Farming Director of Services for the Underserved (S:US) in New York City, provided insight into how a network can benefit those involved. S:US provides individuals in the program an opportunity to run a workshop if they have a unique piece of knowledge or interest.³² This opportunity is mutually beneficial for the participant and the organization.

The participant is able to reach a larger audience with more support than they might have otherwise, and the organization is able to encourage member involvement and host interesting workshops to retain member interest and support. Through NOFA and S:US, the team gained a more precise understanding of how a network supporting urban agriculture can work, through centralized support and mutually beneficial practices to those involved.

Interviewing different actors led to a better understanding of Copenhagen's urban agriculture communities

The team conducted 21 interviews with representatives from small scale urban farms and neighborhood gardens, leaders of local eco-friendly organizations, university professors, beekeepers, and local landscape architects and designers within Copenhagen (see Figure 5).

Some of these contacts were provided by the project's sponsor, while others were located using an online map of urban agriculture,²⁶ which includes contact information for a number of farms throughout Copenhagen. Additionally, other online resources, including LinkedIn and Facebook, were used to find supplementary contacts. Thus, the interview sample was biased towards farms and individuals that had accounts and actively used electronic communication, including email and Facebook. This may have created a subtle bias towards farms that have regular employees or volunteers, who may have been more likely to check social media and spend time speaking with the team. Also, as farms that were no longer in operation did not tend to have a

strong (or any) online presence or response, that segment of the population was not sampled during the interview process. This made it difficult to assess the major difficulties faced by farms, as farms that failed were not interviewed. Due to the limitations of the project team, interviewees were selected based on the ability to speak English.

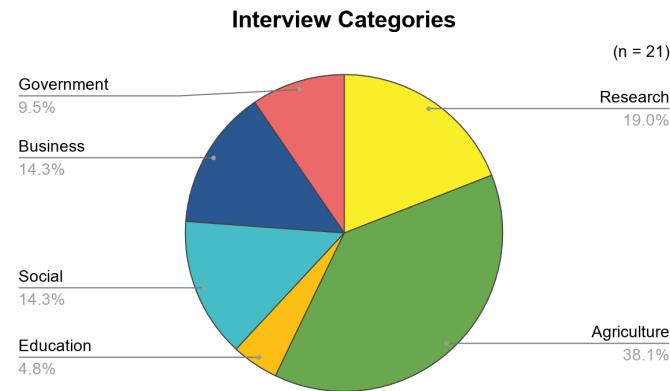


Figure 5: Primary Categories of Contacts

Individuals were contacted for an interview based on several attributes, including involvement with urban agriculture directly, academic research surrounding networks, farming, or food behavior, and their status within the community. The team visited several neighborhoods throughout Copenhagen while performing interviews (see Figure 6). The majority of urban farms visited were located in the northwest quadrant of the city; however, this is not entirely an indicator of the location trends within Copenhagen. Many farms that were contacted either declined or did not respond. In addition, the team was also not able to contact all farms and gardens within the city due to lack of online presence, difficulty finding contact

information, or time constraints.

The team used their connection with Growing Pathways to build credibility when reaching out via email to specific farms and individuals. For each contact that accepted the interview request, the team wrote a brief summary of their background and relevance to the project, along with contact-specific interview questions (summaries can be found in the Supplementary Materials section). Questions were designed to



Figure 6: Interview Locations

first build rapport and gather background information about participants, then inquire about specific ideas related to their status and interactions with others in the community. The interviews focused on gathering information about the needs and interests of the participants regarding urban agriculture, the formal and informal connections between individuals, and potential ways to sustain established relationships and build new connections.

Interviews revealed common strengths, weaknesses, opportunities, and threats within the urban agriculture community

Conducting interviews gave the team qualitative information about the networking practices and needs of individuals within Copenhagen's urban agriculture community. These interviews improved the team's understanding of the current state of urban agriculture networks within Copenhagen and gave insight into methods that failed in the past. At the end of the data collection period, the team used

inductive coding to analyze the interviews which revealed themes within the urban agriculture community. Specifically, the team focused on analyzing the connections, resources, and social aspects of the interviewees. The team discovered several consistencies between interviewees regarding these trends and the resiliency of each farm.

Using these discovered themes, the team performed a SWOT analysis for each urban farm or garden discussed in interviews. A SWOT analysis is used by individuals, organizations, and businesses to identify internal and external factors that might impact success. SWOT stands for Strengths, Weaknesses, Opportunities, and

Threats. SWOT is intended to provide insight and inform strategic decisions.³³ Each individual SWOT response was placed into 1 of 9 categories: mission and passion, community involvement (including events), product management and method of profit, staff (including regular volunteers), land-related (i.e. security and access), network and collaboration, funding, physical/business/membership expansion, and policy. Responses for each category were tallied within each SWOT segment to gather an overview of the strengths, weaknesses, opportunities, and threats facing the community at large. See Supplementary Materials for full SWOT analysis.

As shown in Figure 7, many of the strengths and weaknesses can be two-sided. For example, some farms feature strong community involvement - high interest and commitment from volunteers, consistent attendance at events - as a strength, while others struggle in that category. Similarly, some farms have successful and stable methods of managing their production and making a profit, while others do not. This double-sided comparison was seen frequently throughout analysis, as strategies that work for one farm may not transfer to another farm in a different situation. That said, common threads were found among all farms, especially when analyzing external threats to success.

