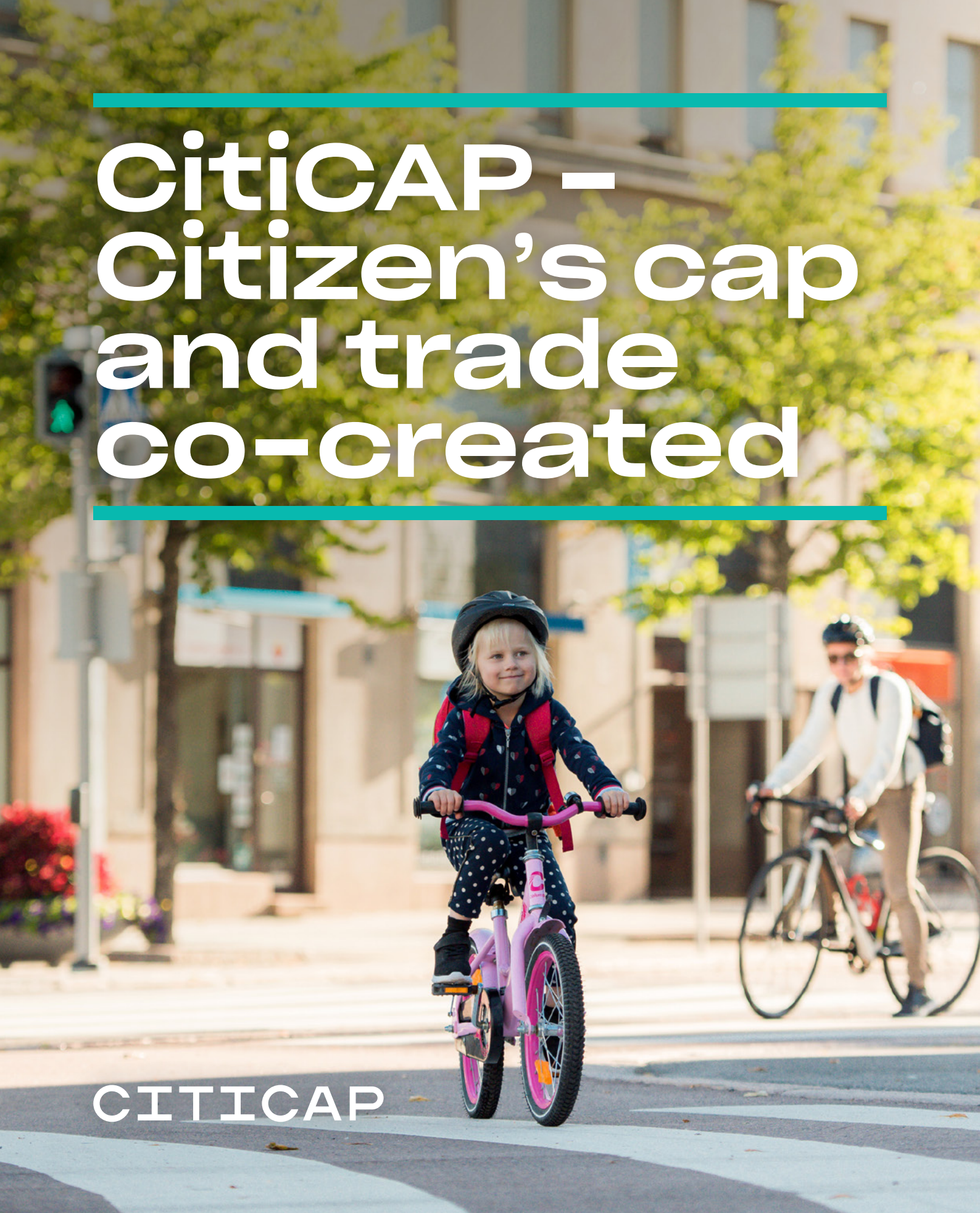
CitiCAP – Citizen's cap and trade co-created



CITICAP

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CitiCAP – Citizen's cap and trade co-created

The CitiCAP project (Citizens' cap and trade co-created) was carried out in Lahti between 2018 and 2021 with funding from the EU's Urban Innovative Actions initiative. The CitiCAP project included running a pilot scheme on citizens' personal carbon trading on mobility, formulating the City's first Sustainable Urban Mobility Plan, creating a data platform for transport data and building a bicycle highway based on modern design instructions.

