Research on Smart Cities – Solving Problems of Urbanization

Lasse Berntzen

About me

- Professor (Information Systems) at University College of Southeast Norway
- Eight campuses located south and west of Oslo
- 18.000 students
- Department of business, history and social sciences (Vestfold campus)
- Multidisciplinary team working on digital transformation and smart cities
- Several papers, book chapters and articles on smart cities

Smart City Tutorial

- Introduction
- Two research papers
- Public service delivery – self service
- Own research
  - The role of citizens in the smart city
    - Open and transparent city
    - Political participation
    - Non-political participation
  - Is smart about size?
  - Recent project: Air quality monitoring

Introduction

Smart Cities

- Smart city is a concept
- Most definitions includes the use of computer technology
- Main objective is to improve quality of life for its citizens
  - Provide better services
  - Reduce environmental footprint, sustainability
  - Facilitate participation

What is a Smart City?

Smart cities are places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address **social**, **economic**, and **environmental** problems.

Anthony B. Townsend. (2014) Smart Cities, W.W.Norton & Company

What is a Smart City?

"A smart sustainable city (SSC) is an innovative city that uses information and communication technologies (ICTs) and other means to improve **quality of life**, **efficiency of urban operation and services**, and **competitiveness**, while ensuring that it meets the needs of present and future generations with respect to **economic**, **social** and **environmental** aspects".

ITU-T Focus Group on Smart Sustainable Cities (2014) Smart sustainable cities: An analysis of definitions

What is a Smart City?

*"Projects of smart cities have an impact on the **quality of life** of citizens and aim to foster more informed, educated, and participatory citizens.*

*Additionally, smart cities initiatives allow members of the city to **participate** in the governance and management of the city and become active users"*

From Chourabi et al. (2012) Understanding Smart Cities: An Integrative Framework

Smart Cities

- Can be seen as an umbrella for research on public service delivery, environmental awareness and good governance.
- The most common approach is to choose an application area, and develop a new product, service or process to deal with some specific problem, or to study an existing product, service or process.
- Another approach is to study the smart city as a large, complex system.

Smart Cities

Some application areas:

- Communication
- Culture
- Education
- Energy
- Emergency services
- Environment/climate
- Health
- Safety and security
- Tourism
- Transport
- Utilities
- Work

Example: Transport

- Use data to make better traffic flow
- Examples:
  - Where is traffic jams, alternative routes?
  - Use traffic data to control traffic lights
  - Where to find an available parking spot?
    - Avoid driving around to find a free one
- Real time information on public transport
- Autonomous vehicles – self driving buses and cars

IEEE Internet Computing, Special issue on Smart Cities, Nov/Des 2013

Video

- Smart Cities - Infrastructure and Transport of the Future
- By Volvo
- https://www.youtube.com/watch?v=d1DndVz9dAs

Example: Environment

- Monitor environmental conditions
- When to enforce traffic restrictions (control pollution levels)
- Better public transport solutions (to reduce car use)
- Smart street lights (to conserve energy)
- Teleworking (to reduce car use)
- Using renewable energy

Example: Safety and Security

- Improved emergency response services
- Surveillance cameras, sound detection
- Send messages or do automated phone calls to alert citizens of emergencies.
- Use data for crime prevention

Two research papers on smart cities

Background Paper #1

- **Smart Cities – Ranking of European medium-sized cities (2007)**
- One of the most cited papers on “smart cities”.
- Research done from April to October 2007
- Authors: Rudolf Giffinger, Vienna UT; Christian Fertner, Vienna UT; Hans Kramar, Vienna UT; Robert Kalasek, Vienna UT; Nataša Pichler-Milanović, University of Ljubljana; Evert Meijers, Delft UT
- 70 European cities

Indicators

- 74 indicators
- Indicators mainly derived from open data sources
- Some data collected by research team
- Coverage: 87% of the indicators

Characteristics of a Smart City

Smart Economy
Smart People
Smart Governance
Smart Mobility
Smart Environment
Smart Living

Smart Economy (Competitiveness)

- Innovative spirit
- Entrepreneurship
- Economic image & trademarks
- Productivity
- Flexibility of labour market
- International embeddedness
- *Ability to transform*

Smart People (Social and Human Capital)

- Level of qualification
- Affinity to life long learning
- Social and ethnic plurality
- Flexibility
- Creativity
- Cosmopolitanism/Open-mindedness
- Participation in public life

Smart Governance (Participation)

- Participation in decision-making
- Public and social services
- Transparent governance
- *Political strategies & perspectives*

Smart Mobility (Transport and ICT)

- Local accessibility
- (Inter-)national accessibility
- Availability of ICT-infrastructure
- Sustainable, innovative and safe transport systems

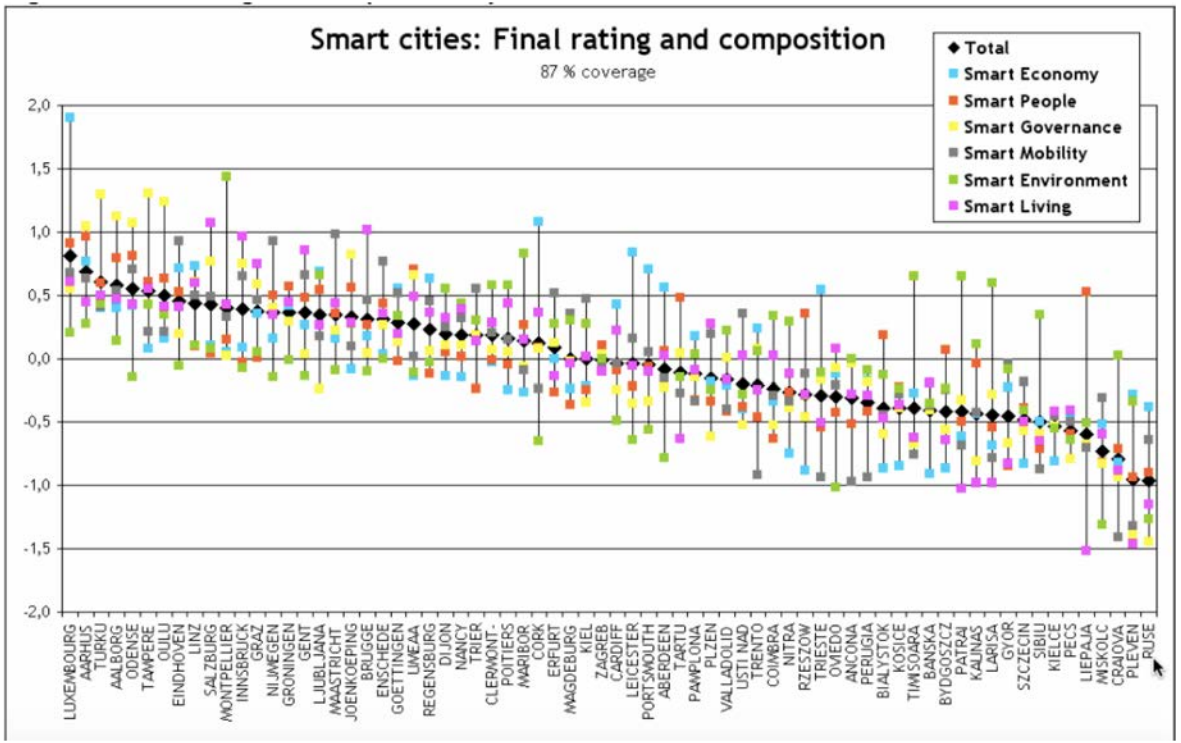
Smart Environment (Natural resources)