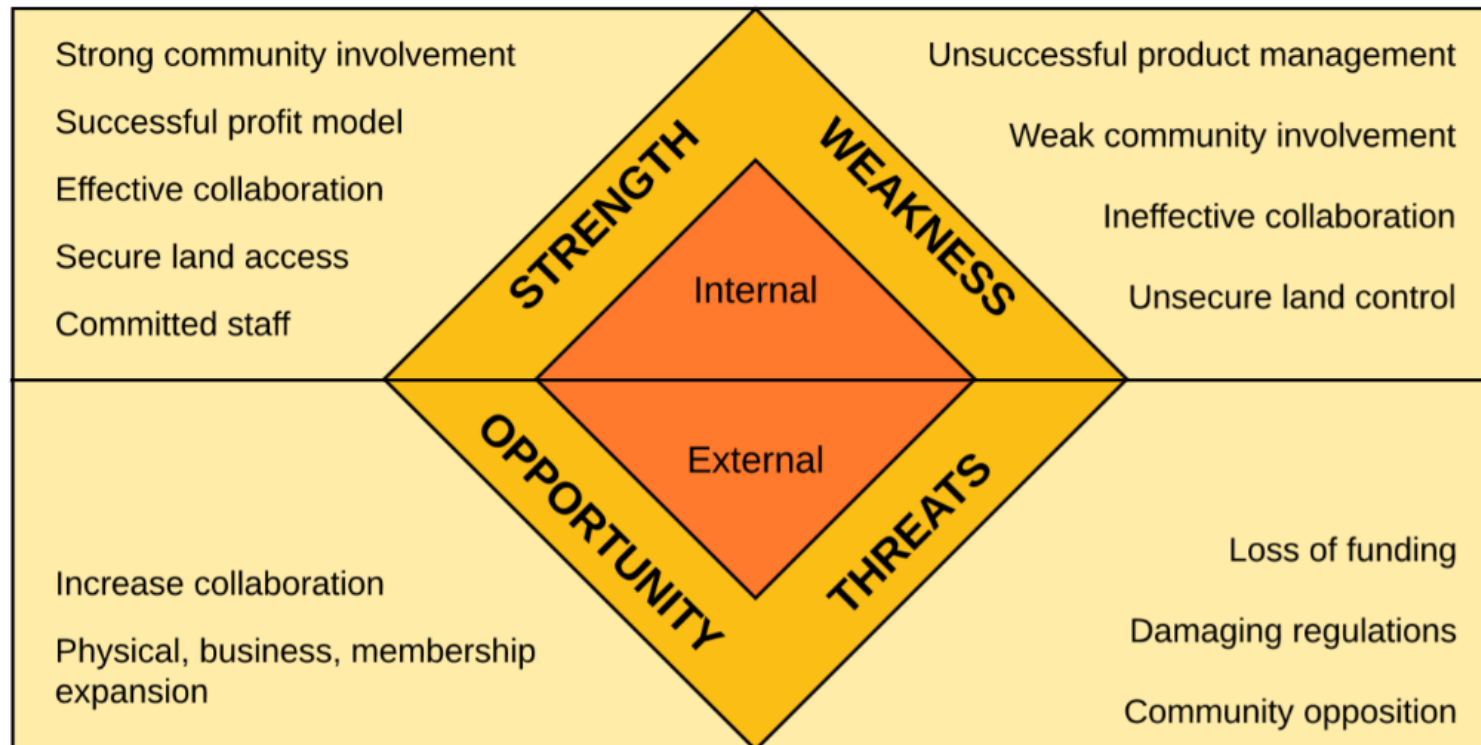


Figure 7: Aggregate SWOT Analysis

Farmers who own arable land and have paid employees are more resilient than those who do not

Two key strengths demonstrated by several urban farms include land security and committed staff. These characteristics can be linked to the resilience of a farm. In Figure 8, Quadrant I represents farms with strong resilience because they have paid staff through various sources of funding or income and secure land-based on stable, long-term contracts.

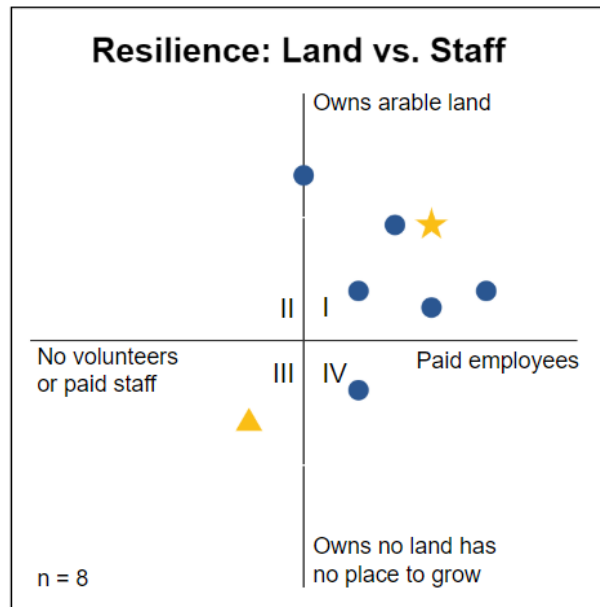


Figure 8: Resilience as Indicated by Land Security and Type of Staff

The star in Quadrant I represents ØsterGRO, a rooftop farm in the Climate Neighborhood of Copenhagen. ØsterGRO operates as a CSA, where community members join the farm, receive weekly boxes of produce,

and have the opportunity to participate in the harvest. This income supports a staff of 10 full-time and 2 part-time employees in the summer.

This has grown from the original 2 co-founders, who took small salaries while ØsterGRO was being established. Following a struggle with the municipality concerning their claim to the roof, ØsterGRO's land security has now stabilized for the near future.³⁴ This combination of stability of the workforce and secure land access makes ØsterGRO an example of a strong, resilient farm.

