〈日本知財学会誌〉Vol. 20 No. 3— 2024 : 71-85【事例報告】

European Experience in Sharing Foods, Lands and Commons : Role of ICT sharing applications and human-nature relationships in era of Digital Transformation on the example of the fruit tree sharing map *mundraub*

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【Abstract】 The sharing of resources like food and land, as a measure to improve the relationship to nature, food production, local produce and identity and sustainable lifestyle have gained salience in recent years, observed in surging numbers of relevant projects and studies. The increasing possibilities of Information and Communication Technologies (ICT) add a new dimension to the sharing dynamic. The use of digital applications due its nature expands the geographic and social range.

This case study explains the approaches of *mundraub*, a digital map for fruit trees, made by citizens for citizens, with the aim to reconnecting nature and people, rediscover, preserve and share knowledge about edible plants and create a social network. A short introduction of other sharing projects with similar or related focus, such as food saving or land sharing, shows the change of sharing behaviour and gives an indication of if and how future projects can implement ICT to improve their public acceptance. To accept citizens as emerging actors for co-creating, co-managing and co-monitoring of green space can result in a better acceptance and long-term existence of projects. Despite the challenges related to organization and management, sharing services and the leverage of ICT tools can offer novel approaches to the shared use of green space.

【Keywords】 sharing services edible urban commons ICT sharing application digital transformation mundraub

1. Introduction

Landscapes provide opportunities to rebuild the deprived connection between humans and nature. Utilizing landscape resources by sharing has been a topic in several studies (Ryu, Basu, and Saito 2019). Sharing projects evolve in different ways, either bottom-up or top-down with both requiring a strong engagement from citizens to form resilient communities. Since the 1990s, the term 'citizen science' has been used to describe the participation processes of citizens in re-

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search, planning and policy-making. Under this concept, citizens are included in the development of strategies and research on various topics. Based on two authors, the topic is approached in two ways. Iwin (1995) emphasizes the collaboration and circulating exchange of information and knowledge between professional scientists and citizens for the co-creation of research goals and results. In the second approach of citizen science by Bonney (1996) scientists lead the process while help is borrowed from citizens for research, for example in the form of data collection, with the emphasis on awareness-raising. Both approaches aim to gather public knowledge and promote research, increase educational activities and outreach to widely disseminated research results (in *Citzen Sci.*, 2018).

Collaboration between local governments and active citizens regarding green space development can provide ecological and social benefits. The institutional culture of local governments and specific sociocultural and environmental contexts play a substantial role in active citizenship (Buijs et al. 2019).

The emergence of new Information and Communication Technologies (ICT) brings a novel dimension of participation into the discussion, possibly improving public support and engagement in developing projects of public resources. The diversity of views and voices for flexible adaptability concerning data-driven decisions can provide more flexible, efficient and real-time management in urban planning (Chien, Hori, and Saito 2022 ; Kane and Novelli 2019 ; Loukis, Charalabidis, and Millard 2012).

Understanding the motivation and values of participants is important for the practitioners to create an encouraging environment. Participants of citizen science projects and sharing services value transparency about what their contribution was being used for. Feedback can be preserved as motivating and new technologies may fasten such time-consuming but essential processes (West, Sarah ; Pateman, Rachel ; Dyke 2016).

1.1. Trends in sharing dynamics with citizens as emerging actors

Research on commons-based resource management concentrated in the beginning mostly on rural areas with a strong focus on property and action rights (Schlager et al. 2010). A high number of studies on sharing projects focus on mobility and housing, but there is less extensive research on sharing food and knowledge. Success stories of Airbnb and Uber show the potential, but their longer observation makes scientists warn about the risk of commercialization of sharing culture. Even if participation is often motivated by economic benefits, resource sharing also has a positive impact on environmental sustainability. Sharing culture can contribute to stronger community bonds and food and knowledge sharing can enhance resilience and sustainable systems (Blay-Palmer, Sonnino, and Custot 2016 ; Ryu, Basu, and Saito 2019).

Publications like 'sharing cities', introduce civil society-initiated projects about the exchange of housing, mobility, food, work and energy all over the world. The projects are often supported by the government and reflect the growing interest and influence of sharing processes on various aspects of urban life. To support the frame of geographically bounded communities might reduce the risk of commercial co-optation (Shareable 2018).

When considering sustainable urban planning it is important to factor in and include non-traditional stakeholders like citizens as key actors for co-management, co-design and co-monitoring of urban commons (Chien, Hori, and Saito 2022 ; S.R. Foster and Laione 2016 ; Scharf et al. 2019).

1.2. Benefits and challenges of edible urban commons as a physical sharing and the involvement of citizens and varieties the top-down or bottom-up processes

Ostrom's work since 1990 has directed attention to a different approach to the collective actions problems of overuse or degrading shared resources, especially in

rural areas (e.g., fishing activities). Instead of government or private companies interfering and enforcing rules to solve the problems, Ostrom raises the option of community-built institutions to solve their collection action problems (Ostrom 2015). The discussion has been influencing urban commons in terms of resource management and self-governing institutions (S. Foster and Swiney 2021). Urban commons are collaborative arrangements for the creation, use and management of different possible resources in an urban context (Seravalli 2018).