The personal carbon trading (PCT) pilot designed and implemented in the CitiCAP project has been the first citywide pilot scheme of its kind in the world. Carbon trading was carried out with a mobile application that was able to recognize different mobility modes. Users were rewarded for making sustainable mobility choices. The open testing of the application began in autumn 2019, and the actual carbon trading pilot was carried out in 2020. The pilot was completed in December 2020.

CitiCAP project has been the first city-wide pilot scheme of its kind in the world.

For the first time, the Sustainable Urban Mobility Plan was created alongside updating the City's master plan as part of the 2017-2020 Lahti Direction work. The developed model acts as an example for other cities of a rolling process combining land use and sustainable urban mobility planning.

The project also involved the construction of the CitiCAP bicycle highway in accordance with the City's cycling network plan. The bicycle highway travels from Apilakatu in Laune to the Travel Centre and is about 2.5 kilometres in length. Various smart solutions, such as reflected traffic signs, have been tested on the new bicycle lane.

The CitiCAP project introduced the LiikenneNyt service realised by Infotripla offering real-time information about the traffic situation in Lahti. The platform allows users to view walking and cycling calculation data, bus traffic data, traffic weather data, car traffic amounts and roadworks. Furthermore, Mattersoft has installed calculation devices onto buses in the Lahti region, allowing their real-time monitoring.

Sustainable Urban Mobility Plan (SUMP)

The Sustainable Urban Mobility Plan created under the CitiCAP project is a programme of measures based on the European Commission's guidance implementing the city strategy and allowing the city to steer and encourage people towards more sustainable mobility. The plan features 13 measures and sub-measures. These measures are linked to e.g. the systematic improvement of walking and cycling infrastructure and conditions, mobility management, mobility services and developing the city centre traffic system.

In Lahti, the Sustainable Urban Mobility Plan (SUMP) was now for the first time drawn up alongside master planning as part of the work named 2017-2020 Lahti Direction. The Lahti Direction work is done in cycles of four years by the City Council terms and it enables continuous development and monitoring of implementation. SUMP acts as an umbrella programme for more specific action plans and thus guides the promotion of sustainable mobility. The objective of the Sustainable Urban Mobility Plan is to contribute to achieving Lahti's carbon neutrality goal by 2025 and sustainable transport modal share by 2030. The SUMP can be found here.

Developing the CitiCAP application

The entire project consortium was involved in designing and developing the CitiCAP application. The application is based on the carbon trading model developed by LUT University and built using components from three companies. Future Dialog Oy designed the user interface, Moprim Oy has developed the technology enabling mobility monitoring and recognition, and Good Sign Oy realised the personal carbon trading database and platform. LAB University of Applied Sciences was in charge of coordinating the technical development.

Development work started when the project was initiated in March 2018. Testing of the Android version of the application began in the spring of 2019. The cyberattack against the City of Lahti's data systems in summer 2019 significantly hindered the iOS version development. This is why the testing phase available to all residents was initiated with the Android version in September 2019.

Events presenting the application during European Mobility Week and feedback gathered from users highlighted both strengths and weaknesses in the application. The application concept and technology (motion recognition) received a great deal of praise, whereas the clarity and usability of the user interface was criticised. Errors were initially discovered in the mobility recognition, but its accuracy improved a great deal as the number of users increased. The iOS version was not finalised until March 2020, meaning that it had a significantly shorter testing period than the Android version.