In contrast, Quadrant III includes farms with no paid staff and insecure or no land. The triangle in Quadrant III represents Byhumle, a small-scale urban farm focused on growing hops that operates solely through a volunteer force. Byhumle is located in a parking lot in the Nordvest area called Garage Park, which is set to be renovated within 5 years. Byhumle does not currently have an official plan for relocation.³⁵ This, combined with a lack of organization of their volunteer force, indicates low resilience and potential danger of failure.



P. Garver, B. Cicione, and J. Whitwell at Byhumle

Urban farms with high resilience are self-sustained based on income from product or service sales and do not rely on outside funding

Resources - especially money - are a significant concern in the establishment and resiliency of urban farms. Initial funding is crucial during the early stages of growth, particularly for expanding staff and purchasing start-up resources. Until an operation has funding of some kind, all costs are out of pocket and labor is typically done by volunteers. Oliver Maxwell from Bybi explained that the most difficult task for his business was finding consistent funding at the beginning. In Figure 9, Bybi is represented by the pentagon in Quadrant I. As shown by the graph, Bybi is now fully self-sufficient through profit

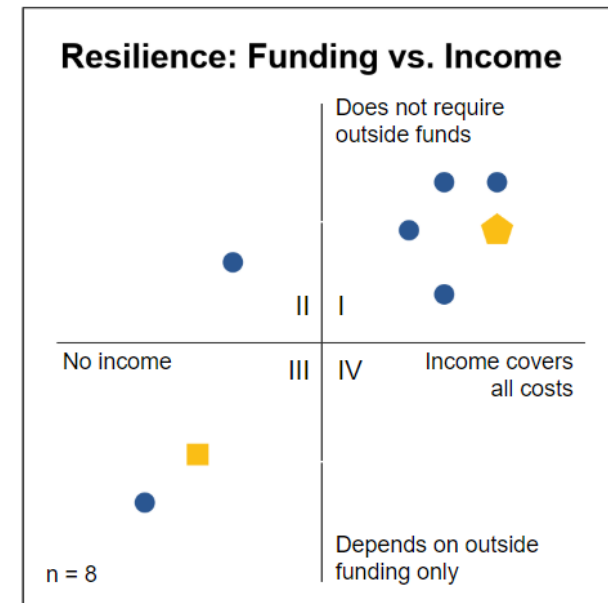


Figure 8: Resilience as Indicated by Outside Funding and Self-sustaining Income

and no longer relies on any outside funding.³⁶ In this way, the funding models of farms can morph to enable the farm to become more stable and resilient.



Greenhouse Dome at Haven I Tingbjerg

In contrast, Haven I Tingbjerg (see the square in Quadrant III of Figure 9) is funded entirely from outside organizations. The farm relies on several different sources of funding to continue operation, purchase essential resources, and pay staff members.³⁷ In most cases, the longer an organization has had an external grant, the less secure the funding is. There is no “sunk cost fallacy.”³⁸ Funders instead have the opinion that organizations should be able to stand on their own feet after receiving funding for a long period of time. For this reason, funding for the project is not

guaranteed for long-term operation, which places the resilience of the farm in jeopardy.

Social connections between network actors could increase resilience related to land access

Creating social maps of Copenhagen’s agricultural community has given insight into how to alleviate issues within the community, including land security and volunteer retention. Each interviewee was asked about their current connections in the urban agriculture community, common issues throughout the community, and the community’s willingness to communicate through a networking tool. With this data,

potential connections were created to theorize ways of alleviating these issues.

Land security is a common struggle faced by urban farms,. Land lease contracts terminate after a set time period, often with no option for renewal. One solution to this problem is to connect these farmers with landowners such as Lars Strand of KAB Bolig³⁹ or Jens Christian Elle from the Brønshøj-Husum Lokaludvalg⁴⁰ who are interested in engaging with farms. For example, BYGAARD grows microgreens and mushrooms by recycling soil in the basement of a property leased to them by KAB Bolig. They sell these products out of a store on the level above the basement.³⁹ This demonstrates actor-network theory in action (see Figure 10).

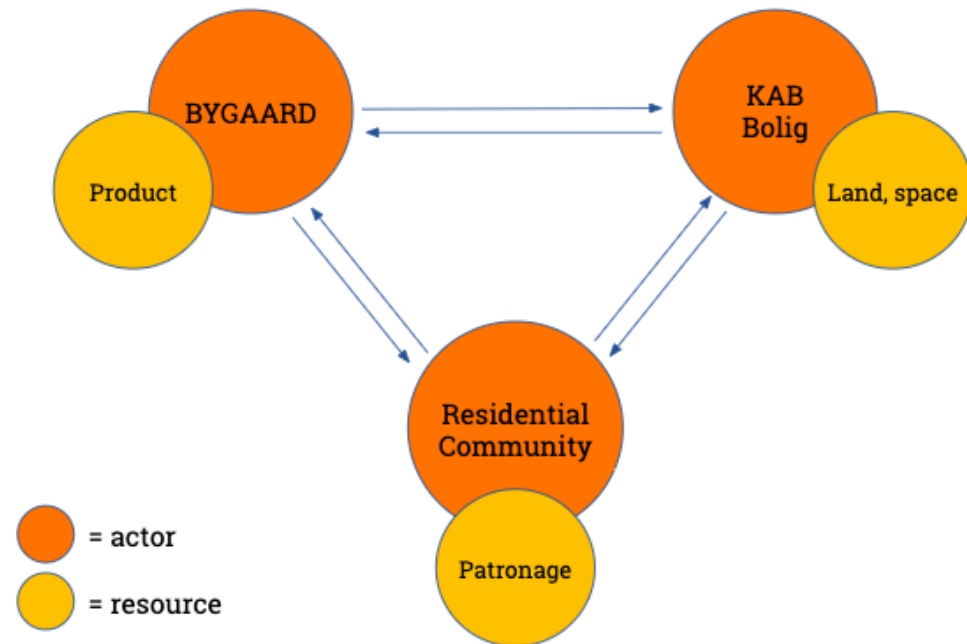


Figure 10: Actor-Network Theory Demonstrated by KAB Bolig Community

Each actor shares a resource with other actors to create a functioning network. This relationship stems from BYGAARD's land lease agreement with KAB Bolig. KAB Bolig derives benefits through the residential community's interest in BYGAARD and subsequent interest in KAB Bolig properties.³⁹ This is an example of a secondary incentive for landowners to host urban farms. Emulating this successful example may prove complicated; however, there is a clear path for farmers and prospective landowners to take.

