Smart City Solutions for a Riskier World

Citizen Sentiment Tracker

ESI THOUGHTLAB

Introduction: Citizen sentiment around the SDGs and smart technology

ESI ThoughtLab's ground-breaking study, **Smart City Solutions for a Riskier World**, examined the approaches of 167 worldwide cities to address the UN's 17 Sustainable Development Goals (SDGs). The study analyzed how these cities use smart innovation to achieve those goals.

To understand citizen perspectives on smart, sustainable programs, we also created a real-time, AI-enabled **Citizen Sentiment Tracker.** This unique tool used AI to collect, categorize, and assess citizen views expressed through hundreds of thousands of Twitter feeds. It allowed our team to identify which SDGs and technologies are top of mind for city residents and how their views compared with the efforts of cities they live in.

We selected 10 cities to examine—Abu Dhabi, Amsterdam, Auckland, Barcelona, Bogota, Lagos, New York, San Diego, Singapore, and Vancouver—to provide a representative sample of municipalities from around the world. The cities varied by region, population size, and stage of development. The tool monitored citizen views on each of the 17 SDGs and 13 emerging technologies.

The UN's Sustainable Development Goals

Smart technologies covered

AI   Robotics   Cloud   Data analytics   Data security   Digital/mobile   Autonomous vehicles   AR/VR   Biometrics   Blockchain   IoT   Geospatial

An interactive, real-time tool

The Citizen Sentiment Tracker collects tweets, in real time, using key words to categorize the comments as they relate to the specific SDGs and smart technologies. We used the AI-enabled tool to dig into the tweets of residents of the 10 representative cities; analyze which were the areas of key interest, both overall and at the city level; assess trends over time; and examine whether the comments generally exhibited positive or negative opinions on the SDGs and technologies. For this report, the tool collected and filtered roughly 640,000 tweets over nearly 10 weeks, from January 25th to March 31st, 2021. The tracker's dashboard provides an immediate visualization of the volume of tweets by city. For example, the largest number of tweets in Amsterdam were on good health and well-being, while peace, justice, and strong institutions was the most discussed SDG topic in Barcelona.

01 No Poverty
02 Zero Hunger
03 Good Health And Well-Being
04 Quality Education
05 Gender Equality
06 Clean Water And Sanitation
07 Affordable And Clean Energy
08 Decent Work And Economic Growth
09 Industry, Innovation, And Infrastructure
10 Reduced Inequality
11 Sustainable Cities And Communities
12 Responsible Consumption And Production
13 Climate Action
14 Life Below Water
15 Life On Land
16 Peace And Justice, Strong Institutions
17 Partnerhsips To Achieve The Goal

Amsterdam SDGs   explore →
36,224 Docs

Barcelona SDGs   explore →
100,697 Docs

Abu Dhabi SDGs   Bogotá SDGs   Lagos SDGs   New York SDGs   San Diego SDGs   Singapore SDGs   Vancouver SDGs   Auckland SDGs

Good health and well-being are top of mind

It is not surprising that the SDG good health and well-being accounted for almost half of the tweets collected. COVID-19 was the overwhelming concern of most city residents around the world and made public health a top priority for policy-makers as well. While the focus on health and well-being fluctuated somewhat over the period under review, it generally remained the most salient topic.

Peace, justice, and strong institutions followed, accounting for 29.3% of tweets collected. This reflected rising public concerns around social justice, civil unrest, political polarization, and democratic processes in many of the cities. For instance, in Barcelona, the Catalan regional elections spurred discourse around separatism, while large-scale protests against the military takeover in Myanmar were a major topic of discussion among Singaporeans. The ongoing Colombian peace process between the national government and the FARC leftist guerilla group continued to foster debate around post-conflict justice and sustainable peace.

The remaining SDGs were mentioned far less often. Tweets related to **no poverty** made up just 5% of the total and many of these reflected pandemic-related issues. In New York, for instance, they centered on COVID-19's economic impact and support for government relief packages. **Industry, innovation, and infrastructure**, the fourth-placed SDG, was cited most in Abu Dhabi (8% of tweets), a city striving to be the technology and innovation hub of the Middle East. SDGs related to the environment got the least tweets, since these concerns were eclipsed by more immediate worries.