- Attractivity of natural conditions
- Pollution
- Environmental protection
- Sustainable resource management

Smart Living (Quality of life)

- Cultural facilities
- Health conditions
- Individual safety
- Housing quality
- Education facilities
- Touristic attractivity
- Social cohesion

Results


Smart cities: Final rating and composition
87 % coverage
Total
Smart Economy
Smart People
Smart Governance
Smart Mobility
Smart Environment
Smart Living
2,0
1,5
1,0
0,5
0,0
-0,5
-1,0
-1,5
-2,0
LUXEMBOURG
AARHUS
TURKU
AALBORG
ODENSE
TAMPERE
OULU
EINDHOVEN
LINZ
SALZBURG
MONTPELLIER
INNSBRUCK
GRAZ
NIJMEGEN
GRONINGEN
GENT
LJUBLJANA
MAASTRICHT
JOENKOEPING
BRUGGE
ENSCHEDE
GOETTINGEN
UMEAA
REGENSBURG
DIJON
NANCY
TRIER
CLERMONT-
POITIERS
MARIBOR
CORK
ERFURT
MAGDEBURG
KIEL
ZAGREB
CARDIFF
LEICESTER
PORTSMOUTH
ABERDEEN
TARTU
PAMPLONA
PLZEN
VALLADOLID
USTI NAD
TRENTO
COIMBRA
NITRA
RZESZOW
TRIESTE
OVIEDO
ANCONA
PERUGIA
BIALYSTOK
KOSICE
TIMISOARA
BANSKA
BYDGOSZCZ
PATRAI
KAUNAS
LARISA
GYOR
SZCZECIN
SIBIU
KIELCE
PECS
LIEPAJA
MISKOLC
CRAIOVA
PLEVEN
RUSE

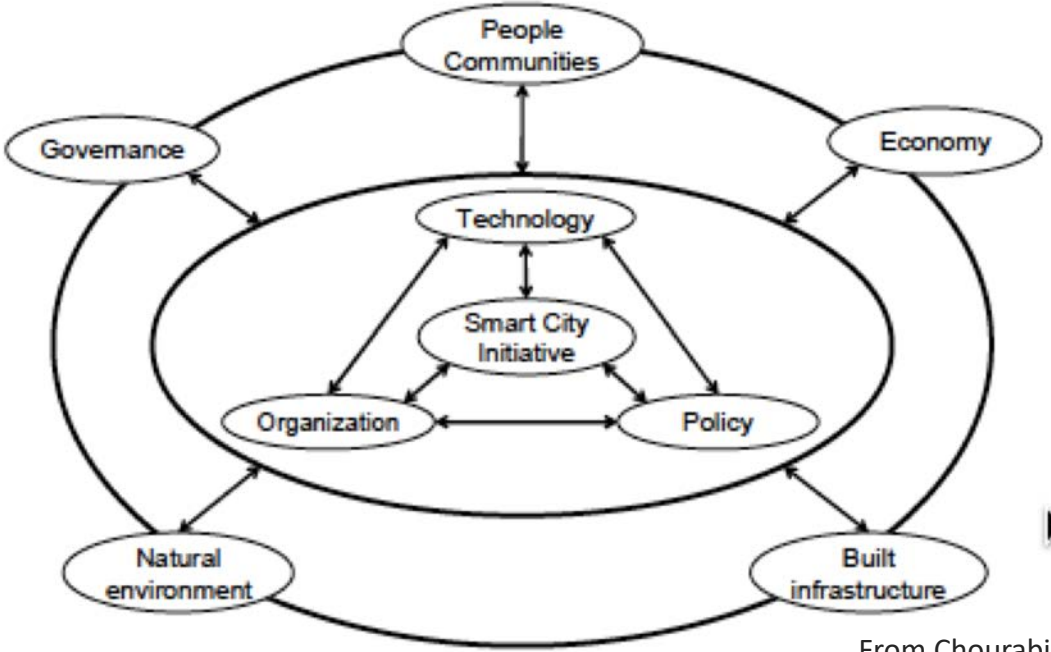
Background Paper #2

- **Understanding Smart Cities: An Integrative Framework (2012)**
- Authors: Hafedh Courabi, Taewoo Nam, Shawn Walker, J. Ramon Gil-Garcia, Sehl Mellouli, Karine Nahon, Theresa A. Pardo, Hans Jochen Scholl.
  Presented at 45th Hawaii International Conference on System Sciences (HICSS), 2012
- Different approach
- Based on a literature study
- Trying to extract characteristics of smart cities from a set of sources

Success Factors and Challenges

- Management and organization (silos, end-user involvement, alignment)
- Technology (IT skills, cross-sectoral cooperation)
- Governance (leadership, participation, accountability, transparency)
- Policy context (legal, political, institutional, culture)
- People and communities (digital divide, accessibility)
- Economy (efficiency, competitiveness, innovation, entrepreneurship)
- Built infrastructure (infrastructure, security and privacy, operational costs)
- Natural environment (sustainability)

Smart City Initiatives Framework



From Chourabi et al. (2012) Understanding Smart Cities: An Integrative Framework

Video

- What is a smart city?

- https://www.youtube.com/watch?v=bANfnYDTzxE

Public Service Delivery

Smart services

Public Service Delivery

- Citizens expect public sector to be just as user-centric as the private sector.
- Most services are delivered by employees, not by computers
- Some services can completely be delivered online
- Other services can be supported or enhanced by digital means

Public Service Delivery

- Services that can be completely digitalized
  - Requesting information
  - Applying for permits
  - Tracking interactions with government/municipality

Public Service Delivery

- Services that can be supported or enhanced
  - Applying for physical services, e.g. kindergarten or nursing home
  - Making appointments and reservations for physical services
  - Payments for physical services
  - Providing feedback on physical services

Efficiency and Self Service

- City of Copenhagen, Denmark
- Average costs of citizen contact:
  - Personal appearance: 10 Euro
  - Telephone: 5 Euro
  - Digital self-service: 40 Cent
- Note:
  - Investments are not calculated
  - User experience/satisfaction is not discussed

Example Service: Prescriptions

- Electronic prescriptions
- Faster – just a click to transfer prescription from the medical doctor to the pharmacy
- Better quality / less mistakes (it used to be handwriting)
- Harder to misuse

Key Challenges

- Overlapping, aging infrastructure
- Integration of subsystems / connectivity
- Using «Big Data» to make better decisions
  - Internet of Things (IoT)
  - Mining the web and open data sources
- Real participation
- Privacy

Video

- We visited Italy´s smartest city

- https://www.youtube.com/watch?v=09Jm3BzvFhM

The Role of Citizens in the Smart City

https://www.researchgate.net/publication/309040628_The_Role_of_Citizens_in_Smart_Cities