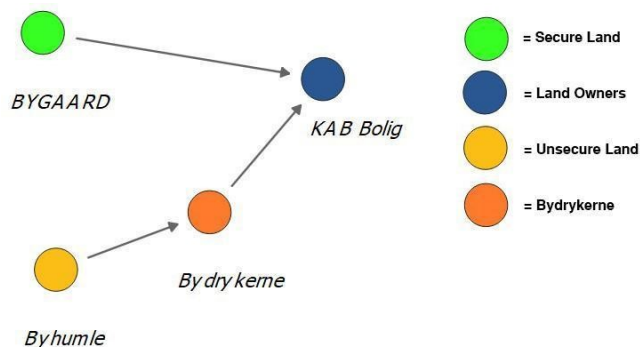


Figure 11: Related Parties Connected Through Growing Pathways

Mapping current and potential relations shows how land security can be addressed by landowners interested in urban agriculture. As seen in Figure 11, BYGAARD has been able to secure their land through collaboration with KAB Bolig, to whom Growing Pathways is connected. Byhumle, a farm struggling to find secure land, could benefit from the connections the Bydrykerne project would provide. Urban agriculture projects can be connected to these landowners through other organizations in a network. In this way, Bydrykerne would have the potential to connect several farms operating on unsecure land to interested landowners. This

secondary connection can be leveraged by the farm to increase their resilience by securing stable land. This example provides insight into how connecting different parties through a network could solve issues affecting the community. Applying and expanding upon current social connections is necessary for the network to increase the resilience of urban farmers in Copenhagen.

Laws relating to the use of land impact the ability of urban farmers to engage in agriculture projects

Major threats facing urban farms include loss of funding and restrictive government regulations. For example, the rooftop farm ØsterGRO struggled with regulations concerning zoning of the roof. The roof was originally planned and accepted by the city to contain 29 parking spots. Though these spots were not being used, ØsterGRO had to enter a legal dispute with the municipality to get approval to relocate 11 spots and excuse 12 so that they could continue using the roof for farming. The issue was resolved in September, 2019, following an almost year-long battle.³⁴ ØsterGRO is now secure in their land for the foreseeable future, but still serves as an example of the difficulty farms face with regulations surrounding zoning and land access.

Similarly, regulations surrounding land use for specific types of planting can also limit the capabilities of farms. For example, the city of Copenhagen limits residents' ability to plant trees directly into the ground. This is because of the possibility that electrical wiring, plumbing, and other infrastructure is located in the plot underground.⁴¹ This regulation is based on logical

concerns, but the city does not work to examine lots or differentiate between lots that might be safe for planting. This limits some farms and gardens to only planting in raised beds, thus limiting the produce grown.



B. Cicione washing beets and radishes at ØsterGRO

Farms and gardens that develop a strong link to institutions are more resilient

There are a variety of ways an agricultural endeavor can connect with an established

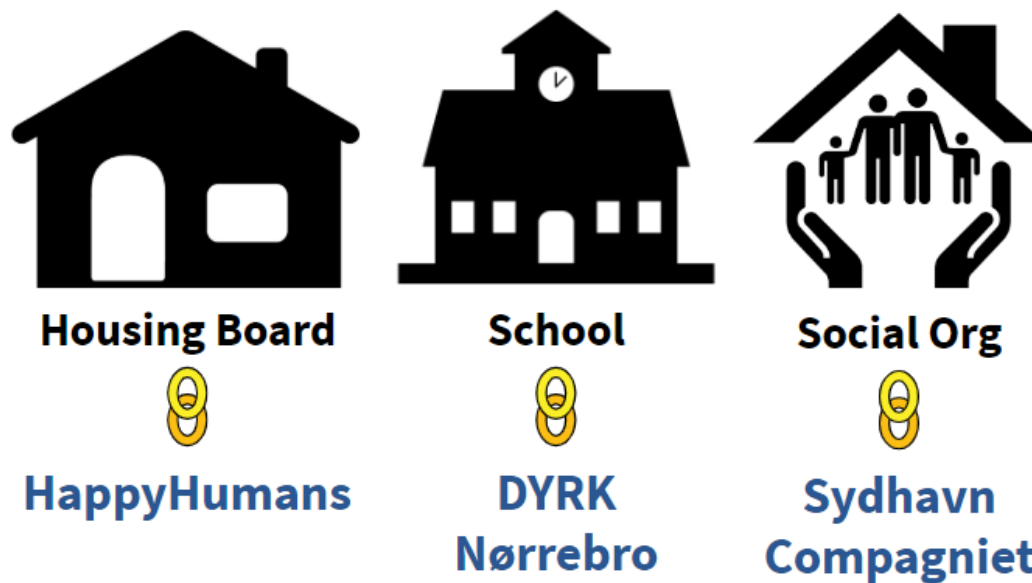


Figure 15: Farms Linked to Institutions

institution such as schools, social organizations, or government entities (see Figure 15). This is beneficial because it sustains project operations, but limitations arise if an institution decides to cut its funding to a farm.