Singapore | Peace & Justice

> 20:58 - Apr 05, 2021 🐦
>
> Military junta thugs set fire to NantThar ward, Mandalay and provided beds n shelter to fire victims as if they aren't the one who set the fire. The people however knew the truth and didn't accept what the terrorists have given. #WhatsHappeningInMyanmar
>
> 👁 **read more**

Percentage of tweets per SDG

47.9% Good health & well-being	**2.7%** Reduced inequality	**1.2%** Climate action
29.3% Peace, justice & strong institutions	**2.3%** Decent work & economic growth	**1.2%** Gender equality
5% No poverty	**1.4%** Zero hunger	**1.1%** Quality education
3.6% Industry, innovation, & infrastructure	**1.4%** Sustainable cities & communities	**0.8%** Clean water & sanitation

0.6% Affordable & clean energy	**0.2%** Responsible consumption & production
0.5% Partnerships to achieve the goals	
0.4% Life below water	
0.3% Life on land	

New York | Good health

> 20:13 - Feb 09, 2021 🐦
>
> ICYMI - COVID update: The US has ramped up genome sequencing in the hunt for coronavirus variants 10 fold 32,340,146 have received 1 or more doses of vaccine More than 9.5 million people have been fully vaccinated with 2 doses #WearAMask
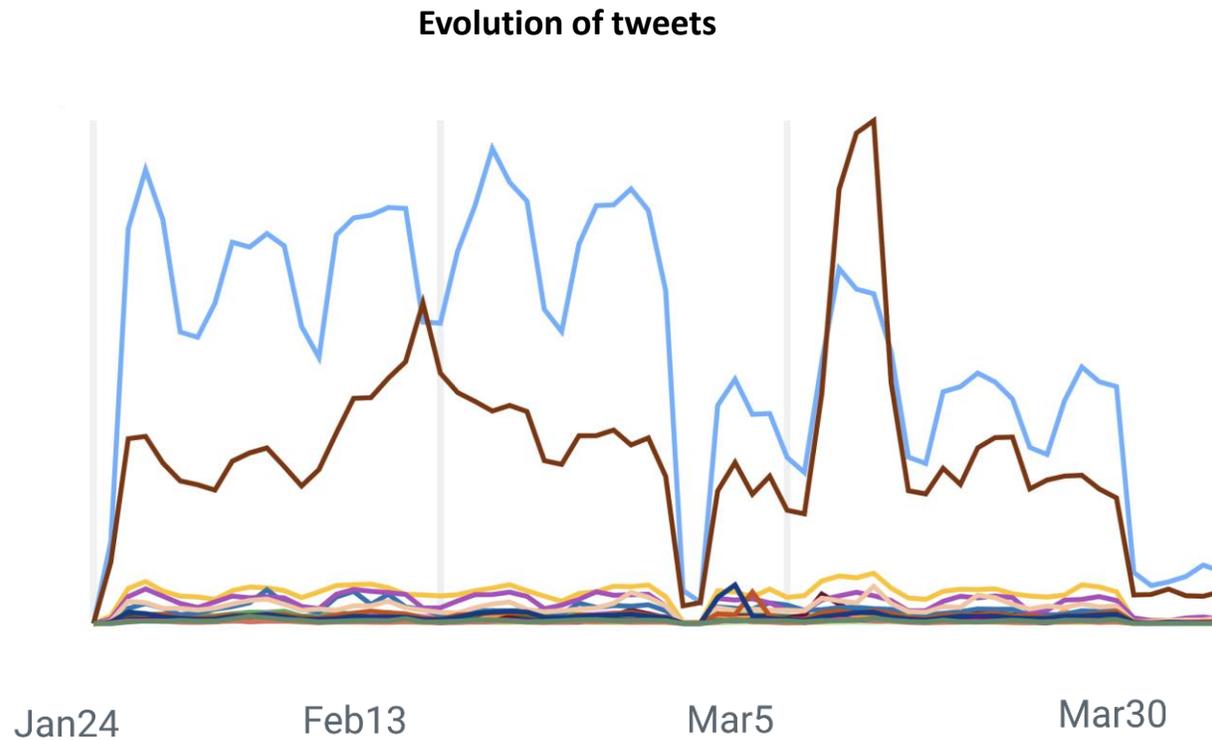>
> 👁 **read more**