The COVID-19 restrictions caused one launching event cancellation after another, and the official carbon trading pilot scheme was only initiated in late spring 2020. The application was active for a total of eight months between 5/2020 and 3/2021. Had the duration of the development project been longer, the app would have been constantly updated based on feedback.

The CitiCAP application was withdrawn from application stores in March 2021 and the project was archived for future use. The table below contains improvement suggestions for the further development of the personal carbon trading application.

Problem	Suggestion
Too many implementation parties (a total of five parties)	A simpler division of front end and back end could entail more efficient application development.
Errors in motion detection	Limiting the motion detection to driving, walking/running and cycling could eliminate errors and improve the user experience. The use of public transport could be monitored regionally (e.g. public transport in Lahti is used more -> Lahti residents could get a bonus in the app).
User interface and user experience	As it is a non-commercial application, the user experience is more important than the user interface layout. The application must be clear and fast and efficient to use.
Prioritisation	The main priority of this pilot was carbon trading, meaning that the back end development received the majority of resources. The pilot showed that too few resources in front end development can have an impact on the permanence of users. Balance the budget between front end and back end more evenly (it was now 5:1).
Platform (Android and iOS)	Although nearly everyone has a smartphone nowadays, their models and features vary significantly. This made development more difficult and increased the likelihood of errors in e.g. motion detection. A separate device connected to the application could be used to recognise walking, cycling and driving. This would standardise the equipment and simplify the development.

Engaging residents in the development work

Getting residents involved was central in the carbon trading model and CitiCAP application planning and implementation. By involving residents, answers were sought to the following questions:

What is the motivation for reducing your mobility carbon footprint?

Which factors could hinder or promote sustainable mobility?

What are Lahti residents ready to change in their everyday lives in order to mitigate climate change?

At the beginning of the project, an interaction plan was created to define the objectives, processes and methods of interaction with residents. Interaction situations involved trying out new, creative and functional methods, and an interaction process was developed.

Efficient means of interaction with people were face to face meetings for example in shops, libraries and public transport. This way those residents who would not necessarily otherwise joined the discussion or participated in events were reached. Research and other surveys and social media channels were essential in reaching the wider audience.

During the project, a number of events were organized presenting the carbon trading model and CitiCAP application development, the cycle path project and the Sustainable Urban Mobility Plan (SUMP) preparation. The project featured notably in the annual National Cycling Weeks and the European Mobility Weeks with a broad range of events.

Project communications and marketing

The objectives of the communication and marketing measures were to gain users for the application, share the results gained from research and share information about the construction of the bicycle path and other measures carried out in the project. During the project, several bulletins were published and active communication campaigns were carried out via the project's social media channels.

The communication about the application picked up speed in June 2020, when the application's test phase ended. Residents of Lahti were encouraged to start using the application through a social media competition, among other measures, and the project was also advertised in the street scene. The application garnered interest from both local and international media and earned 170 media hits from the international press during the summer months alone. The number of potential readers was more than 80 million. With the help of marketing measures, the application gained roughly 2,500 users within a few months. Due to the coronavirus pandemic, hardly any live events were held and support to use the service was offered through social media channels and a guidance video.

Developing the carbon trading model and related research

Earlier research has viewed the citizens' personal carbon trading (PCT) as an interesting approach to cutting emissions, but few practical trials have been carried out. The development of information technology has created opportunities for realising PCT automatically based on mobile phone technology. The research section of the CitiCAP project aimed to generate information about PCT and its usability and possibilities in the area of mobility. In addition to mobility data, the research material included postal and online surveys, interviews, participation diaries and workshops with city residents.