Ditte Katherine Engelstoftegård is a permaculturist from HappyHumans who works with two housing boards.⁴¹ She is paid by the housing boards to create and maintain gardens in two courtyards. In addition to harvesting the produce for the residents of each community, she also hosts gardening workshops, strengthening her relationship with the residents. This creates a strong connection between herself and the residents, which reinforces her value to the housing boards. HappyHumans is resilient because of this key relationship with the housing boards.

Farms also find success when connected to

a school. DYRK Nørrebro is a rooftop garden that sits on top of a primary school. The school uses the farm to educate children about planting and maintaining a garden. The farm also hosts different events to get the local community involved.⁴³ Since they are linked to a school, they've received continued support and volunteers through the school's program, which has helped the farm prosper.

Similarly, connection to a social organization with a clear social objective creates increased resilience. SydhavnsCompagniet is an organization focused on social outreach in Sydhavn. They recruit unemployed or vulnerable volunteers to participate in structured activities. One activity includes working with a small bee farm keeping bees. Volunteers receive beekeeper certification training along with the satisfaction of creating a physical product through honey

production.⁴⁴ This form of institutionalization, while small scale, keeps the bee farm resilient through its access to a group of consistent volunteers.

Connections with existing institutions have been shown to increase the resilience of an associated farm. When initial funding is secured through an external entity, it is easier for a given farm to take risks and remain operational; however, farms that have successfully gained external funding face the issue that their associated institutions might retract that funding. ByOasen, a project dedicated to developing an oasis with different animals and greenery mainly for children, relies on a grant from the municipality. ByOasen must reapply for the grant to be renewed by the municipality every three years. The project has received this funding twice over the last six years. Previously, the project was funded through separate outside funding. This funding was withdrawn, placing ByOasen in danger of closure until they were able to procure new funding.⁴⁵



ByOasen

The urban agriculture community in Copenhagen is loosely connected through an informal network

Figure 16 shows a social map of the current underlying connections within the urban agriculture community constructed during the interview process. This social map does not include every urban agriculture-related space in Copenhagen due to time constraints. Instead, it shows the connections between the interviewed individuals through a visual construction of their relationships. The arrows on the map point from the group or individual to an entity that they mentioned. For example, Bioteket mentioned Byhumle as a connection; as a result, the arrow starts from Bioteket and goes to Byhumle.⁴⁶ Understanding the current connections between

members of the Copenhagen agricultural community was valuable when attempting to encourage the use of a tool that would increase the resiliency of the farms in the network.

Copenhagen's current urban agriculture community is broken into a few different communities and networks. Community gardens are not included in this map, because this project focuses on urban farming. Using this social map, it is possible to analyze the smaller networks that are already built within the community. For the sake of simplicity, the map only shows connections to other urban farms and agriculture-related organizations. Due to this, SydhavnsCompagniet is not connected to the other farms and related organizations by their own choice.⁴⁴

As discussed above, ØsterGRO is an example of a farm with high resilience. Figure 16

shows ØsterGRO is at the center of a major sub-network within the urban farming community. This indicates that the support of these relationships contributes to the resilience of the farm. Additionally, ØsterGRO relies on this network to help them supply produce to their CSA members, which has allowed them to expand their membership.³⁴ The figure also shows that farms with resilience may be more likely to have an expansive network.

The team found that these networks are generally built upon friendships and previous relationships. Many people in the community went to university together and formed their connections with each other there. One example of this is Bioteket, a biotechnology company with a greenhouse where they test innovative farming techniques. Bioteket allows people interested in researching and teaching farming techniques to use their premises. Many of these people are recent university graduates interested in testing their ideas further. From this, Bioteket has formed its own small network with others who share their passion.⁴⁶