Shifts in sentiment over time

While good health and well-being was the predominant focus of the public since January, it exhibited spikes and fluctuations. For example, a record number of COVID-19 hospitalizations in Vancouver as well as discussion around vaccine development and distribution in New York drove the first spike in January. A lull in tweets followed in late February.

The volume of comments about peace and justice remained high but the news cycle in various cities affected the trend line. The first major spike on February 13th was driven by Barcelona and preceded the Catalan regional elections of the next day. A peaceful demonstration turned violent in Bogota on March 10th, pushing peace and justice issues to the forefront. In Lagos, the kidnapping of hundreds of schoolgirls by armed groups provoked outrage, further boosting the number of tweets overall on peace and justice topics.

Evolution of tweets

Legend:
- 01 No Poverty
- 02 Zero Hunger
- 03 Good Health And Well-Being
- 04 Quality Education
- 05 Gender Equality
- 06 Clean Water And Sanitation
- 07 Affordable And Clean Energy
- 08 Decent Work And Economic Growth
- 09 Industry, Innovation, And Infrastructure
- 10 Reduced Inequality
- 11 Sustainable Cities And Communities
- 12 Responsible Consumption And Production
- 13 Climate Action
- 14 Life Below Water
- 15 Life On Land
- 16 Peace And Justice, Strong Institutions
- 17 Partnerhsips To Achieve The Goal

X-axis: Jan24, Feb13, Mar5, Mar30

Vancouver | Good health

23:57 - Jan 28, 2021

4,455 known active COVID-19 cases (+195) 291 in hospital (-12) 75 in ICU (+1) 59,141 fully recovered (+363 or 89.2% of all recorded cases) 6,520 people under active public health monitoring after coming in close contact with a positive person. (+656)

Bogota | Peace & Justice

17:19 - Mar 31, 2021

Con ese mundo de plata, compran personajes de escasísima estatura moral. Y son el apoyo del Uribismo: Cómplices en crímenes contra la administración pública Cómplices en delitos de lesa humanidad Cómplices en delitos de narcotráfico. Cómplices en
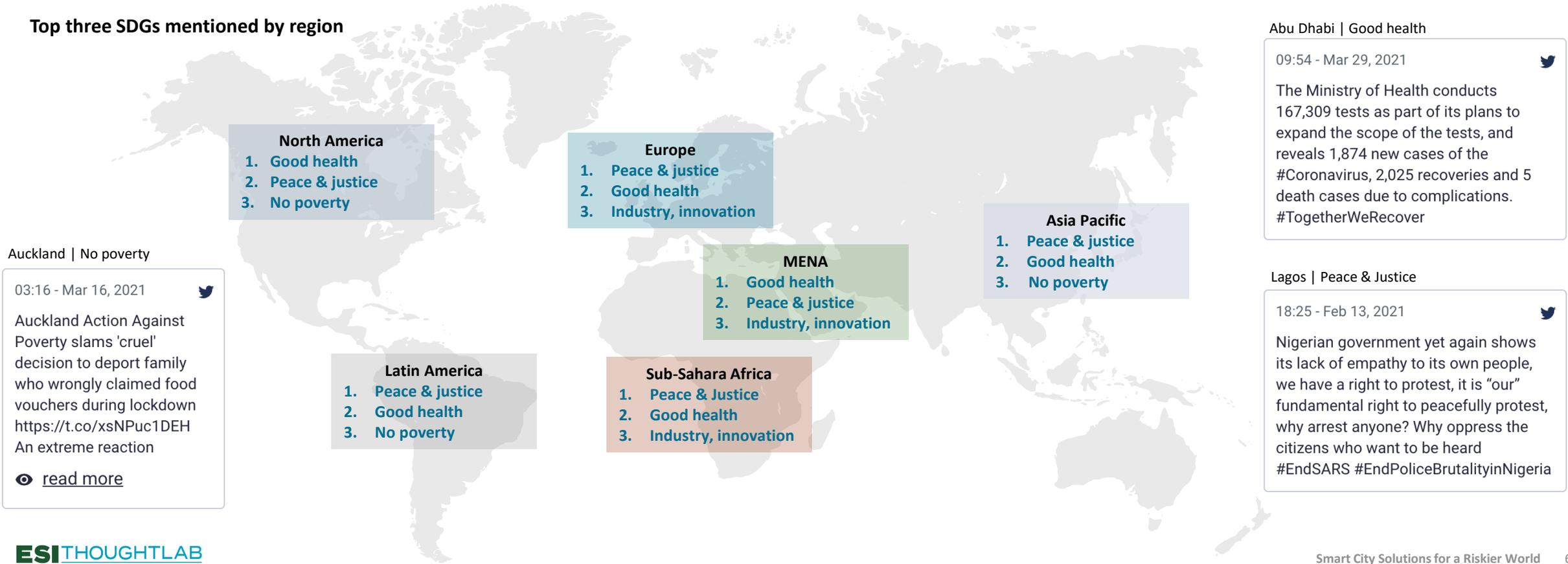
👁 read more