To show the foundation on which sharing services are built on, concerning value and interest put in by citizens and official institutions, we will first review an example of such urban commons of sharing farmlands in a physical form, not necessarily utilizing ICT tools.

Public spaces, co-owned, co-governed and/or co-designed by individual citizens or communities, might appear in the form of community gardens, separated by a barrier or freely accessible by passer-by public grouped fruit trees. For example, lockdown periods during the Covid-19 Pandemic in 2020 and 2021 encouraged the popularity of growing and harvesting fresh food. The pandemic has shown how fragile the global food supply system actually is. Food-conscious urban design can emphasize a sustainable urban landscape in the future (Partahm, S. and Abelman, J. in Zeuner and Waterman 2018).

Additionally, as Light and Welch (2018) concluded in their research 'Aspects of growing edible plants' (in Zeuner and Waterman 2018) that growing food grounded people locally and globally, improved community building and the connection with nature by drawing attention to the seasonal circle. Urban food growing contributes to resilience when existing systems waver or collapse (Barthel, Parker, and Ernstson 2015).

The lack of private gardens increases interest in using public parks and green spaces. Additionally, to a resource of food, the educational purpose and the raise of biodiversity, multifunctional green areas further provide space for cultural and recreational activities (Sardeshpande, Rupprecht, and Russo 2021).

Reflecting such trends, the newly coined term 'edible city' has been continuously gaining interest and salience over the last two decades. Making public land more accessible by sharing it to grow fruits, vegetables and herbs instead of ornamental plants was meant as an attempt to involve the citizens more in the creation and encourage enhanced use. 'Edible city' projects can be initiated by the government, like in the case of the City of Adernach in western Germany (since 2010)[1] or by bottom-up initiatives like the city of Kassel in eastern Germany (since 2009)[2]. Artman, Sartison, and Vávra (2020) documented in their case study the positive impact on urban attractiveness, place attachment, place identity and social bonding. Human-food connections and awareness of local and pro-environmental food consumption improved through observation and participation. In the case of Adernach the issue of the low active participation of residents of～26% (besides for recreational usage), was raised, possibly related to the top-down approach, doubts regarding food safety and the motivation to leave food for people with lower income. Strategies of the city to improve participation include information activities about urban gardening food hygiene, pollution monitoring and societal benefits (Artmann, Sartison, and Vávra 2020).

Science plays an important role in addressing and investigating certain potential risks. With the growing cases of urban edible landscapes, the question of food safety of production in urban environments becomes more prominent. Different studies have addressed the issue of food growing in potentially contaminated environments like cities. Especially interesting for this article are the risks of contaminated fruit- and nut-producing trees and shrubs. The results indicate a lower risk for woody species to accumulate contaminants, for example, polycyclic aromatic hydrocarbons and heavy metals, in their fruits. However, the inconsistency of these trends and differences in contamination depending on location calls for more research in

the future (Gori, Ferrini, and Fini 2019 ; Romanova and Lovell 2021).

With the limits and challenges in mind, there is momentum in the number of participating and interested municipalities. Most cases of 'edible cities' describe a network of individuals or organizations, to some extent supported by governmental instances, dedicated to promoting urban agriculture, permaculture and edible landscapes. The goals are to utilize green space in the city, to emphasize community and identity building and to educate about food production. As residents become key actors in urban development through participation and self-organization, social resilience increases (Scharf et al. 2019). Initiatives such as the 'Edible City Network', funded by the EU, connect existing edible city projects around the world and support them with creating and implementing new projects[3]. That undermines the potential for sustainable urban development (Artmann, Sartison, and Vávra 2020).

1.3. Additional dimension of sharing through Information and Communication Technologies (ICT)

1.3.1. Recent Trends

In recent years Information and Communication Technologies (ICT) filled gaps and expanded the reach and possibilities of what can be shared, how and with whom, unrestricted by kinship, family or geographical boundaries (Davies and Evans 2019).

Online applications make life in the city more convenient. For example, food delivery apps have increased, especially as a result of the social distancing caused by Covid-19 Pandemic (Selvan and Andrew 2021). An unfortunate consequence is the increased distance from food production and natural resources and a negative impact on health (Stephens, Miller, and Militello 2020).