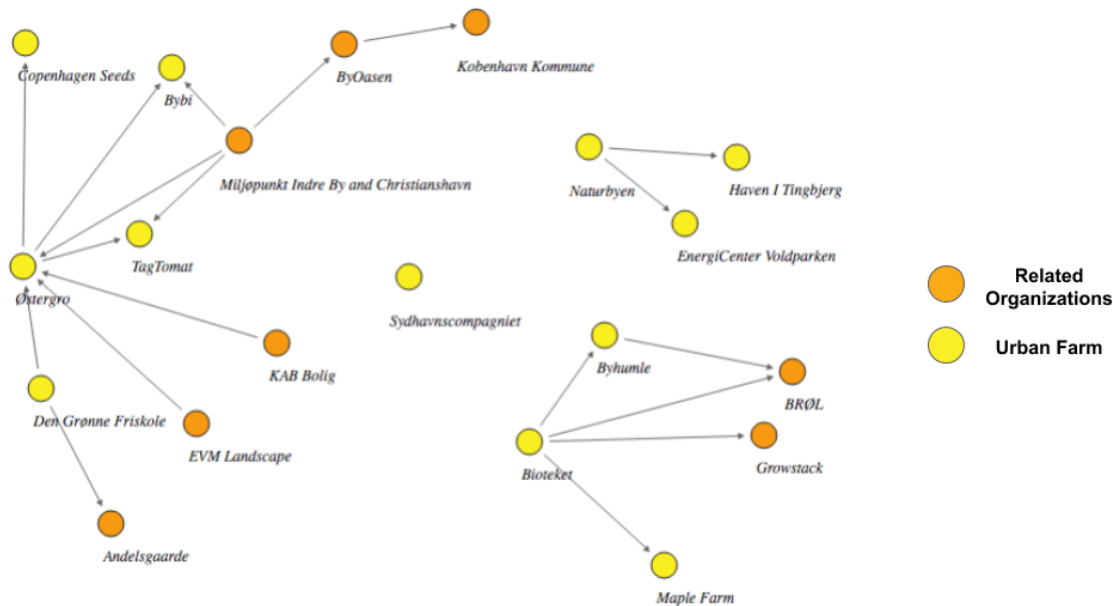


Figure 16: Current Underlying Connections



Bioteket Aquaponics⁴⁷

Shan Khan from Bioteket maintains that there are two disparate ideologies in the urban agriculture community. One group has a passion for learning and teaching others about urban agriculture, while the other group has more profit-driven motives.⁴⁶ Many people with similar ideologies tend to work together in their own smaller networks. Khan stated that the groups do not typically collaborate because of their different foci, resulting in no overarching network.⁴⁶ Experts on network formation and analysis stated that there must be a common goal or problem that actors share to set up an overarching network.⁴⁸ The actors within a network must be able to share resources to reach a common goal or to create a new resource from the collaboration. If this is not possible, then the network will fall apart.⁴⁹ One possible avenue for uniting the community is through the prospects of mutually confronting shared problems that the groups face. Finding ways to alleviate or solve these common issues would be one binding force necessary to keep a network functional in Copenhagen.

An electronic networking tool requires a pre-existing, connected, underlying community to create value

One possible way to address large-scale issues for urban farmers is by using a networking tool. A networking tool can directly address these issues by connecting relevant parties to more easily address issues related to the distribution of land, resources, and funding. There are multiple types of networking tools. Networking tools can be digital (i.e. a website, an app) or non-digital

(i.e. a print resource, a social gathering, an organization such as NOFA). A digital networking tool has the ability to direct an expansive network, while a non-digital networking tool can be used to build initial connections.

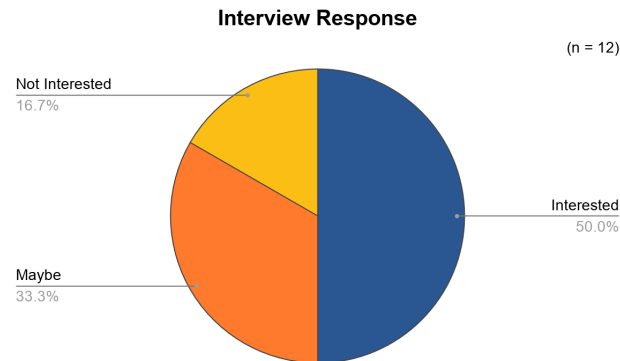


Figure 17: Interest in a Networking Tool

Urban farmers expressed interest in using a networking tool during the interview process (see Figure 17). Of 21 interviewees, 12 were directly asked by the team about their interest in participating in an online tool. These 12 were selected based on direct involvement with an urban agriculture project as a project leader, architect, or volunteer. Researchers, though welcome and included in the selected platform, were not directly asked about their interest in participating. Half of those asked responded positively and with high interest in the tool. Those that hesitated did so for various reasons, including the desire for further specific information, reservations about time commitment or receivable value, and concerns about heavy involvement in other existing networking platforms. Individuals who declined to participate were not interested in expanding their network or were planning on moving away from urban agriculture. Figure 17

shows that the majority of interviewees directly involved with urban agriculture would be interested in a digital networking tool.

For a digital networking tool to work, there must be an existing sense of community in the anticipated user base. Thomas Burø, a researcher in the field of cultural organization, explained how a rural farming community created a Facebook group to allow for easier communication between members.⁴⁸ In order for this group to work online, there needed to be an existing community. Without this, people would not use the platform. The pre-existing underlying community gave members more trust, which encouraged them to feel more open to sharing resources, knowledge, and labor with one another. Without pre-existing connections from in-person events, the members would be less willing to communicate and use the platform for cooperation.

Digital tool selection considered feature availability, usability, and applicability

It was important to research both digital and non-digital tools as a way of networking. A digital tool can be polarizing, as people may not be willing or electronically literate enough to use it. While this is true, digital networking tools also serve to connect disconnected areas more easily when properly implemented. Similarly, non-digital networking tools such as a print resource or a social gathering can limit access based on physical location and are difficult to update once distributed. For the purpose of this project, a digital tool was selected to balance the need for networking and communication with a focus on

sharing relevant knowledge. There are a variety of applicable digital networking tools publicly available, including LinkedIn, Meetup, Facebook groups, Slack, and Discord.

One aspect considered in choosing a tool was cost. Cost is a limiting factor, and free options are generally more accessible. The tools listed above all have a free option, however, these free options are different. For LinkedIn,⁵⁰ Meetup,⁵¹ Facebook,⁵² and Discord,⁵³ the free option is not limited, and no payment is needed to continue using the software. In contrast, Slack's free version is limited to 10,000 searchable messages.⁵⁴ Once that limit is reached, functionality is handicapped until payment has been remitted for premium services. A free software with high functionality is both appealing and practical.

Features Available	LinkedIn	Meetup	Facebook	Slack	Discord
Free Version	✓	✓	✓	✓	✓
No Limit on Free Version	✓	✓	✓		✓
Supports Danish	✓		✓		✓
User Friendly	✓	✓	✓	✓	✓
Dedicated Channels				✓	✓

Figure 18: Digital Tool Comparison

Another important aspect that was considered was the user-friendliness of the tool. All of the tools that were looked into are relatively intuitive to use, as seen in Figure 18. Despite this, user-friendliness is a broader topic

that also encompasses support for Danish. Since people may not have used the online platform before, it was important for the tool to be welcoming to those in Copenhagen. If Danes are unable to access the tool, then creating a tool with that platform would be futile. LinkedIn,⁵⁰ Facebook,⁵² and Discord⁵³ all have support for Danish, while Meetup⁵¹ and Slack⁵⁴ do not. This isn't exactly necessary for the tool's use as people can write messages in Danish without any issues, but if a user were to contact the company for support, Danish would not be supported. Through compiling information from interested parties and researching various tools, it became clear Danish language support would be necessary.