Carbon trading implementation

The research section started with planning and implementing a PCT model as joint cooperation with Lahti residents. The idea was to aim for a 25% average reduction in emissions from mobility by setting a weekly personal emissions cap for each user. The method of emission allowance distribution was voted on by the residents in autumn 2018. The voting took place through a survey. The survey had a total of 304 respondents, and they voted to distribute the allowance based on participant-specific emission quotas. The basic level of the personal emissions cap was 17 kg C02eq, but the quota could be increased based on the user's situation in life, e.g. due to mobility problems or living far away from services. At the end of each pilot week, the weekly mobility emissions of each user were compared to their personal emission allowance. If the user had remained within their quota, extra emission allowances were sold to the system for virtual euros. However, if the user had exceeded their emission quota, they would have to buy extra emission allowances with virtual euros. The total amount of gained and lost virtual euros was added up every four weeks. If the user had managed to earn virtual euros, they were added to their virtual wallet in the application. However, the users did not have to pay for any net losses of virtual euros, but they could try again during the next four weeks. The price of emission allowances in virtual euros was varied during the study period, and earned virtual euros could be used in the application's marketplace for various products and services.

Carbon trading impact on mobility choices

A total of 2,500 user IDs were created in the CitiCAP application, and there were around 100-350 weekly active users in the research period between May and December 2020. In addition, a smaller number of Lahti residents took part in the control group whose mobility emissions were monitored but who did not take part in the PCT. Extensive initial and final surveys conducted through the app gathered information about the participants' mobility and participation experiences. The initial survey was carried out in September-October 2020 and had 131 respondents. The final survey was carried out in December 2020 with 47 respondents. The reference values for the information of the initial survey were gathered with a similar postal survey in the Lahti region, carried out in December 2019. 16 participant interviews on emission allowance prices were carried out in December 2020.

Based on the initial survey, the pilot participants were slightly more educated and had a higher income than Lahti residents on average, and were mainly from younger age groups. Furthermore, in relation to the Lahti average, a significantly larger share reported that their household had no car (see Figure 1.)

		Lahti residents (n=358)	CitiCAP participants (n=131)
Sex	Male	47%	45%
	Female	53%	52%
	Other	-	3%
Age group	16–29	20%	31%
	30–39	12%	30%
	40–49	15%	25%
	50–59	17%	11%
	60–69	17%	4%
	70–	19%	0%
Education level	Basic education	21%	8%
	Upper secondary education	50%	39%
	Bachelor's degree	16%	25%
	Master's degree	10%	24%
	Doctorate, licentiate	3%	4%
Annual household income per adult (€)	0–12 000	13%	15%
	12 001–18 000	18%	10%
	18 001–24 000	23%	9%
	24 001–30 000	20%	16%
	30 001–42 000	15%	26%
	42 001–60 000	9%	18%
	60 001–	3%	5%
Professional status	Employed	47%	74%
	Unemployed	6%	7%
	Pensioner	34%	1%
	Student	10%	18%
Car in the household	No car	17%	37%
	Car	83%	63%
	2+ cars	21%	12%

FIGURE 1: Initial survey of pilot participants compared to the Lahti averages received through a postal survey.

The study period revealed that there was no dependence between the price of emission allowance and the average emissions of PCT participants. Based on the final survey and interview data, this might be due to a large number of users not monitoring the price of the allowance or the related messages in the application. Furthermore, many users found it hard to comprehend the price of emission allowances. It was also discovered that the price and the rewards redeemed with virtual euros were not a sufficiently strong incentive to make changes to mandatory everyday mobility. It was discovered during autumn 2020, however, that there was a decreasing trend in the PCT participants' emissions. A similar decline, though somewhat smaller, was observed in the control group and the traffic measuring points in Lahti. However, the mobility data measured in autumn 2018 showed a slight increase during the autumn. It can therefore be concluded that the development of the COVID-19 situation during autumn was probably the most significant factor impacting the users' mobility. It is also possible, however, that taking part in PCT also steered the mobility towards lower emissions. About 36 % of the final survey respondents felt that their mobility now produced less emissions, and the key reasons behind this fact were the information received about personal mobility emissions, desire to challenge themselves and rewards received through PCT.