Citizen concerns vary by region

The 10 representative cities reflected broader trends in their regions.

Citizen worries about peace and justice in Bogota mirror those of citizens throughout Latin America, a region that struggles with civil unrest, criminal organizations, high levels of corruption, and fragile state institutions and rule of law. Similar problems have long afflicted Africa, where armed groups, ineffective law enforcement, and weak democratic institutions make peace and justice a top concern. In Europe, electoral battles and political polarization have been top of mind not only in Barcelona but throughout the region. The fight for democracy in Asia has pushed the conversation around peace to the forefront in cities like Singapore and Hong Kong.

Metro residents in North America (New York, San Diego, and Vancouver) and MENA (Abu Dhabi) tweeted more on good health. A weak government response at the start of the pandemic hurt these two regions. No poverty was a top-three issue in North America, Asia, and Latin America, reflecting more comments around the economic turmoil that accompanied the pandemic. Industry and innovation was a slightly more important SDG for Europe, MENA, and Africa.

Top three SDGs mentioned by region

North America
1. Good health
2. Peace & justice
3. No poverty

Europe
1. Peace & justice
2. Good health
3. Industry, innovation

Asia Pacific
1. Peace & justice
2. Good health
3. No poverty

MENA
1. Good health
2. Peace & justice
3. Industry, innovation

Latin America
1. Peace & justice
2. Good health
3. No poverty

Sub-Sahara Africa
1. Peace & Justice
2. Good health
3. Industry, innovation

Abu Dhabi | Good health

09:54 - Mar 29, 2021

The Ministry of Health conducts 167,309 tests as part of its plans to expand the scope of the tests, and reveals 1,874 new cases of the #Coronavirus, 2,025 recoveries and 5 death cases due to complications. #TogetherWeRecover

Lagos | Peace & Justice

18:25 - Feb 13, 2021

Nigerian government yet again shows its lack of empathy to its own people, we have a right to protest, it is "our" fundamental right to peacefully protest, why arrest anyone? Why oppress the citizens who want to be heard #EndSARS #EndPoliceBrutalityinNigeria

Auckland | No poverty

03:16 - Mar 16, 2021

Auckland Action Against Poverty slams 'cruel' decision to deport family who wrongly claimed food vouchers during lockdown https://t.co/xsNPuc1DEH An extreme reaction

👁 read more

SDG outliers

Although many of the concerns across cities were similar, an analysis of tweets per topic by city shows divergent views on some of the SDGs. In New York, the government's pandemic relief bill and stimulus checks prompted more comments than in other cities about poverty and inequality, while this was a lower concern in Singapore. Ranked as one of the best in the world, Singapore's education system is a high priority for the city, where discussions around teaching styles and curriculum quality were recurrent. Conversely, citizens in Bogota had less to say about education quality in their city, which has been improving over the years. Peace and justice was a major concern in many cities, but not Auckland and Vancouver, which are among the most livable, peaceful metropolises in the world.