A user's access to relevant information was also important to consider. Both Discord⁵³ and Slack⁵⁴ provided this access through the ability to create dedicated channels on these platforms. These channels create space for focused discussions. Similarly, Meetup allows for the creation of dedicated discussion topics, similar to a forum.⁵¹ As a result, any user can create a new discussion. While there is value to this, allowing individuals to create topics can lead to redundancy and clutter. When looking at LinkedIn and Facebook, organization is much more limited. Both LinkedIn⁵⁰ and Facebook⁵² allow users to create group chats, but this is the extent to which a group can communicate in a dedicated channel. There is no way to easily organize group chats or create channels for more focused discussion.

Based on this analysis, Discord was chosen as the most suitable tool. While there is a premium version available, it isn't necessary to fully operate the software. Additionally, Discord's website and help team support Danish. The service can be efficiently organized, reducing

clutter and guiding a focused discussion. Discord's low cost, Danish support, and easy to use software all factored into choosing it as the platform for the networking tool.⁵³

A digital platform dedicated to the urban agriculture community will facilitate information exchange between members

Many organizations create groups on Facebook or other online media to bring members of their community together. While this can prove useful, the ability of a group to find success is minimal. Ditte Kathrine Engelstoftegård, of HappyHumans, provided an example from a separate group for which she helps organize volunteering events. When contacting members of the group through Facebook, she noted low interaction between community members and the posts she made. She attributed this to the vast amount of information typically found on Facebook.⁴¹ This is due to the nature of such a platform. On Facebook almost no users are a member of one group, resulting in events of interest getting lost in the flood of information.⁵⁵ When an event is difficult for prospective attendees to find, they are much less likely to participate.

A way to resolve this problem is to use a unique platform designed to ease communication within large groups. We chose Discord for this reason, as it has the ability to create channels for specific topics such as news and upcoming events, which reduces the clutter often found with other electronic communication platforms. This enables users to easily find the information they seek, discover new events, or simply communicate with

one another on a topic of common interest. A tool hosted on a platform designed for this type of communication will more easily facilitate discussions with many participants, while not becoming overwhelming for the user.

Discord meets the needs of the farming community through its customization, software integration, and focused discussion

Discord is able to keep discussion and shared information focused on designated topics through dedicated text channels and software integration. Dedicated channels can be used for either text or voice communication over the platform. These channels will keep the discussion focused on a particular topic. For example, the channel “#deleplads” will serve as a marketplace for sharing resources and services. Here, farmers could post volunteer opportunities for events.

Similarly, landowners can offer their land to farmers who don't have secure access to land.

The creation of dedicated channels for external software can create a pseudo-integration with these other resources. Within the urban agriculture server, this function was used to integrate the software Mapotic. Mapotic allows users to map their location, fill out relevant geographic information, and add a short description of their project or operations. This Mapotic map will allow the members of the network to visualize the locations of other nearby urban farms or community gardens involved in the Discord server to encourage collaboration.

With a dedicated channel for Mapotic, members have been provided information on how to use and access the software. Although Mapotic is useful for visualizing geographical locations, it was not considered as a possible networking tool due to its lack of a communication platform. Discord's ability to be customized and integrated with additional software sets it apart from other

online tools, thus creating a more streamlined networking tool for the member's needs. One example of this is the ability to internally integrate a bot into the server. A Discord bot is an automated user that can perform designated commands given by the creator. Bots can be coded in JavaScript to be completely personalized. It is also possible to use a premade bot's JavaScript for one's own purposes.⁵³ Commands include moderating the server and enabling new users to verify themselves under different roles in the server, which was used in the server created for urban farming in Copenhagen. Roles are currently divided into urban farmers, community gardeners, volunteers/supporters, and researchers. This grouping allows individuals less familiar with one another to more easily identify other participants and their possible interests. Roles are also used to filter notifications based on an individual's interests.

Following user interface design guidelines by consulting community members builds a tailored, useful tool

The team followed the user interface design process (see Figure 19) to evaluate community needs and develop a prototype. Requirement Analysis through interviews indicated that urban farmers would benefit from a tool that would streamline communication, reduce platform clutter, and reach a greater range of potential volunteers, as discussed further above. Social mapping of current connections indicated the existence of an underlying community that would support successful implementation of an online networking tool. While these connections