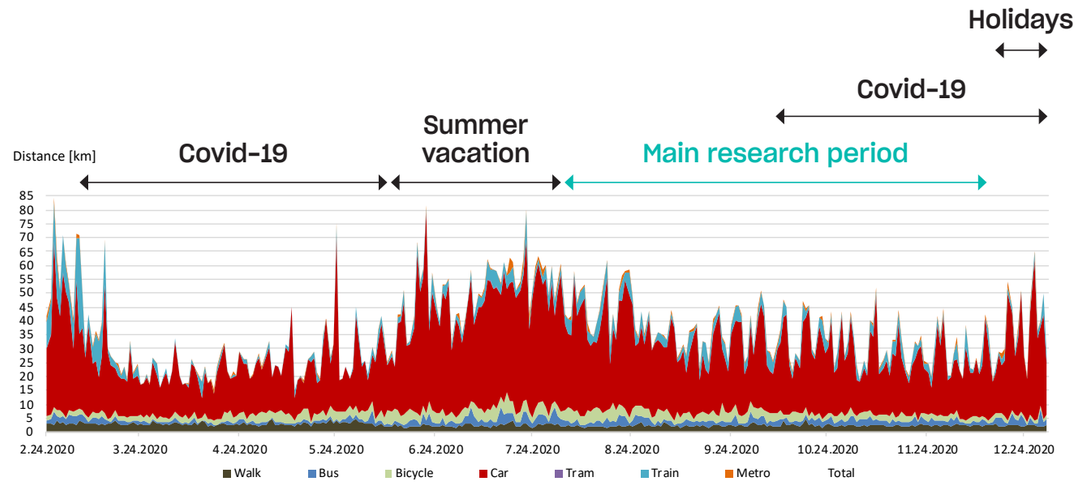

FIGURE 2: Transport amounts by mode during 2020.

Research conclusions

The final survey on the application would suggest that new and complicated policy tools can be difficult to comprehend by ordinary people. For policy measures to be accepted by the residents, policymakers must pay special attention to communication and inclusion. The results also indicate that the voluntary nature of policy tools like PCT can cause challenges, since the pilot may be mainly joined by residents who already are active in their mobility and feel they can benefit from participating. This can bring about bias in the results and emission price formulations and reduce the potential for emission reduction. The challenge for similar pilots in the future is how to engage the underrepresented and passive groups when participation is voluntary. The positive impact on emissions will also be minimised if the pilot only involves residents who already have low emissions. Meanwhile, a voluntary pilot should not involve any sanctions, since sanctions would make it even more difficult for residents to take part. This fact is also supported by the final survey, where the majority of participants were not in favour of a mandatory PCT. Even so, the fact that there were no sanctions made some participants feel that their mobility did not become more sustainable during the pilot.

The pilot shows that a PCT on mobility can be implemented with mobile phone technology, but this also involves the chance to cheat the system by e.g. leaving the phone at home or by disabling GPS. Furthermore, the automatic recognition of mobility modes is not completely accurate and varies according to mobile phone models, interfaces and mobility profiles. This makes implementing a mandatory or sanctioned PCT technically very challenging. If the PCT application works appropriately, i.e. is user-friendly and cannot be cheated, users find it to be a positive tool. The transparency of personal emissions can increase the users' emission awareness, which in turn can impact their mobility choices. Stronger evidence could be gathered with an optimal application, a more heterogenic participant group and through testing the concept for a longer term and in other cities as well.

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Inspiration to other cities

The object of the CitiCAP project was to gain three follower cities to continue the work. These cities would observe the opportunities and approaches to reducing mobility emissions through personal carbon trading and learn from the development work and research carried out in the CitiCAP project.

This project was the first in the world to pilot personal carbon trading, and the pilot received a great deal of national and international attention in different medias. This ensured that there were numerous cities interested in continuing the work.