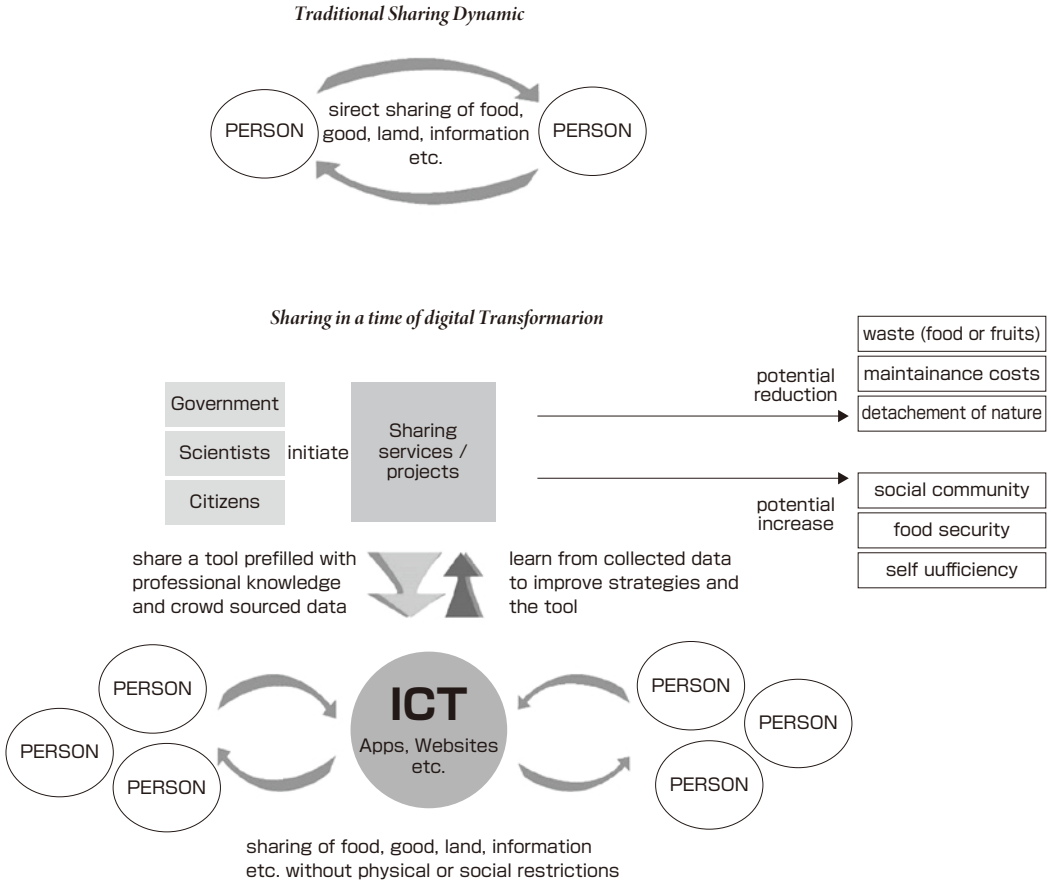
The rise of ICT brought up critics, yet there are also potential positive aspects. Existing projects to encourage citizens to engage with their environment like the above-noted edible urban common projects face challenges like low or short-term participation. Under the condition that project goals and resources are well-defined the use of ICT can emphasize ongoing participation and support (Wiggins 2010). Worldwide scientific cooperation can profit from ICT to exchange information faster and address problems like food security and development more expediently (McLaren et al. 2009).

As summed up in the Fig. 1 the sharing dynamics change with the emergence of sharing services, especially under the implementation of ICT tools like websites and applications expanding the range and amount of exchange. Sharing projects on a bigger scale like the former mentioned, have the potential to mitigate issues like food waste, nature detachment and in the case of shared land also maintenance costs by the government. Utilizing the potential of sharing services can strengthen social communities and improve food security and self-sufficiency to a certain extent (Artmann, Sartison, and Vávra 2020 ; Davies and Evans 2019 ; McLaren et al. 2009 ; Romanova and Lovell 2021 ; Sardeshpande, Rupprecht, and Russo 2021 ; Shareable 2018).

ICTs may be useful to support projects or even become a core of services depending on the shared content. The service of *mundraub* is such an example of ICT. As reaching a wider audience increased, the influence of services becomes more significant.

Community-driven data collections provide easy access to shared knowledge and have the potential to connect people over geographical and social boundaries. Open-source software and new technologies allow new projects to develop quickly and to learn from the experiences of others. One remaining issue is the quality of shared data or knowledge, the ownership of the data and how it can contribute to scientific research. The increasing possibilities of ICT change the way we share and the way researchers can gain and work with data. Overall, ICT may empower citizens to take more active roles in the development

Fig. 1 Conceptual diagram that shows how sharing dynamics change when services and projects are implemented and how the additional dimension of Information and Communication Technology (ICT) influences of sharing activity and the possible benefits.



of governmental or scientific activities (McLaren et al. 2009).

1.3.2. Objectives : Fruit tree location service that leverages ICT to improve the relationship between nature and people over the topic of food sourcing

A case of an online fruit tree is introduced as an example of a community-driven sharing service. In the coming explanation of the service, when using the term *mundraub,* it includes the website and applications with access to the map and all other project-related activities that are displayed on the digital appearances.

The service enables citizens to share locations of forageable fruit trees, mainly on public land or with the owners consent also on private properties. The use of ICT and volunteer engagements adds a novel dimension to sharing services, as it allows the implementation and display of crowd-collected data. Information is shared over different social cultures and classes by appealing to the human instinct for food foraging. The following projects indicate how technology changes sharing behaviour and the role transformation of the involved citizens, businesses, scientists, or the government.

