ICT-enabled citizen science: Where are we and the way forward

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State-of-the Art Study in Citizen Observatories: Technological Trends, Development Challenges and Research Avenues

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I GGI

 My campaigns
 Get new campaign
 Boston Soundscape
 ™ Sensor campaign Paired sensor: EB:61:34:9F:00:7D Latest reading: 53 dBA

FIUILISE ITAL

⊗ Unpair sensor

#### Fostering participation via civic technologies

((.))

✓ All synced



## **Background information of the study**

- Survey study conducted in 2015 (Aug – Dec)
  - Reviewed the last 10 years of participatory sensing literature
  - Performed: a systematic
    literature review +
    surveys + interviews
  - Total of 108 projects studied
  - All data is open access at helda portal helda.helsinki.fi/handle/10138/164810

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## **Systematic literature review**

- RQ1: What are the trends in citizen repositories/observatories in the world?
- RQ2: What are the practices in citizen repositories/observatories in the world?
- RQ3: What are the current and past initiatives in citizen repositories/observatories in Finland and Europe?
  RQ4: What are the current and past initiatives in citizen repositories/observatories in environmental observation in Finland and Europe?
  RQ5: How to engage citizen?

- IEEE Digital Library
- ACM Digital Library
- Sciencedirect / Scopus
- Web of Science
- Springer Link
- Publication in the last 10 years (1/1/2004 – 31/06/2015)
- Books, papers, technical reports
- Explicit mention of citizen observatories or repositories
- Relevance with respect to research questions

## **Systematic literature review process**



	Dutubust	Date		
	IEEE Digital Library	27.7.2015	1981	7275
	ACM Digital Library	28.7.2015	13	347
Sucto	Sciencedirect	28.7.2015	2589	4339
Syste	Web of Science	28.7.2015	6689	15
	Springer Link	28.7.2015	39980	5079
Coorob	Numer Al altimore * AND	abaam * OD	ropositor *	

- Search String A: citizen\* AND observ\* OR repository\* AND environment
- Search String B: citizen\* AND engagement\* AND environ AND observ\*

	IEEE Digital Library	ACM Digital Library	Science direct	Web of Science	Springer Link
Q1+Q2 (Relevant/Included/Found)	18/46/200	18/55/113	19/41/200	3/18/115	12/38/200

- (RQ1,RQ3,RQ4) Project title, environmental focus, participation model, domain, focus–domain, country, description, type of data measured, year of start, activeness, contact, website
- (RQ1,RQ5) Stakeholder, activities description, techniques to engage
- (RQ1) IT platform, description, application type, goal, services use, detail IT infrastructure, social media
- (RQ1,RQ2) Problem or limitation, cause, solution proposed
- RQ2,RQ5) Best practice, process
- (RQ1,RQ2) Recommendations
- (RQ1,RQ2) Standard in use, description, issuing institution, website

# Background – towards citizen science

## **ICT enabled citizen science rise**



## **Public Participation Across History**



## A paradigm shift in governance

#### Government



#### Government



#### Government



Two-way customized communication



Key outcomes from the report Based on 108 projects - What, Where, Why, Who, How,



## **Domains of application**



#### **Environmental Citizen Observatories in Europe**

## **Environmental Focus**

-In Europe, 80% of the identified projects have been collecting environmental information – about species, biodiversity, air and spectrum, water, streams, snow, sea, precipitations, climate change- and the remaining 20% have had focus on: cities management, tools for collecting crowd data.



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9 8

7

6 5

4 3

2

1 0

### **Observatories by location**



■ Water, Streams, Snow, Sea observatories

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Interaction	Technologies Best Feature	
	Accurate measures Easy Installation	Sensors
	Dynamic Reflects trends and opinions Can be used for campaigning	Social media
	Interactive Pervasive Simple	Mobile Apps
	Reliable Deep Effort and knowledge required	Surveys
INTENTIVE	Fast and easy to use Almost universal	Interactive Voice Responder

## **Trendy practices**



- Use citizen observatories to track-solve issues from citizens
- FixMyStreet; SeeClickFix; FixMyArea



- Create experts by empowering field observations
- eBird; Great SunFlower; iBats



- Large networks based projects
- Galaxyzoo; Waze; Spring Watch



- Provide training and recognition
- Fold.it; LAKEWATCH; CURA H2O



Seasonal based observatories

• Spring Watch; Christmas Bird Count











## **Stakeholders and Activities**



#### Citizen

- Provide data;
- Install sensors or apps that collect background data;
- Deploying their own monitoring campaigns.





- Provide data;
- Install sensors or apps that collect data;
- Deploy their own monitoring projects;
- Use result information for decision making;
- Research and development.





- Provide data;
- Install sensors and apps to collect background data;
- Use the data for decision making.





#### Families

- Provide data;
- Install sensors and apps that collect background data;
- Use the information for personal decision making

#### Developers

 Research and development

## Who is running the COs



### Participation Types [Cohn 2008; Tangmunarunkit et al. 2015]



Passive participation: Also known as opportunistic data collection or passive data. Sensor sampling occurs whenever the state of the device (e.g., geographic location) matches the application's requirements described in a sensing task (device-centric data collection).

Active participation: Also known as participatory data collection or selfreported data. Users are actively involved in the collection process by a prompted experience where the participants decide to record their observations (user-centric data collection).



## Why engaging publics matter?

## Operations

A CO platform without public participation is doomed to fail

## Knowledge

Publics have intimate knowledge of patterns and anomalies in their communities, enabling them to respond is both empowering and valuable to long term-research

Expert assessments can miss important contextual information and need to be tempered by the experiences and knowledge of publics



## **Motivations (meta clusters)**



## **Underlying Motivations**

- -Be an exceptional citizen: techniques that award the activeness of a particular citizen as an observer with social recognition in their communities.
- -Citizens Interest based monitoring: techniques that allow citizens to set up and manage observatory of their own concern.
- -Gamification Strategies: gamified techniques that involve to incorporate game elements into their applications.
- -**Partnership**: techniques that empower city managers to install sensors and apps in their cities, to collect background data about different concern issues.
- -**Present Data Benefit**: embraces the discussion with stakeholders, to present them the benefit of the data they will provide.
- -Save Money: This category focused on creating monetary saving for the users, due to their activeness using a particular observatory.
- Unify observatories with recreational activities: use of recreational activities, competitions, learning games and, art campaigns that raise emotional feelings among the stakeholders, while they submit observations.



## **Challenges**

- User Practices (15)
- Data Aggregation Issues (7)
- Technology (5)
- Standardization (4)
- Limited Knowledge (3)
- Limited Resources (3)
- Privacy Issues (1)
- Recognition of Contribution (1)
- Data Accessibility (1)



## **Common concerns**

- Tackling privacy issues and concerns
- Data quality and standards
- Use of proper technologies
- Participation and motivation concerns

## Summary

Src: Gharesifard, M., Wehn, U. and van der Zaag, P., 2017. Towards benchmarking citizen observatories: Features and functioning of online amateur weather networks. Journal of Environmental Management, 193, pp.381-393.



# After the report – the show goes on ?



# **Ongoing Research: Temporality of Motivation**

- What does motivate people to engage in participatory sensing in environmental monitoring?
  - What values underpin the users' motivations?
  - How user motivation changes during a PS initiative?



Jarvi