Singapore | Quality education

17:00 - Mar 24, 2021

" Connecting Learning With The Use of Advance Organizers To Help Enhance Knowledge Assimilation And Retention In Students With Developmental Disabilities" published.

👁 read more

Abu Dhabi | Industry, innovation

07:36 - Mar 29, 2021

Partner advantage: Why co-creation is so important for the future of innovation Developing innovations for customers alone is becoming a thing of the past. See for more details.. #innovation #technology #teampurple #cocreation https://t.co/BsVWQ1mEbe

Barcelona| Peace & Justice

21:39 - Mar 11, 2021

No hay mejor explicación de lo que ha sucedido en Murcia y de como el Partido Popular ha preferido la corrupción a la regeneración de las instituciones. En Ciudadanos somos gente seria y NO blanqueamos las siglas de NADIE.

Percentage of tweets per category

SDG	Average	Abu Dhabi	Amsterdam	Auckland	Barcelona	Bogota	Lagos	New York	San Diego	Singapore	Vancouver
No Poverty	5%	3%	4%	5%	3%	3%	6%	8%	6%	2%	5%
Zero Hunger	1.4%	1%	1%	1%	1%	0%	2%	3%	2%	1%	1%
Good health	47.9%	49%	40%	73%	19%	21%	19%	51%	63%	20%	68%
Quality education	1.1%	1%	1%	1%	1%	0%	1%	2%	1%	4%	1%
Gender Equality	1.2%	2%	1%	1%	1%	1%	2%	2%	1%	1%	1%
Clean Water	0.8%	1%	1%	1%	1%	0%	1%	1%	1%	1%	1%
Affordable energy	0.6%	1%	1%	0%	0%	0%	0%	1%	1%	0%	1%
Decent Work	2.3%	1%	2%	1%	1%	0%	2%	3%	3%	3%	3%
Industry	3.6%	8%	6%	2%	6%	1%	7%	4%	4%	2%	2%
Inequality	2.7%	1%	3%	2%	2%	2%	1%	4%	3%	2%	3%
Sustainable cities	1.4%	1%	2%	2%	1%	0%	1%	2%	1%	2%	1%
Consumption	0.2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Climate Action	1.2%	1%	2%	1%	1%	1%	0%	2%	1%	0%	2%
Life Below Water	0.4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Life On Land	0.3%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%
Peace & Justice	29.3%	30%	36%	9%	63%	70%	59%	17%	13%	63%	9%
Partnerships	0.5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%

Where citizens and city leaders align and diverge

Our study revealed the priorities of city leaders regarding the SDGs and which they have included in their urban plans. Looking at the five broad SDG groupings—people, planet, prosperity, peace, and partnerships—there is general alignment between the focus of city leaders and residents. But there are some areas that are out of sync.

City governments are taking the most action on the SDGs relating to people, with 91% including no poverty in their plans and 89% including good health and well-being. The focus on people issues is shared by citizens, with good health by far their biggest concern as measured by their tweets.