The choice to introduce this bottom-up initiative is made to show the potential of self-organizing citizens and the value of nature involving sharing services, seen in strong resonance with individuals and official bodies.

2. Conversion of physical location and digital information : Case of the fruit tree map *mundraub*

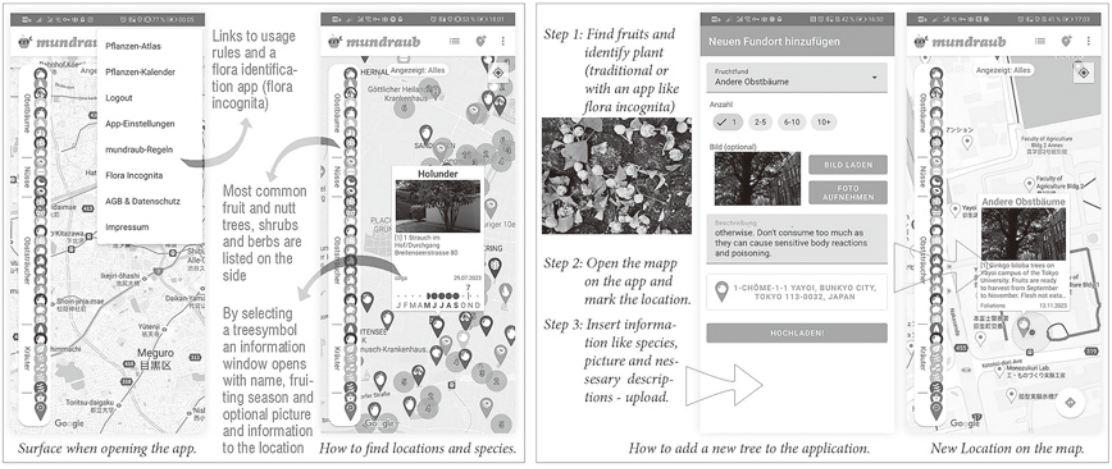
2.1. Introduction

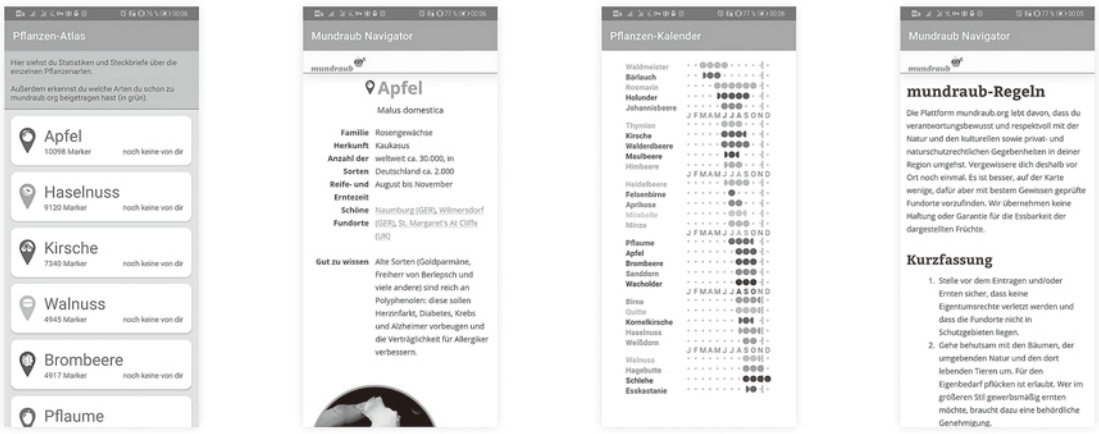
mundraub was founded in 2009 by citizens, accessible over the website *mundraub.org* and the free mobile application called *Mundraub Navigator* (Android) and integrated into the *Zero Waste* app (iOS). Users are enabled to identify locations of fruit trees and other edible plants, on public land, or shared by the private owner themselves for others to harvest.

Once an account is created, the registered person can enter locations, upload pictures and add information to the application without fees. Citizens' voluntary efforts are essential in data collection and correction. To date, over 50.000 fruit trees are registered, mainly located in the German-speaking part of Europe. The initial motivation of the founders was to share the positive experience of retrieving and eating the self-harvested fruits. The idea grew into a non-profit organization with the goals of strengthening the community, increasing awareness of regionality and seasonality and reconnecting people and nature, mainly financed over donations.

Besides the map service, the website offers information on fruit refinement, how to collect with less risk of

Fig. 2 'Mundraub Navigator' application on android, showing marked fruit trees and the most common species (to choose on the left) and an example of how users can add plants including picture and description where to find.





food poisoning, and plant varieties as well. Furthermore, the platform organizes educational programs (e.g.,'Streuobstpädagoge') and collecting tours. The organizers also published books on wild fruits and how to identify and use them.[4,5] These are examples of two-way communication of the applications where citizens are not a passive receiver of information but an active transmitter of knowledge sharing. The website also offers to integrate parts of their *mundraub* map into other websites after placing and confirming a request.