The following criteria were set for the follower cities:

Objective of reducing mobility emissions
- Reducing emissions on the agenda of city decision-makers
- City wants to be a pioneer in climate action

Versatility of transport modes
- Large enough city offering a variety of transport modes

Digitalisation in the city
- City collects and utilises mobility data and has related plans for the future

Inclusion of residents
- City is able to include its residents in designing carbon trading
- City already uses (digital) tools to include residents

Workshops presenting the CitiCAP project and experiences were organised with interested cities. The focus of discussions was on experiences gained in Lahti and determining whether the carbon trading model could be used in the city in question. A roadmap for moving forward was created for the cities on this basis.

Workshops with the interested cities focused on the following perspectives:

- Which operators and cooperation partners would join the mobility carbon trading?
- What would their role be and what could they bring to the carbon trading model?
- What is needed to get these operators to join mobility carbon trading?

The work carried out with these new cities has been a great platform for discussion and information exchange on the opportunities and challenges in developing both policy and practical tools for reducing urban mobility emissions. The cities are at different stages of their emission reductions and come from very different starting points. The cities' resources and competence in initiating carbon trading are also limited. The work highlighted the need of a shared research project and funding source mapping. Currently several Finnish cities are developing their own personal carbon trading or carbon footprint calculation approaches and Lahti is active in mentoring and sparring the cities.

The construction began in summer 2020. The construction entailed building about 2 kilometres of bicycle lane and a new bridge.

CitiCAP bicycle highway

The CitiCAP bicycle highway project placed great emphasis on the inclusion of local residents and businesses. First, the route was selected together with specialists and residents based on reviews and workshops. Several workshops on street plans and a test drive of the selected route was also organised. Building a bicycle path to an existing urban structure aroused great passions in local residents. The bicycle highway route was altered based on feedback received during construction.

In connection with general traffic planning, four different route alternatives between the Travel Centre and Apilakatu were considered. The best route alternative was selected based on functional and economic analysis. The realisation of the bicycle highway was tendered out in autumn 2018. However, the tender process was suspended as we did not receive a sufficient number of bids. The low number of bids was due to the southern ring road construction in Lahti that employed a large share of the region's earthwork companies. The tendering process was restarted in the autumn of 2019. The construction began in summer 2020. The construction entailed building about 2 kilometres of bicycle lane and a new bridge. The lighting was also renewed and cable reservations for smart solutions were added. The building project was completed in February 2021.

Smart solutions

- In the summer of 2018, an innovation challenge was organised to encourage businesses to think about sustainable and smart solutions for the bicycle highway.
- The implemented solutions discovered through the innovation challenge included safe Bikeep bike racks and energy-saving street lighting. We also investigated the possibility of using fly ash and recycled asphalt in the construction. Neither of these solutions could be realised, since the bicycle highway is located in a groundwater area.
- Pilot solutions discovered outside the innovation challenge were projected traffic signs and displays. Furthermore, the CitiCAP bicycle path was the first winter maintenance target piloting the brushing method.
- LAB University of Applied Sciences has piloted traffic calculation based on pattern recognition and developed prototypes for producing weather and road maintenance information.

What has been learned along the way

The carbon trading pilot in Lahti was the world's first citywide pilot of citizens' personal carbon trading available to any resident with a mobile phone.

The international attention gained by the carbon trading pilot shows that there is a demand for carbon trading as a tool for encouraging emission reduction.

The development work was rewarding, but also challenging. The work was held up by the cyberattack on the city, and combining the carbon trading calculation models and several different components into a functional application was no easy task.

Some take aways:

- Personal carbon trading can be a challenging concept from a communications perspective, and it is important to focus on how and to what extent the logic is explained to potential users.
- This also imposes requirements on the application. It must be as easy to use as possible.
- Application development takes time, and the more time you have, the more in-depth the development can be.
- In addition to time, development requires personal resources from technical development to communications and interaction.

Project reports: https://www.lahti.fi/en/citicap/

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