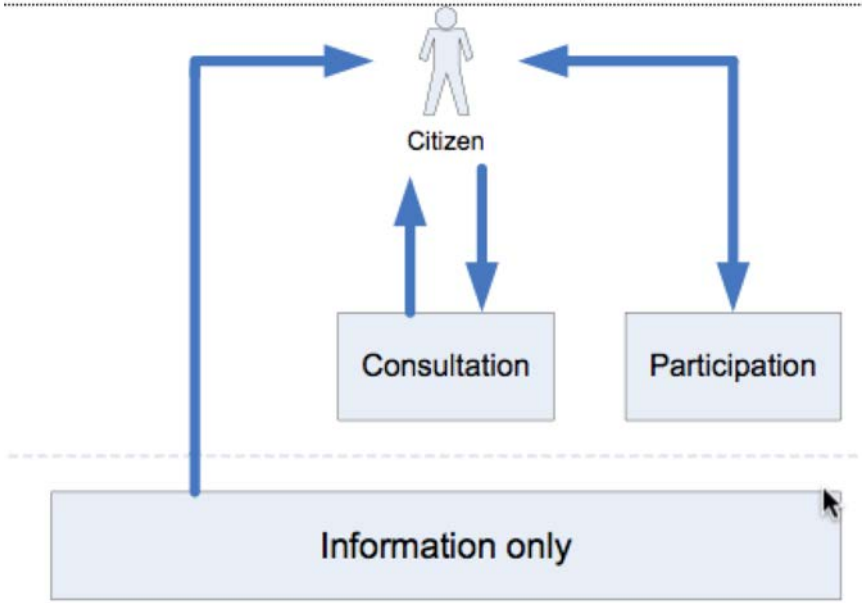
https://www.researchgate.net/publication/318607810_The_Transparent_Smart_City

The Role of Citizens

Citizens can have different roles in the smart city:

- Political processes and decision-making
- Experts (sharing insight)
- Volunteers (sharing time)

OECD Model

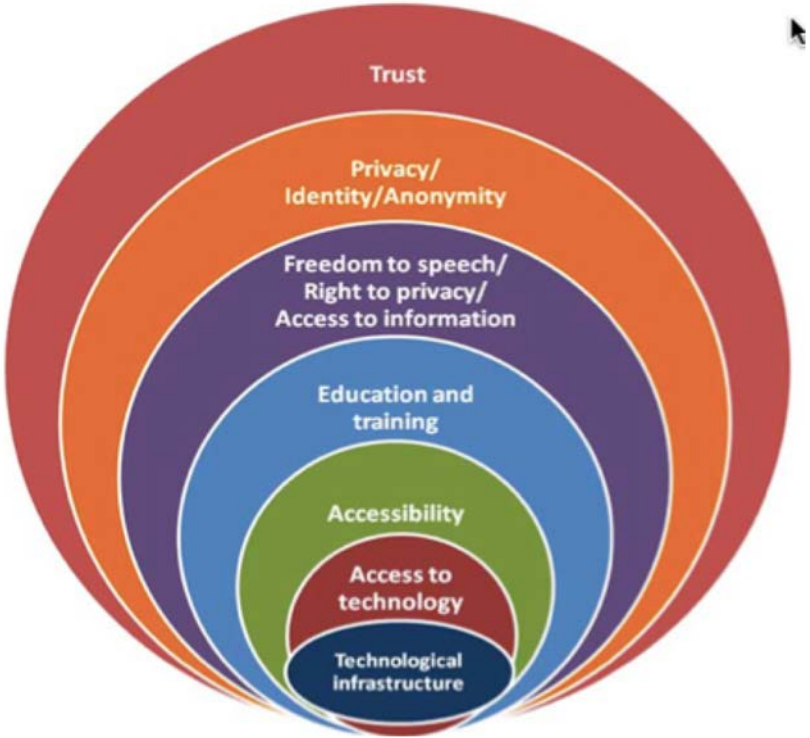


OECD, Engaging Citizens in Policy-making, in OECD Public Management Policy Brief. 2001, OECD: Paris, France.

Political Participation

- In order to take active part in policy-making and political processes, the citizens need access to information
- *The transparent smart city*

Preconditions for Participation



This model was presented at ICDS 2010
Berntzen, L. & Karamagioli, E.
Regulatory Measures to Support eDemocracy
IEEE Computer Society

Preconditions for user participation and involvement

Transparency

- Documents
- Meetings
- Processes
- Benchmarking
- Decision-makers and their agendas
- Disclosure

Documents

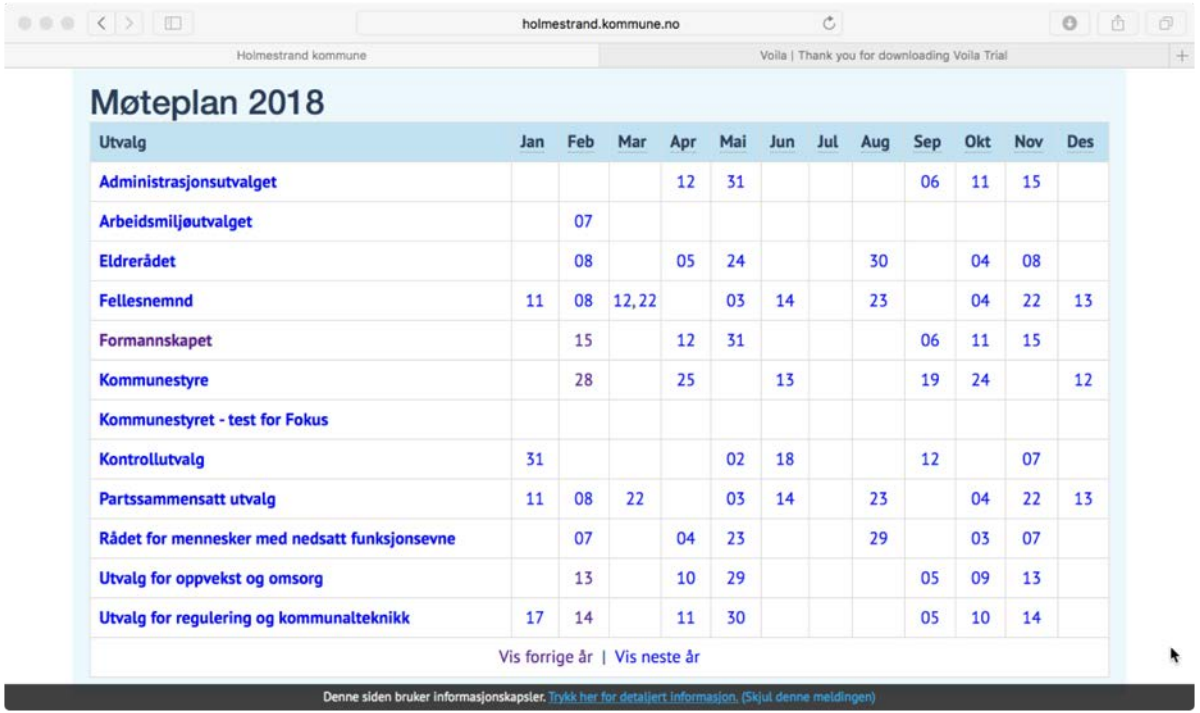
- Access to documents used in the political decision making processes
- Mail records

Meetings

- Agendas
- Proceedings (webcasts)
- Minutes

Meetings

Meeting schedule for a municipality. Clicking the data gives access to meeting agenda and documents