A collaborating network with communal governments named 'wir sind essbar' (we are edible) integrates municipal tree cadastre data into the *mundraub* map. The organization advises and supports municipalities with the conception, realization and preservation of edible landscapes. Displayed on the website and supporting them with their own media presence about their contributions to the edible landscape experience. Additionally, to consulting, educational actions are also offered.[6]

For food safety issues, the website *mundraub.org* provides access to scientific research about the contamination of city-grown food, which show less risk of contamination in fruit-bearing trees and shrubs and in some cases, even higher contamination in supermarket fruits and vegetables for example, lead in apples and plums (Säumel 2013).

2.2. Legal conditions and voluntary agreements

Originally, the name ('mund'=mouth, 'raub' = robbery) refers to theft that was legally not prosecuted until around 1975. The condition was that the robbery of food from fruiting plants or even markets happened because of hunger, for immediate consumption, and limited to small quantities of insignificant value.[7]

Even though the original paragraph is no longer in use, the present legal situation in Germany still favored the development and usage of the sharing application. German law tolerates the harvest of fruits, herbs and other plant parts in small amounts in spots that are not prohibited to enter.[8] Austria (another German-speaking country where the app is widely in use) has a similar situation and illegal appropriation of low-value soil products is not punishable by the courts.[9]

Rules displayed on the *mundraub* website enable help with a low-conflict harvesting experience. The rules should provide a basis for using the app and physical resources (the fruit trees) with as little conflict as possible. These are supported by the German Lawyers' Information Centre. The following rules are originally written in German using a personal style, as transmitted in the following translation.

The short version of the *mundraub*-Rules are as follows :

1. Make sure no property rights are violated before you enter a location. They should be on public grounds and not in a protected area. (Users can report a tree that they think is questionable and it's everybody's responsibility to delete or check their marked trees.)
2. Treat the trees, the surrounding nature and the animals inhabiting the area with care. Respectful behaviour to provide the health and longevity of the trees and the harvesting people's safety. Foraging for personal use is permitted, while for larger-style harvest for commercial use needs an official license. Leave fruits for the wildlife.
3. As the website is built on the sharing principle, do not claim ownership over the plants you map and continue to share locations.
4. Engage in the care and replanting of fruit trees.[10]

2.3. Finding

In summary, *mundraub* was solely developed and upheld by volunteers without the help of scientific or governmental institutions. At present state, it is a non-profit organization mainly supported by donations. The ongoing attention noticeable by the still-growing numbers of participants and expansion into some areas

of governmental management, shows the interest of citizens in using the option of harvesting and engaging with public fruit plants. Within the legal challenges and the complexity of the legal aspects, the system is solely built on trust without any regulating or controlling instances.

In the following chapters, other sharing services will be introduced to give a better understanding of the model *mundraub*.

3. Other sharing projects and their leverage of ICT to share plant locations, food, or with the aim to form sustainable and resilient communities

The list here is not exhaustive, but certain recent services with the sharing theme are outlined. The criteria were based on their relation to the *mundraub* project, for example in the location of development or similar aim to reconnect people with nature and build sustainable and resilient communities and with a substantial contribution of citizens.

The above listing of sharing services gives just a small insight into what can be shared, how it's organized and to what extent ICT is leveraged. Certain services are exclusively digital, while the *mundraub* project connects digital communities and information with the physical land and action of harvest. The project *fallingfruit.org*, which originated in the US, is based on similar motivations as *mundraub* and started as an open-source map, launched in 2013 and filled with edible plants in cities around the globe to encourage urban foraging. Plant inventories from governments and universities are inserted on the map, but also private users can add locations and information.[11][12]

The two listed services to the topic of food rescue show in their display similarities to *mundraub* and have a similar goal to reduce food waste. Both display food locations on a map, visible to individual user of the free applications. The company *Too Good To Go*, founded in 2015 in Denmark, is a business-to-consumer (B2C) model where the consumer buys a surprise bag on the online application for a reduced price offered by stores and restaurants to reduce food waste.[13] *Foodsharing.de* on the other hand was built by citizens (2012, Germany) and works with a peer-to-peer dynamic (P2P) and also with the possibility of no direct contact of users at all. The map is reached over the website, showing a collection of locations, where users can pick up from stores rescued or leftover food. Members of the community do voluntary work to pick up food at cooperating businesses to place them at official food stations and update the station belonging profile about the newly brought food. Additionally, their website offers educational material, information and workshops about topics related to reducing food waste.[14] 'Foodsharing Cities' is an expanded movement to connect cities and civil society with the public sector.[15]

Services like 'Garteln ums Eck' on the other hand have a very passive internet appearance and work with physical interaction and labor. 'Garteln ums Eck' (=Gardening around the corner), initiated by the city of Vienna, shares public urban green space for private use. Citizens are encouraged to engage in the creation and maintenance of small spaces under city trees. To complete the organization, the citizen signs a design agreement, to stay within the set of rules about what they are permitted to plant or to build. The land stays in possession of the city, which also retains the right to enter the area and interfere if required.[16] According to information from official representatives of the area managers, around 1800 tree patches of land are currently maintained by residents.