City leaders are also focused on prosperity issues, with 86% including decent work and economic growth in their plans, and nearly 80% incorporating industry and innovation as well as sustainable cities and communities. These initiatives appear to be paying off, since citizens express fewer concerns about these SDGs.
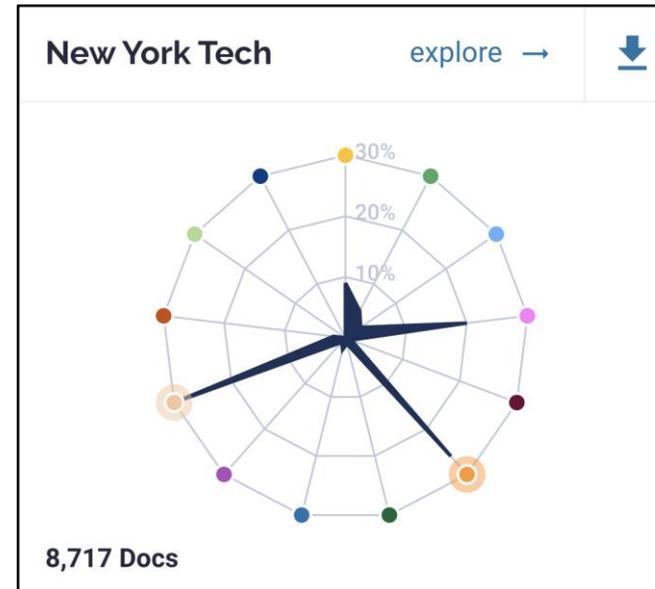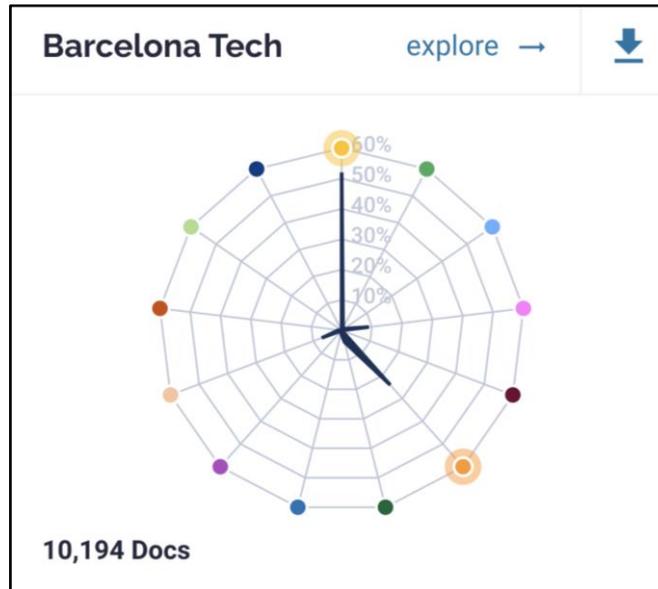
City leaders may want to consider focusing more on peace and justice to assuage the concerns of their citizens, for whom it's the second biggest issue. While partnerships are an important way to drive sustainability, the lack of citizen tweets on this subject could suggest poor awareness of this SDG and others in general. For example, a citizen survey recently conducted in Barcelona showed that most citizens lacked specific knowledge about the SDGs.

% of cities including specific SDGs in their plans

PEOPLE
End poverty and hunger in all forms and ensure dignity and equality

No poverty (91%)
Good health and well-being (89%)
Quality education (86%)
Gender equality (77%)
Zero hunger (75%)

PLANET
Protect our planet's natural resources and climate for future generations

Life on land (83%)
Clean water and sanitation (78%)
Life below water (77%)
Responsible consumption and production (69%)
Climate action (64%)

PROSPERITY
Ensure prosperous and fulfilling lives in harmony with nature

Decent work and economic growth (86%)
Industry, innovation, and infrastructure (79%)
Sustainable cities and communities (78%)
Affordable and clean energy (72%)
Reduced inequalities (60%)

PEACE
Foster peaceful, just, and inclusive societies

Peace and justice strong institutions (78%)

PARTNERSHIPS
Revitalize the global partnership for sustainable development

Partnerships for the goals (71%)

Tracking citizen views on technology

Our survey of 167 cities showed that they are adopting a wide array of digital technologies to meet their social, environmental, and economic goals. Our citizen sentiment tool tracked city residents' comments related to 13 key technologies to gauge the degree of attention being given to these innovations. There was wide variations in the attention paid to specific technologies, both overall by the 10 cities and when examined city by city. With over 10,000 tweets, Barcelona is the city that talks the most about technology, an indication of its aspirations to become a tech hub. In New York, an international center of investment and finance, blockchain accounts for 30% of the tweets.