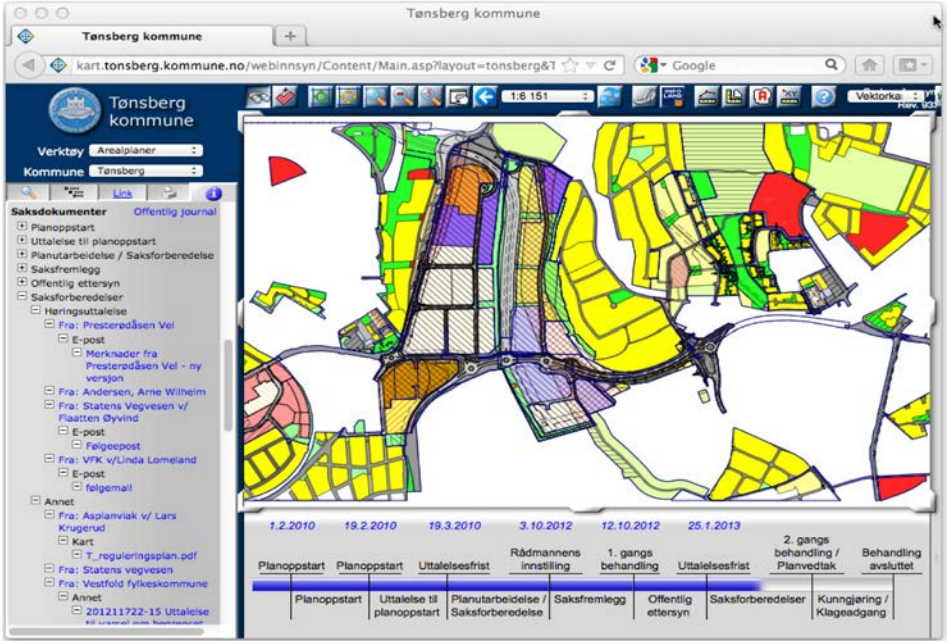
Webcasting


Direktesending
Bystyret
Tittel: Anskaffelse av robuste boliger for vanskeligstilte
Utvalg Bystyret
Sted: Rådhuset 20.04.2016 - 18:30
Saksnr: 045/16/16
Bystyret 20.04.2016
Rapportering lavterskel kafè rusavhengige, boligsosial..
Mottatt innsigelse til område D12 Barkåker syd i komm..
Kommuneplanens arealdel 2014-2026 - PlanID 0704 99007 ..
Mindre justering av kommunegrensen mellom Stokke og Tø..
Godkjenning av møtebok
Referatsaker
Kommunedelplan for dobbeltspor Nykirke - Barkåker, Pla..
Interkommunal kommunedelplan for gange, sykkel og koll..
Detaljregulering av Åsgårdstrandsveien 402. PlanID 070..
Anskaffelse av robuste boliger for vanskeligstilte
Avskrivning av tap på fordring - konkursbo Conradis AS
Tønsberg kontrollutvalg - årsrapport 2015
Plan for forvaltningsrevisjon 2016 - 2019.
Nordbyen Nedre. Innføring av boligsoneparkering.
Godkjenning av etablering av Klokkeråsen barnehage
Handlingsplan vold i nære relasjoner - over 18 år
Kommunereformen. Status og vurderinger fra Tønsberg ko..
172:15
192:58
Kameravalg Salen
Multikameravisning
Vedlegg:
Ingen vedlegg
Send på epost
DEL
Løsningen levert av: Aventia AS
2016
v3.0.17

Processes

- It is important for citizens to understand the processes leading to the decisions
- Processes may be visualized as a flowchart
- Timeline

Digital Planning Dialog



http://nettv.regjeringen.no/digitalt-planregister-og-plandialog

Benchmarking

- The possibility to compare how the city is doing compared to other cities.
- Indicators

KOSTRA

Grunnskoleopplæring - KOSTRA

Lag egne tabeller og figurer

1 Velg tabell som inneholder de variablene du ønsker | 2 Velg verdier fra ulike variabler | 3 Se din skreddersydde tabell, eksporter eller lagre

Tabell: 04684: D. Grunnskoleopplæring - nivå 3 (K)

Logg inn

Rotér tabell | Sorter tabell | Rediger tabell: Vis kode/tekst OK | Vis grafisk: Kart OK | Lagre som: Excel OK

D. Grunnskoleopplæring - nivå 3 (K) etter region, statistikkvariabel og tid

	2010	2011	2012
0701 Horten			
Netto driftsutgifter til grunnskolesektor (202, 214, 215, 222, 223)	236 984	243 098	277 328
0702 Holmestrand			
Netto driftsutgifter til grunnskolesektor (202, 214, 215, 222, 223)	96 574	105 422	104 880
0704 Tønsberg			
Netto driftsutgifter til grunnskolesektor (202, 214, 215, 222, 223)	387 122	409 789	420 104
0706 Sandefjord			
Netto driftsutgifter til grunnskolesektor (202, 214, 215, 222, 223)	473 984	475 373	503 471
0709 Larvik			
Netto driftsutgifter til grunnskolesektor (202, 214, 215, 222, 223)	428 291	427 949	437 900

Fotnote(r):
En generell kompensasjonsordning for merverdiavgift innført fra 1.1.2004 kan føre til brudd i tidsserien fra 2003 til 2004 i ulike regnskapsbegreper. Ordningen vil kunne innebære reduksjon i netto driftsutgifter totalt, netto driftsutgifter på funksjon/tjenesteområde, korrigerte brutto driftsutgifter totalt, korrigerte brutto driftsutgifter på funksjon/tjenesteområde og brutto driftsutgifter på funksjon/tjenesteområde eller økning i brutto driftsinntekter på funksjon/tjenesteområde. For nærmere forklaring henvises til Faglig veiledning kapitlene 2B - 2E.

Funksjon 383 for musikk- og kulturskoler er flyttet fra tjenester for grunnskole til tjenester for kultur f.o.m 2001