The Application *Flora Incognita* for identifying plant species is an example of how ICT is used to effectively communicate educational content on environmental topics especially to young adults and involve users in the process of continuous improvement of content and technology. The Project involved an interdisciplinary

Table 1 Short overview of a selection of free sharing service with that share locations, food, land and knowledge.

Name	Since	Numbers	Characteristic	Sharing Dynamics
FRUIT TREES				
mundraub *mundraub.org and Mundraub Navigator and Zero Waste applications*	2009	~ 50.000 registered fruit trees ~ 100.000 downloads of the app	Interactive map on App in which users mark the locations of fruit-bearing trees and other edible plants for others to find and harvest. Also organizes events and educates people.	People to people, government to people Digital information on physical location of physical products and action
fallingfruit.org	2013	~ 1,5 Mio. registered fruit trees ~ 2 Mio. visitors. on the website	Interactive map listing public orchards, food forests, fruit trees in cities, fields and other neighbourhoods. Imports data set from other foraging maps and is open to edit, download and develop.	People to people, government to people Digital data and code of the map is openly shared. Information about forageable plants is shared through the digital app
FOOD RESCUE				
foodsharing.de	2012	~ 1300 sharing places for food storage and exchange	Website with map where users can find storage locations of leftover food filled by volunteers, which bring it from their places or from or companies.	People to people, companies to people Digital information on location for physical location for pick up
Too Good To Go app	2015	~ 10 Mio. downloads (Google Play)	Businesses put left over food from the day online on the app in form of surprise bags. Costumers pay a reduced price online before picking it up.	Companies to people (customers) Digital information on location for physical location for pick up
PLANT IDENTITY				
floraicognita.de	2010 (2018-App release)	~ 1 Mio. downloads (Google Play) ~ 16.000 plant species registered	App to identify plant species by taking pictures of their features using KI technology and crowd sourced data. Offers information and the possibility to export maps with findings.	Science to People (APP), People to science (pictures database) Digital information on plant species.
URBAN TREE				
itreetools.org	2006		Software suite from the USDA Forest Service that provides urban and rural forestry analysis and beneficial assessment tools. Tool to report on individual urban trees and to mark locations in parcels, neighbourhoods, cities and states.	People to people, Scientists to people and vice-versa Digital tool for sharing information on physical trees without suggested interaction.
Baumkataster Wien	2013	~ 200.000 tree locations marked	Online map from the City of Vienna, where locations, species and additional information of city trees can be accessed.	Government to people and companies Digital information on location without suggested interaction with physical object.
LANDSHARE				
Garteln ums Eck	2013	~ 1 800 agreements signed between citizens and city (2023)	City council organized free personal use of public green spaces (under trees) for citizens. Project explained on the official website.	Government to people Physical location and action

Fig. 3 Application *Flora Incognita* to identify plant species by taking photos of the visual features like flower, leaf and whole plant habitus, saving found plants and sharing knowledge about species like taxonomy and occurrence.

Surface when opening the app. With one touch the camera is opened and the identification process can start.

By taking photos of different plant parts the app tries to identify the species.

When idenfified, a profil opens including information like taxonometry, distribution and observations, etc. araccesable.

Former found species are saved in a map that is exportable for further use like research (google maps or GIS).

team from the specialist areas of computer science, physics and media sciences and is financed by government and university. The app involves automated learning and citizen science (crowd-sourced data) intending to transfer traditional plant vocabulary into the digital age. For this purpose, the *Flora Capture* App was developed to create a digital herbarium to achieve the large number of images needed to train the deep learning algorithm to automatically identify plants. 2020, more than 200.000 images have been collected by thousands of users since 2016 (Boho et al. 2020). In the case of *Flora Incognita* no physical product or labor, but knowledge is shared on a digital level. Saved species can be exported on maps and used for projects or research. The data can be used for example to assess climate change by monitoring plant phenology (Katal et al. 2023).

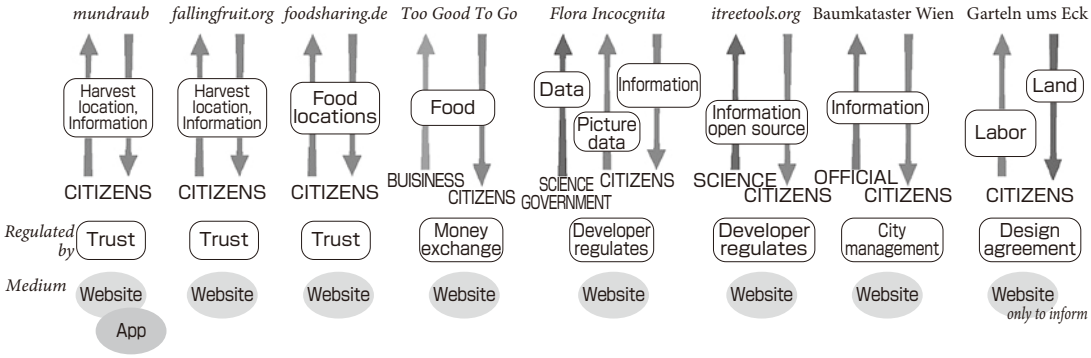
The 'Baumkataster Wien', the map of city trees in Vienna, differs from the other introduced services as it is initiated and maintained by the government.[17] The city of Vienna prohibits the felling of trees without an application that has been reviewed and approved by official bodies. Depending on the size and state of the felled tree, the number of replacement trees is increased. Fruit trees that are not included in this law and therefore also not accepted as replacement trees.[18]

It was integrated into this list to show the opportunity for citizens to learn more about their city trees.