01 Artificial Intelligence
02 Robotics
03 Cloud Services
04 Data Analytics
05 Data Security And Privacy
06 Digital And Mobile Techonologies
07 Autonomous Vehicles
08 Augmented And Virtual Reality
09 Biometrics/Facial Recognition
10 Blockchain
11 IoT And Sensors
12 Digital Divide
13 Geospatial Technology

Barcelona Tech   explore →
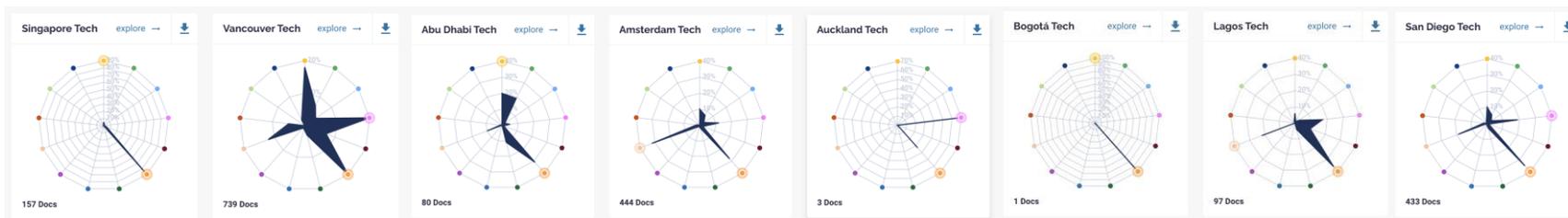10,194 Docs

New York Tech   explore →
8,717 Docs

Lagos | Cloud services

16:08 - Mar 30, 2021

In 2021, firms are preparing for the cloud to trickle into all departments. Here are some cloud trends to watch. https://t.co/2426TMIEK0 #CloudComputing #ai #DigitalTransformation #cloudflexng

San Diego | Blockchain

21:07 - Mar 31, 2021

With more and more people, companies, and institutions becoming involved with Bitcoin, many find themselves wondering - "How can I invest in Bitcoin?" This beginner's guide will get you started: https://t.co/EzvQ9Ltx4j

Singapore Tech   explore →   157 Docs
Vancouver Tech   explore →   739 Docs
Abu Dhabi Tech   explore →   80 Docs
Amsterdam Tech   explore →   444 Docs
Auckland Tech   explore →   3 Docs
Bogotá Tech   explore →   1 Docs
Lagos Tech   explore →   97 Docs
San Diego Tech   explore →   433 Docs

Citizens talk most about mobile and blockchain

The Citizen Sentiment Tracker revealed a large difference in the volume of tweets related to various smart technologies. At the top of the list were digital and mobile, AI, and blockchain.
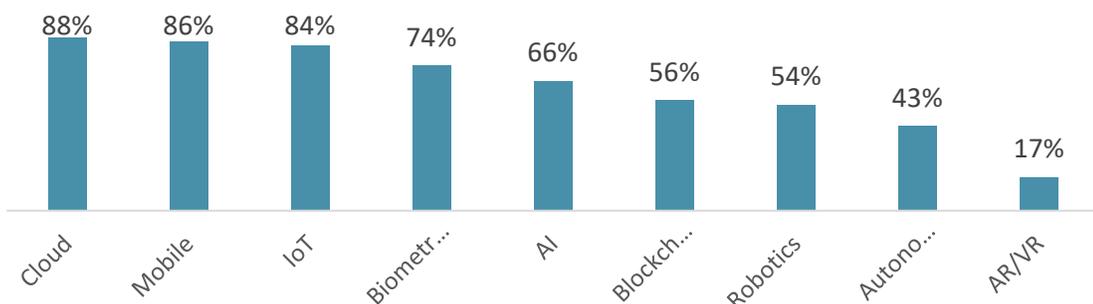
Many of the tweets around mobile centered on apps, the quality of mobile networks and phones, and availability of 5G. Blockchain was a popular topic because of a surge in discussion about bitcoin and other cryptocurrency investing—especially in Lagos, where 52% of tweets focused on this technology.