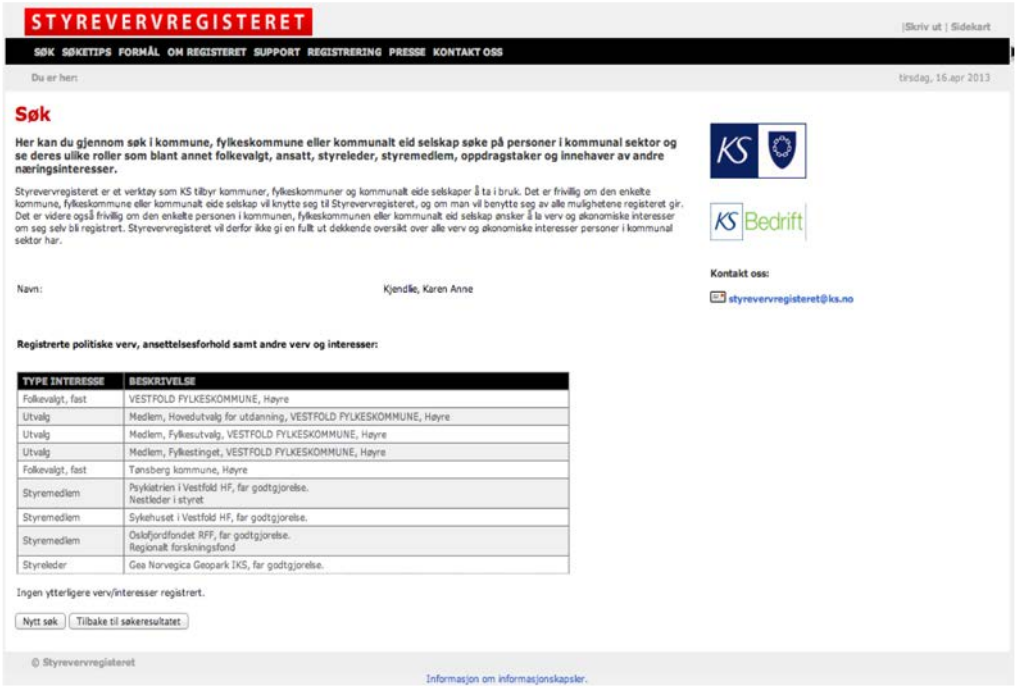
Vis i eget vindu Skriv ut

BedreKommune.no

Decision Makers

- The personal interests of decision makers should be known to the citizens

Register of Interests



STYREVERVREGISTERET

|Skriv ut | Sidekart

SØK SØKETIPS FORMÅL OM REGISTERET SUPPORT REGISTRERING PRESSE KONTAKT OSS

Du er her: tirsdag, 16.apr 2013

Søk

Her kan du gjennom søk i kommune, fylkeskommune eller kommunalt eid selskap søke på personer i kommunal sektor og se deres ulike roller som blant annet folkevalgt, ansatt, styreleder, styremedlem, oppdragstaker og innehaver av andre næringsinteresser.

Styrevervregisteret er et verktøy som KS tilbyr kommuner, fylkeskommuner og kommunalt eide selskaper å ta i bruk. Det er frivillig om den enkelte kommune, fylkeskommune eller kommunalt eide selskap vil knytte seg til Styrevervregisteret, og om man vil benytte seg av alle mulighetene registeret gir. Det er videre også frivillig om den enkelte personen i kommunen, fylkeskommunen eller kommunalt eid selskap ønsker å la verv og økonomiske interesser om seg selv bli registrert. Styrevervregisteret vil derfor ikke gi en fullt ut dekkende oversikt over alle verv og økonomiske interesser personer i kommunal sektor har.

KS

KS Bedrift

Kontakt oss:

styrevervregisteret@ks.no

Navn: Kjendlie, Karen Anne

Registrerte politiske verv, ansettelsesforhold samt andre verv og interesser:

TYPE INTERESSE	BESKRIVELSE
Folkevalgt, fast	VESTFOLD FYLKESKOMMUNE, Høyre
Utvalg	Medlem, Hovedutvalg for utdanning, VESTFOLD FYLKESKOMMUNE, Høyre
Utvalg	Medlem, Fylkesutvalg, VESTFOLD FYLKESKOMMUNE, Høyre
Utvalg	Medlem, Fylkestinget, VESTFOLD FYLKESKOMMUNE, Høyre
Folkevalgt, fast	Tønsberg kommune, Høyre
Styremedlem	Psykiatrien i Vestfold HF, far godtgjørelse. Nestleder i styret
Styremedlem	Sykehuset i Vestfold HF, far godtgjørelse.
Styremedlem	Oslofjordfondet RFF, far godtgjørelse. Regionalt forskningsfond
Styreleder	Gea Norvegica Geopark IKS, far godtgjørelse.

Ingen ytterligere verv/interesser registrert.

Nytt søk | Tilbake til søkeresultatet

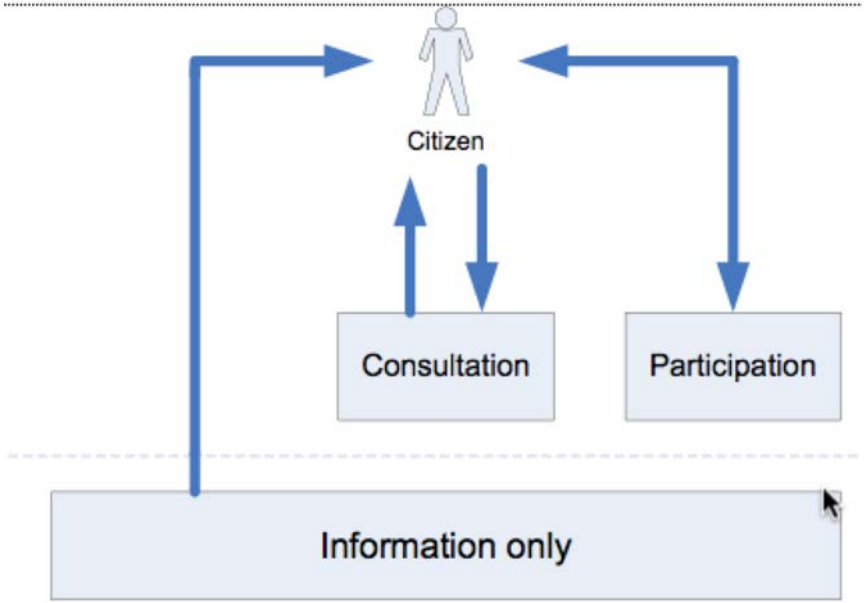
© Styrevervregisteret

Informasjon om informasjonskapsler.

Disclosure

- Citizens should be able to ask for information regarding the running of the city.

OECD Model



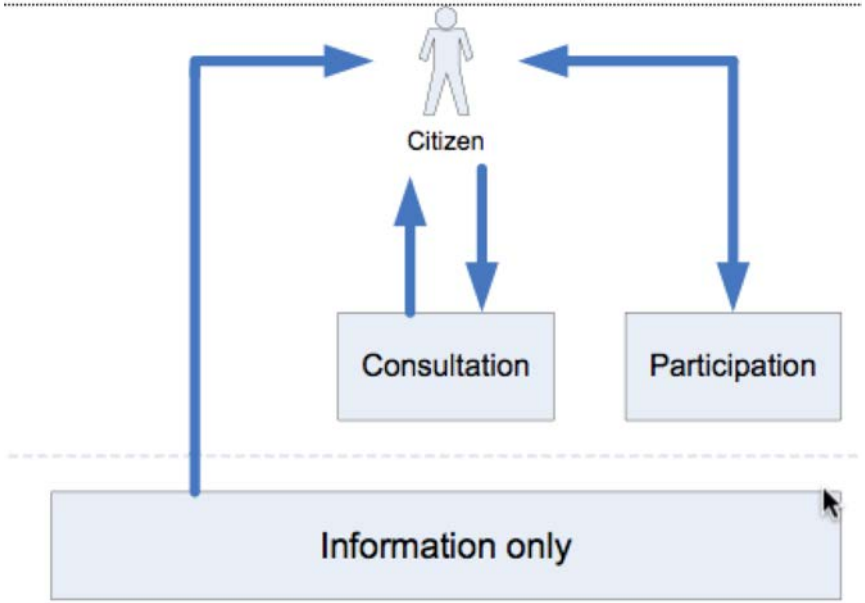
Consultations

- The city asks for input on specific issues, and provides a service for collecting input from its citizens
- Some kind of feedback should be provided on how the input has been used
- If input is not valued, interest will disappear

Polling

- Citizens are asked about specific issues, but the responses are normally limited to yes/no or values on a scale.

OECD Model



Participation

- Consultations are top-down. The city asks its citizens for input on specific issues
- Participation is different. The citizens may raise issues they are concerned about
- The goal is to have a dialog between the city and its citizens.

Discussion Forums

- Several Norwegian municipalities established discussion forums to collect input and start dialog with their citizens.
- Unfortunately, they have been closed down, one after another due to abuse.
- Racial discrimination, attacks on city employees.