Shown in the summary above, *mundraub* combines physical and digital sharing and utilizes the opportunity of ICT by providing access to the service from the website and the application. In none of the mentioned services does the ownership and associated rights of land or the harvestable plant change. Products or place of activity is shared, but not the ownership. Citizens are not necessarily only recipients of the sharing services, but also voluntarily contribute information or actions in the form of uploading locations and pictures (e.g., *mundraub, Flora Incognita*) or creating appealing green space (e.g., 'Garteln ums Eck'). In some cases, the exchange relies on the goodwill of the users (e.g., *mundraub, foodsharing.de*) and in others it is regulated by city management (e.g.,'Garteln ums Eck') or rules and terms fixated by the business owners (e.g., *Too Good To Go*).

Fig. 4 gives an overview of the introduced sharing services and allows an easier comparison with the case

Fig. 4 Characteristics and dynamics of the former introduced sharing services.



of *mundraub*.

4. Discussion

4.1. When does ICT enrich or improve a sharing project?

In the introduction, the question was posed 'What can ICT contribute to the development of sharing services and sustainable community development?'

In short, the answer largely depends on factors like intended target groups and the geographic range of the project. Local services like the land sharing project 'Garteln ums Eck' use ICT to a limited extent. The service is directed towards local citizens, who want to physically engage with their close surroundings to improve their quality of life as stated by the official responsible bodies.

Sharing services or projects differ depending on the dynamic of how things or information are shared and the audience. The services *mundraub* and *foodsharing.de* have a people-to-people dynamic, with the ICT as a mediator in between, like a book that is sent back and forth, written by both sides. The service *Too Good To Go* has a business-to-consumer relationship that only enables location and money exchange online before food is exchanged physically at a later date. Another dynamic comes from projects like *Flora Incognita* where the shared information is based on professional scientific knowledge, enriched by crowd-sourced data from citizens to be combined and constantly updated thanks to ICT and usable by specialists and any other interested person or group.

ICT can be applied to engage non-traditional stakeholders (such as citizens) as a resource like in the example of the *Flora Capture* App collecting over 200.000 plant images uploaded by citizens to help with the development of the *Flora Incognita* App (Boho et al. 2020). Engaging users in policy-making increases public support and engagement, diversity of views and voices for flexible adaption for data-driven decisions (Chien, Hori, and Saito 2022). It is to notice how citizens invest extensive time, energy and resources in research supported by new technologies (Bonney et al., 2014 in *Citzen Sci.*, 2018).

4.2. Sharing and participation dynamics and their challenges and limitations

What enabled the *mundraub* project to be more long-lasting than other services? Compared to similar, yet unsustainable projects, *mundraub* has established its value for approximately 14 years to this date and continues to develop, as we can see in the collaboration with government and educational systems. Successful applications have shown that the existence of a gap between physical shareable common spaces and products (including the fruits from fruit trees) and the interest of people in participating in building communities, that make use of these resources and offer data, knowledge and even physical participation is necessary for long term growth. Some of which are cov-

ered in this work.

The named and other projects, built on community engagement, are characterized by existing as an ongoing process rather than a stable arrangement. This means that the further success and existence of the project relies on proper management. To establish urban communes over the initial phase into long-term projects, former arrangements have to be able to be remodeled and reworked according to the development and unexpected actions as shown by Seravalli (2018) in her case study about infrastructure in urban commons. Design and management of common space offer the opportunity for citizen participation to enable more sustainable and liveable urban spaces. Urban governance, that wants to utilize citizens' potential, should consider the temporal and fallible nature of the participation and build a well-organized structure, with options for reworking arrangements, that supports transparency of decision-making and accountability in these co-designing projects. For a sustainable operation, transparency and clear distribution of tasks and responsibility is essential (Seravalli, 2018).

Doubts regarding food safety can limit participation in food foraging projects like *mundraub*. Transparency is a key factor in building trust in consuming urban-grown fruits. Science and Policy have started to address the issue shown on studies on the contamination of food grown in urban environments. As the location is essential, initiators of urban food growing projects are encouraged to analyze their local conditions to reassure participating and interested parties (Gori, Ferrini, and Fini 2019 ; Romanova and Lovell 2021).

The *mundraub* project showcases the role of citizens when it comes to food and knowledge sharing. By engaging residents as active participants in data collection, research and sharing, communities are empowered to shape sustainable and resilient environments. Ryu et al. mentioned the inclusion of data provided by non-academic sources like websites may provide a better understanding of how and what we share (Ryu, Basu, and Saito 2019).