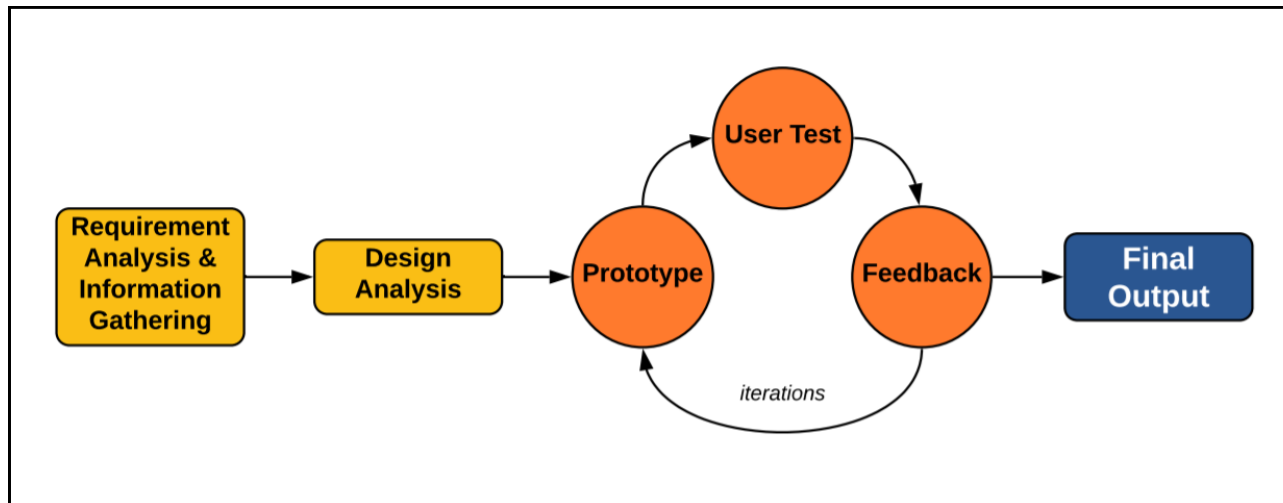


Figure 19: User Interface Design (UID) Process

exist and are more thorough than could be mapped, in-person events will be necessary to preserve and develop this community. A digital networking tool was chosen for its ability to connect communities throughout a broad geographic area, while maintaining the ability to organize in person. As discussed above, Discord was selected following comparison of several tools. The team created an initial prototype based around specified channels, a verification bot, and integration with Mapotic (see Figure 20).

The team contacted interview participants with a follow-up request to user test the tool and provide feedback. The follow-up email included specific testing instructions covering sign-up,

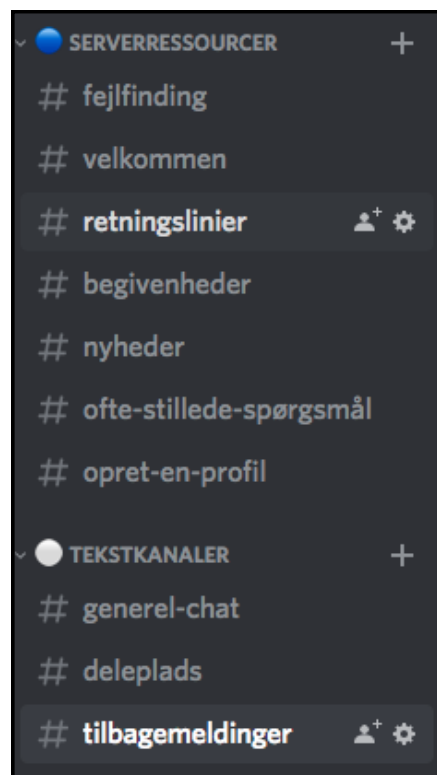


Figure 20: Initial Discord Channels

profile creation, and using Mapotic and a set of questions and prompts to gather feedback. Instructions for joining and testing the server can be found in the Supplementary Material. After reviewing and considering these responses, the team made recommendations to Growing Pathways for the future of the tool.

Bydyrkerne should actively moderate and participate in the server during the initial stages of growth. Bydyrkerne should manage the Discord server by sending regular messages, monitoring activity, and managing feedback. Recommending potential events to attend as a group will encourage activity on the server. Demonstrating message formats and content ideas, such as community events, will help limit potential intimidation about sending a message and inspire members to share their own events or ideas. Additionally, having an active administrator will increase the activity of participants. Finally, monitoring the status of the server will ensure technical difficulties are caught and remedied in a timely fashion without damaging the communication capabilities of the group.

Bydyrkerne should conduct a pilot study to further test and improve the Discord server. For the Discord server to successfully add value to the urban agriculture community, it must be tested in-depth to find opportunities for improvement. Growing Pathways should conduct a pilot study to gather feedback from interested individuals involved in various areas of the urban agriculture community. This group should test the server through a structured test protocol based on given prompts. Feedback should be used to improve the server using the guidelines in the Discord Instruction Manual (see Supplementary

Material) to ensure that the server is user-friendly and free of errors. Periodically, Bydyrkerne should conduct more testing when deemed necessary to ensure the server fits the needs of the expanding community.

Bydyrkerne should organize periodic events to both strengthen and expand the existing community. Organizing periodic events will allow Growing Pathways to get a better understanding of the community they aim to serve. While an online tool has value in its ability to connect people throughout a large geographic area, there are limitations to only communicating through text. Meeting in person will encourage the creation of new connections and strengthen pre-existing relationships between members of the community. Gatherings should be casual events that aren't necessarily related to urban agriculture, such as picnics, barbecues, music events, or anything widely accessible.

These events should focus on creating a friendly environment for members in the network to build a stronger level of trust with one another. This trust can then improve the ability of individuals to communicate in ways that will increase their resilience, through sharing knowledge, solutions to common issues, approaches to business management, etc. Meeting in person will also effectively remove doubt and intimidation surrounding interaction online. The events should be scheduled periodically, with the time and date provided in the server. There are different ways of using Discord to notify the members. One option is to have the bot notify everyone in the server with a timer for monthly events. Another method is having a mix of both an events calendar and members of Growing Pathways notifying the server.

Bydykerne should ask individuals who have joined the server to invite their volunteers to the server. For the server to work effectively, there must be a lot of users. This should not only include those involved in urban agriculture, but also volunteers who work with those people. Bydykerne should encourage farmers and gardeners on the network to invite these individuals to join the server in order to grow a strong base of volunteers interested in urban agriculture. With this volunteer user base, agricultural endeavors have an opportunity to share their volunteer events on the server. Increasing the number of members on the server will help urban farms and community gardens strengthen the security of their workforce.

Acknowledgments

The team would like to thank our sponsor, Oleg Koefoed from Growing Pathways, for his support and guidance. Thank you to Professor Holly Ault and Professor James P. Hanlan for the time and effort they put in to advising and providing feedback on the project. Lastly, the team would like to acknowledge all of the participants in our interviews for their time and willingness to share.

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