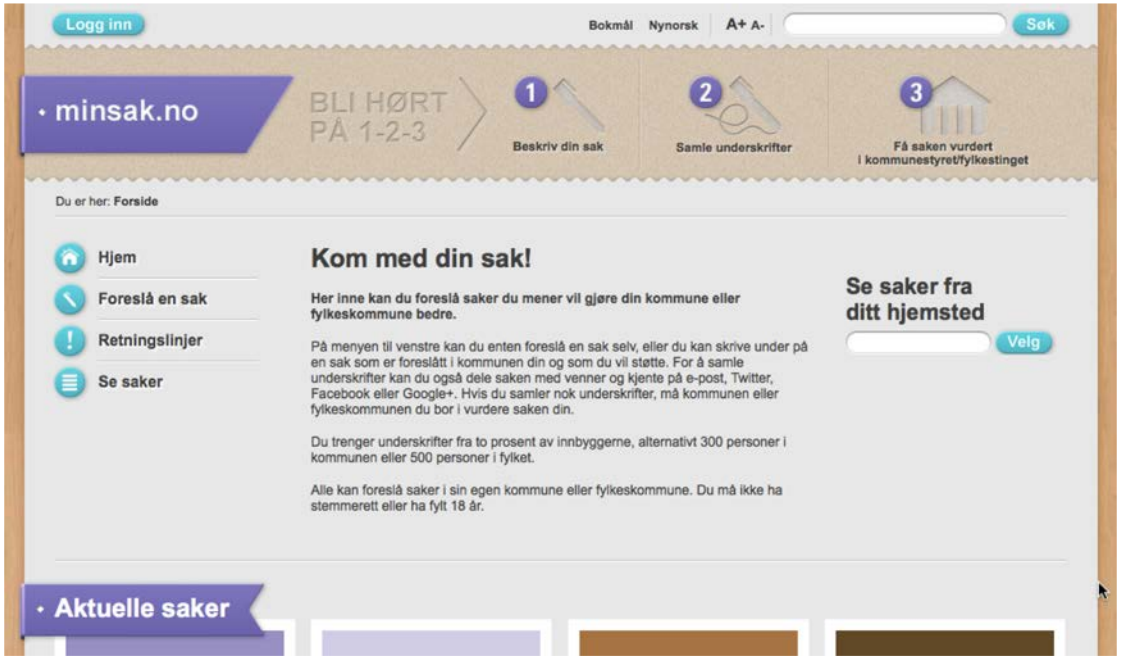
Citizen Initiative

- Between elections, citizens can raise issues by making a “citizen initiative”.
- The citizen initiative is embedded in the legislation. If the initiator manages to collect signatures from 2% of the population or 300 signatures, the local council is obligated to discuss the initiative.
- No positive response is guaranteed.

MinSak.no (MyCase)

- The government has established a platform “minsak.no” to facilitate both proposals and collection of signatures
- The platform has so far 685 registered initiatives

MinSak.no


Logg inn
Bokmål Nynorsk A+ A-
Søk
minsak.no
BLI HØRT PÅ 1-2-3
1 Beskriv din sak
2 Samle underskrifter
3 Få saken vurdert i kommunestyret/fylkestinget
Du er her: Forside
Hjem
Foreslå en sak
Retningslinjer
Se saker
Kom med din sak!
Her inne kan du foreslå saker du mener vil gjøre din kommune eller fylkeskommune bedre.
På menyen til venstre kan du enten foreslå en sak selv, eller du kan skrive under på en sak som er foreslått i kommunen din og som du vil støtte. For å samle underskrifter kan du også dele saken med venner og kjente på e-post, Twitter, Facebook eller Google+. Hvis du samler nok underskrifter, må kommunen eller fylkeskommunen du bor i vurdere saken din.
Du trenger underskrifter fra to prosent av innbyggerne, alternativt 300 personer i kommunen eller 500 personer i fylket.
Alle kan foreslå saker i sin egen kommune eller fylkeskommune. Du må ikke ha stemmerett eller ha fylt 18 år.
Se saker fra ditt hjemsted
Velg
Aktuelle saker

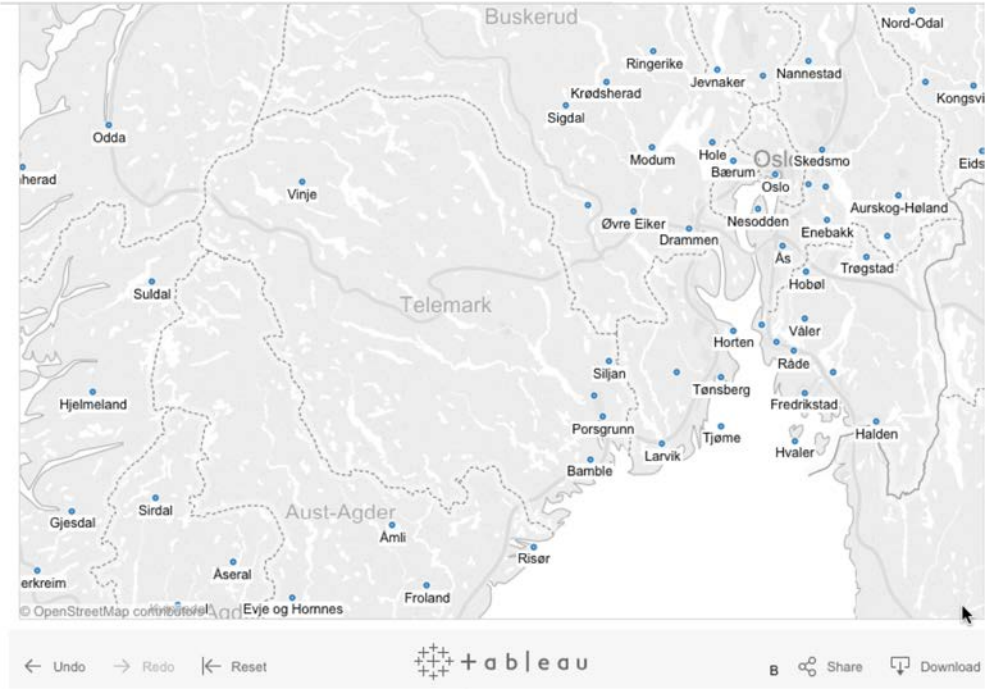
Social Media

- Many municipalities (184) have established themselves in social media (Facebook)
- These pages are mostly used for questions and answers, but there is some examples of dialog taking place
- Citizens have to use their Facebook profile, which disciplines the discussions

Social Media

- Two of my students made a solution to track the use of municipal Facebook pages
- Show comments, reactions and shares

Social Media



http://socialmediadata.citizencentric.net/maps_tableau.html

Participatory Budgeting

- Participatory budgeting has become widespread, where the citizens vote on the use of (a portion) of the total budget for a city. In this case, the results are a consequence of the participation
- Participatory budgeting is a powerful mechanism to make participation work. The incentive to participate is high, since the citizens will see direct results from taking part in the decision making

Political Participation

- Political participation is seen as important by many researchers
- A shift towards direct democracy
- Or support for indirect democracy?
- What is successful participation?
  - Quantity?
  - Impact?