Edible urban common programs like 'Edible Cities' encourage a different approach, a perspective of urban landscape shaping/design. The implementation of productive landscapes into cities can become an essential element of sustainable urban infrastructure (Parham, S. and Abelman, J. in Zeuner & Waterman, 2018). Cooperative projects all around the world between citizens, organizations and officials underline that governments are acknowledging the value of these initiatives to improve the image of the area and the quality of life (Rut and Davies 2018 ; Shareable 2018). Edible urban commons projects like 'edible cities' and public fruit tree forage-encouraging apps like *mundraub*, rely on, due to the complexity of the legal aspects, the goodwill of the participants. Rules of use can be written and posted, but enforcement is not regulated and the system relies on trust in responsible behaviour from each participating individual.

5. Conclusion

The initial dimension of the citizen involvement is, as with many other contexts, primarily providing the primary data including tree locations (*mundraub*) or plant pictures (*Flora Incognita*). In the further phase, the applications went beyond these. In developing similar services or projects involving citizen sciences, they need to attract and retain participants besides initiating a platform.

Approachable and practical topics encourage interest and long-term engagement. As an example, the improvement of the ability to forage food in nature, for survival, family bonding and reawakening childhood memories are relatable to a wider interest group and satisfy curiosity. These are made possible by encouraging understanding of the nature surrounding us, with the help of online educational identification tools, in turn raising interest in nature.

For example, 'Fruit picking' in Japan is mainly associated with a social outgoing at a farm where you pay for the amount you harvest and bring for home

consumption. The system is organized with the ownership and rules of usage clearly defined. There are different kinds of challenges to overcome compared to European models regarding the attraction of participants due to different societal perspectives and expectations. Future research should factor in users' correlation to the trustworthiness of the service and what the user perceives as encouraging in different cultural and local locations, perceptions and customs. With a stronger consideration of citizens-including design processes of public space, the role of experts (e.g., planner and scientists) often becomes a supportive, instead of a leading role.

Another factor for a successful project is the transparent communication between specialists and participants. The introduced apps have the advantages, that they openly present what the contributed data is used for. The use of digital media enables the user to directly see the result of their engagement, which has a motivating effect for future contributions.

The integration of ICT into the sharing dynamics changed how rather than what we share. Instead of communicating directly with neighbours, family or friends about things or knowledge to share, strangers, possibly physically distant, become the source of information about locations and of knowledge. A challenge of sharing through digital media, for example, the absence of a visible person might decrease the feeling of trustworthiness. A functioning community could function as a replacement for the personal contact and relationships.

ICT tools shorten the gap between the provider and user of physical elements, including fruits and knowledge. They can play an important role in preserving or rediscovering knowledge about commonly unknown local food sources and help build a community beyond geographical boundaries. Maps where plants are also marked on private land can improve communication in communities by encouraging people to talk to each other if the trees were marked with the owner's consent. When Citizens are involved as newly emerging actors in co-creating and co-managing their surroundings, it strengthens the local community, leading to more resilience and well-being within. The leverage of ICT tools, enables us to learn from strangers while still having the feeling of closeness and belonging to a community united by the same ideals and motivation.

ICT in the form of online application apps takes on not just the role of mediator between people but also nature and people. The availability of large portable data sources enables citizens to interact with their surroundings and learn more about them, supported by an easy-to-use interface and filled with information collected and curated by specialists and citizens, all accessible through their smartphones. Services that can be used over online applications like *mundraub* or *Flora Incognita* encourage people to go outside and explore.

For all the advantages, sharing projects and ICT tools can bring to society and planning processes, it is still important to be aware of their short-lived characteristics unless specific considerations are given. Knowing the factors could lead to more realistic planning and strategy development if one intends to evolve the apps into long-term projects. Started as a citizen-made online map, *mundraub* has existed for over a decade and continues to gain popularity. Projects with municipals and educational services added new topics and showed how these bottom-up initiatives can expand and survive. Other beneficial attributes are transparency of decisions, rules and management and the acknowledgment of, and reaction to worries like food safety, for example by adding research results to the website.

A large community including officials and researchers gives sharing services more opportunities to work out upcoming questions but also creates challenges. Crowd-sourced data with minimal or no review levels are vulnerable to errors. Awareness about the risk of misuse and misinformation enables the preparation of countermeasures. Many of these apps encourage

their users to correct mistakes if noticed. It's a never-ending project and in constant correction and expansion.

There are successful services that are encouraging people to build communities and rediscover relationships with nature. With mutual goals and trust, careful management and transparency between the people and the city officials, these projects and applications can help people to live lives closer to and with nature.

Notes

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2 https://essbare-stadt.de/wp/ 2023-09-01
3 https://www.edicitnet.com/de/ 2023-09-01
4 https://mundraub.org/sites/default/files/2017-08/2017-08_Freiraumgestalter_Interview_Kai.pdf 2023-10-03
5 https://mundraub.org/%C3%BCber-uns 2023-11-23
6 https://wir-sind-essbar.org/staedte_regionen/ 2023-10-03
7 § 370 Nr. 5 StGB Deutsches Strafgesetzbuch https://lexetius.com/StGB/370,1 2023-08-24
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