Political Participation

- In my opinion, the “smart city” should listen to its citizens, since they sometimes have concerns that should be taken into account
- At the same time, we have to be realistic. Not all citizens have opinions on everything
- In their book“Stealth Democracy”, Hibbing and Theiss-Morse from USA support this

“Stealth Democracy”

- *“The last thing people want is to be involved in more decision making: They do not want to make political decisions themselves; they do not want to provide much input to those who are assigned to to make these decisions; and they would rather not know all the details of the decision-making process.”*
- Hibbing and Theiss-Morse build on empirical data from U.S.A.

The Role of Citizens

Citizens can have different roles in the smart city:

- Political processes and decision-making
- Experts (sharing insight)
- Volunteers (sharing time)

Non-political participation

Mobilization

- The smart city may use information technology to mobilize citizens to help making the city a better place to live
- I will now show a couple of practical examples on how this can be done

Human Sensors

- A “human sensor” is a person that observes some issue and reports it using some platform.
- Smart phones

Green Watch Project

- The project distributed 200 smart devices to citizens of Paris. The devices sensed ozone and noise levels as the citizens lived their normal lives, and the results where shared through a mapping engine
- The project showed how a grassroots-sensing network could reduce monitoring costs dramatically, and at the same time engage citizens in environmental monitoring and regulation

FixMyStreet

- FixMyStreet is an application that allows citizens to report on issues and problems through their computer or smart phone
- The application is location based, it uses the address or GPS coordinates as a tag to show the exact location of the issue or problem. Typical problems are holes in the road, broken light bulbs in street lightning, abandoned vehicles, broken water pipes etc.

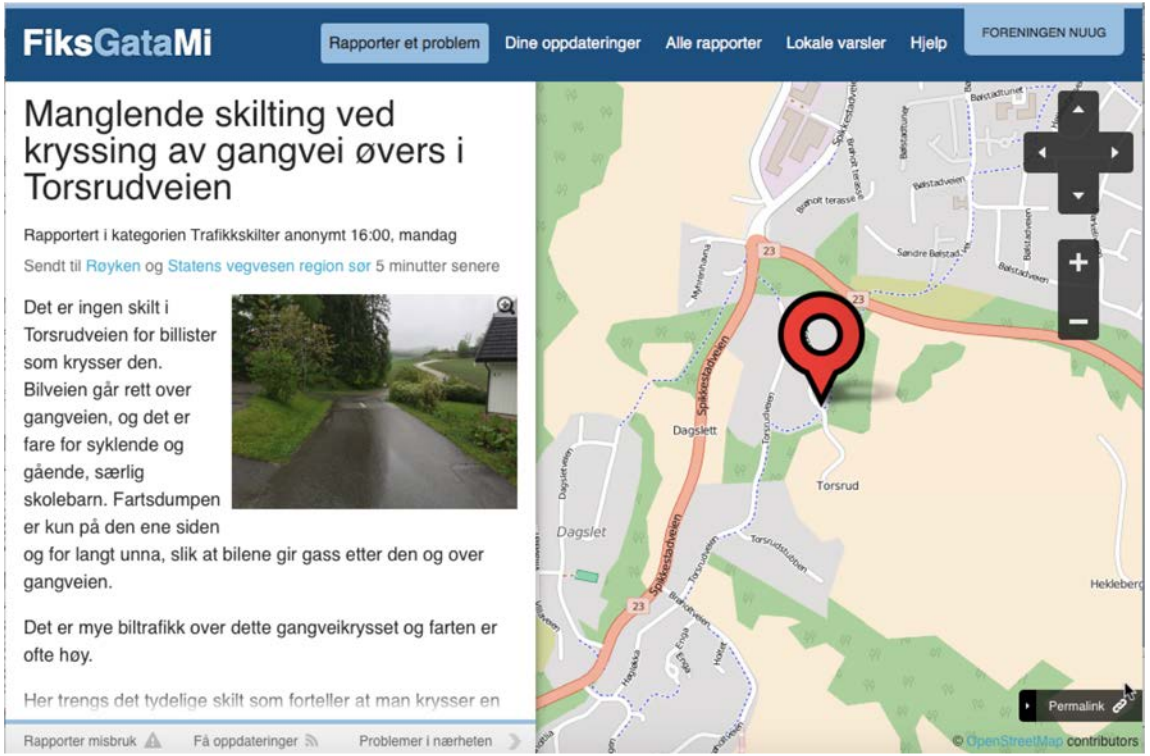
FixMyStreet

- FixMyStreet mobilizes citizens to alert the city administration when something needs to be fixed
- The application also provides feedback on status.
- It is possible to see how fast (or slow) the city is responding to reported problems

FixMyStreet

- FixMyStreet is widely used in United Kingdom, but the software itself is open source, and has been adopted by cities all over the world. In Norway, the application has been translated into „FiksGataMi“
- In this case the citizens are acting as „human sensors“. They observe something is wrong and report it

FixMyStreet



Sauberes Wiesbaden

- The project aims to promote the participation of the citizens to quickly and easily report illegal garbage in the area of Wiesbaden, Germany
- An app has been developed to make reporting easy. The app uses the location data from the mobile phone to give exact position of the problem

SafetyNet

- SafetyNet is a self-help network. The initial idea was to provide self-help to spouses of patients suffering strokes or dementia
- The platform is run by a consortium of municipalities, and have later been extended to support parents of children with psychological problems, and relatives of drug abusers

SafetyNet

- The whole idea is to learn from other citizens experiencing the same situation
- The platform includes video communication between network members, and access to a knowledge database with information written by medical professionals

SafetyNet

- The network is run by coordinators employed by the municipalities, and these coordinators also arranges off-line events

http://www.trygghetsnett.no/safetynet/safetynet-article755-599.html

Conclusion (not the final)

- Participation is more than **political** participation
- Researchers have been too concerned with political engagement
- But participation is more than politics, it can be used to build better services and achieve better quality of life for the citizens

Video

- Smart City Barcelona (IDG)

- https://www.youtube.com/watch?v=4rKwBBDtOCE

Size doesn´t matter
Small cities can be smart too

Based on a presentation:
North Atlantic Forum
Bø, Telemark, NORWAY
15.09.2017

Smart Cities and Smart Places

- Does a city need to be large to be smart?
- I will try to answer the question by asking questions:
  - Will a small city benefit from citizen participation?
  - Does a small city have parking problems?
  - Is environment and climate only an issue in large cities?
  - Is quality of life important in small cities?

Size Doesn’t Matter

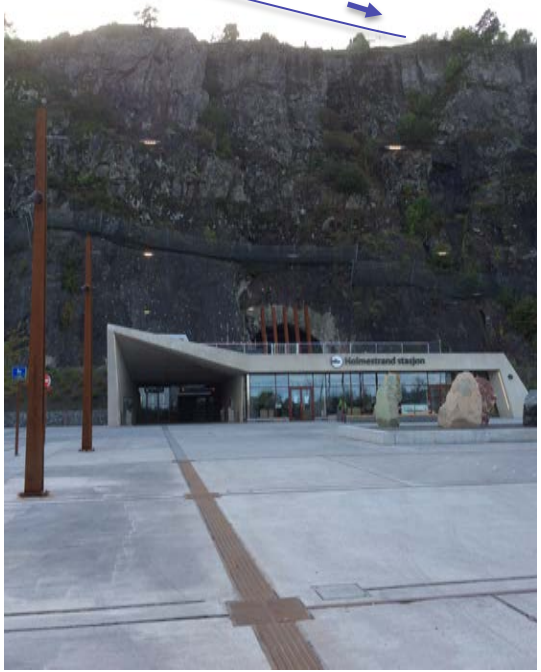
- Most issues are just as important for citizens in small cities
- In literature it seems that large cities are dominant in smart city projects and research papers
- Smart city research is relevant also for smaller cities

Case: Holmestrand, Norway

- Population approx. 14.212 (2018)
- Case study: Smart is not only about ICT, scope is much broader

- Urban planning to build more dense around public transport stops
- Two level city: New elevator to provide access to railway station
- Upgrade of harbor area to increase attractiveness and quality of life

Smart Transport



Quality of Life

Holmestrand harbour

Outside Holmestrand City Library

Case: Holmestrand, Norway

- Municipal plan to reduce environmental footprint
- Home care uses electric cars
- Free charging stations for electric cars
- Nursing home heated by ground-coupled heath-exchange
- Positioning technology on snow removal trucks

Home Care uses Electric Cars

Charging Stations

Free charging on campus and in front of city hall

Also fast-charging for payment outside local supermarket

Case: Oslo, Norway – High Ambitions

- 2017 Municipal cars with zero emission (1100)
- 2020 New taxis with zero emission
- 2020 Public transport with zero emission
- 2025 All cars sold should be with zero emission

Case: Vestfold County

- County is responsible for secondary schools, public transport, and county roads.

- New environmentally friendly high school
- Buses and garbage trucks run on biofuel
- Apps for route planning and electronic tickets
- GPS Tracking of buses
- WiFi on buses
- Intelligent and LED street lights
- Bike roads

Garbage Sorting

Outside my home

Inside primary school

Biofuel from Food Waste

THANK YOU FOR THE FOOD

Food waste is transformed into biofuel by biological processes
THE MAGIC FACTORY
GREVE BIOGASS

Biofuel from Food Waste

Biogas from Food Waste

- The method itself is well known
- Two phases, each with its own type of bacteria
- Break down waste, then produce biogas (methane +)
- But the point here is not the process

Social Awareness

- We teach children about recycling
- Children are ambassadors
- They influence parents and family
- Bio-waste is food for buses and garbage trucks

New Horten Secondary School

New Horten Secondary School

- A plus building is producing more energy than it consumes. The surplus energy is sent onto the electrical power grid.
- BREEAM NOR is a framework for assurance of environmental, social and economic sustainability goals. The new school will have the highest classification: BREEAM NOR OUTSTANDING
- To be classified as a Plus-building, a building need to produce at least 2 kWh/m2 gross area every year. The new school is planned to produce 53 kWh/m2.
- The energy is produced as a combination between solar energy and geothermal energy. The roof will be covered with 3470 m^2 of solar cells. Geothermal energy is retrieved from several wells.
- Construction site is CO_2 neutral

Intelligent and LED Street Lights

LED – more light for less energy
Intelligent – turn on only when necessary

Bikes


Statens vegvesen
12 C
Syklister i dag
815
Syklister i år
36253
GOD TUR

Conclusion

- “Smart Cities” is not about population or specific ICT systems from Cisco and IBM
- “Smart Cities” is more about values and attitudes
- These values and attitudes are just as well represented in smaller places, and even rural areas
  - (Citizens in rural areas need ICT-based services even more)
- So we should speak more about “Smart Places”

Monitoring Air Quality
IoT in the Smart City

https://www.thinkmind.org/index.php?view=article&articleid=smart_2017_1_20_40024

Introduction

- One of the key areas of smart cities is environment.
- Environmental monitoring provides current conditions and can be used to find trends
- The results can be used for decision making.

The Context

- Every winter, Oslo and Bergen, the capital and the second largest city of Norway, have severe problems with air quality.
- The air quality problems are caused by certain climatic conditions that put a lid on top of the cities.

Measures

- Bergen use the last digit on the number plate to decide what day you are allowed to drive in the city.
- Oslo is considering different approaches, like raising the toll fees or restricting the types of cars allowed to drive in the city.
- On Tuesday, January 17th 2017, cars using diesel were not allowed to drive in Oslo. The ban was lifted in the evening the same day.

How are Decisions Made?

- Each city has a limited number of stationary measurement units. Oslo has seven units.
- Pollution may vary with location
- Low granularity gives inaccurate readings
- Decisions may not reflect the real situation

Citi-Sense

- European Union – funded project
- Made mobile hand-held units
- Need people to carry them around

Our Goals

The ultimate goal is better decision making through improved analysis and data collection.

- More units provides better granularity
- Mobile units make it possible to measure at more locations
- Inexpensive units make data collection feasible

Our Approach

- Mobile unit
- Installed in cars
- Starts collecting information when car is parked
- Transmits information to central server.

Project Organization

- This project is done in collaboration between Faculty of Engineering, “Lucian Blaga” University of Sibiu”, Romania and University College of Southeast Norway.
- Three students built the first prototype during their mobility stay in Norway (Two from Sibiu, one from Craiova).
- EEA grant

First Prototype

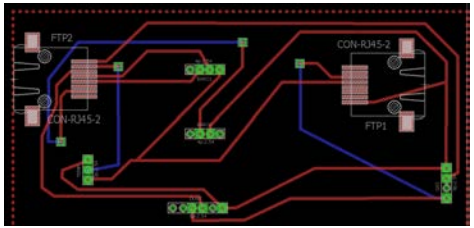
- The first prototype used Intel Edison as processing unit
- Communication was hendeled through Bluetooth connection to a mobile phone
- GPS unit provided location information
- Sensors for barometric pressure, temperature, humidity, sound, and CO2,

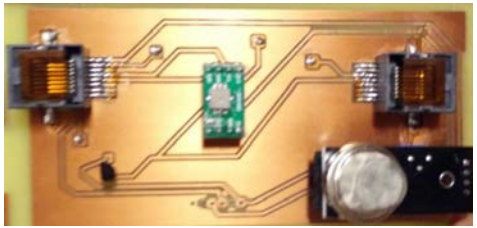
Lessons Learnt – First Prototype

- Use of Android phone for communication requires a phone with a subscription. App need to be installed. Not good for larger deployments.
- Sound sensor had limited use
- Intel Edison is a quite expensive processing unit

Second Prototype

- Based on LinkIt Duo, a cheap dual processing unit.
- Combined GPS and GSM unit
- No sound sensor
- Added a particle sensor
- Replaced CO_2 sensor with sensor able to also measure NO_X





Second Prototype

- 16 environmental platform sensors has been made in Sibiu.
- First test in Sibiu, February 2017
- Collaboration with Romanian National Environmental Agency and CitizenAlert (NGO)
- Planning larger project with more than 100 units.
- Unit cost: Around Euro 120,-

Lessons Learnt – Second Prototype

- Availability of components may be a problem
- GSM modem need to be compatible with operator (2G/3G/4G)
- Quality of sensors should be verified

Conclusion

Conclusion

- “Smart Cities” is an umbrella for research and development of solutions that make cities more sustainable, effective and democratic.
- Application areas provide endless opportunities for research and development, spanning from sensor technology to finding new ways of engaging citizens.
- The size is not important, but the values are.

Thank you for listening

If you are interested, please stay in touch

lasse.berntzen@usn.no


HSN
University College
of Southeast Norway