AI attracted over 20% of all tweets, and data analytics 15%. AI-related comments were most pervasive in Barcelona (52% of tweets) and Abu Dhabi (26% of tweets), reflecting these cities' plans to become innovation hubs.
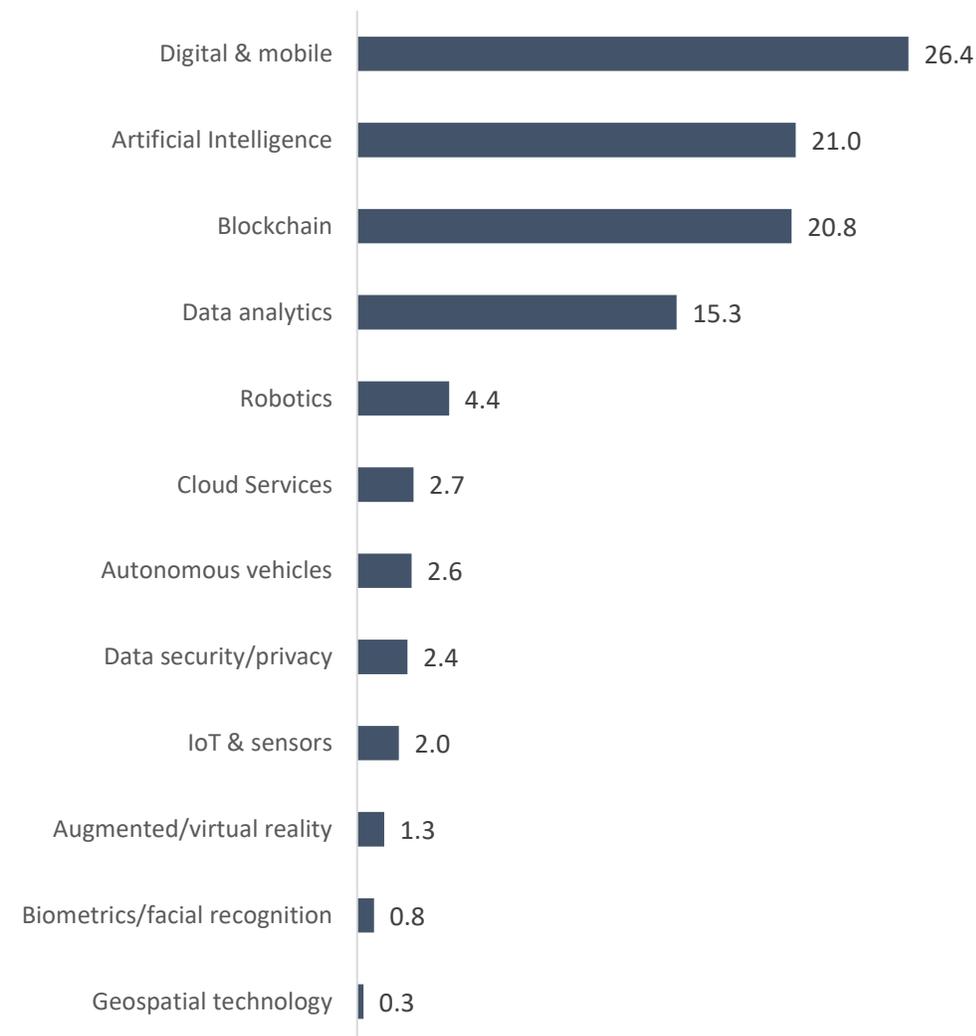
All other technologies barely got mentions. City residents commented very little on biometrics and augmented and virtual reality. The latter is understandable, since AR and VR are still in early stages of development and have very limited application by cities thus far. The lack of discussion on biometrics is surprising, however, since facial recognition technology has received a good degree of media attention in some countries owing to concerns about its potential impact on civil liberties. Geospatial tech got even less attention.

The most discussed technologies by citizens contrast somewhat with those that are most important to cities—cloud, IoT, biometrics, and AI, in which more than 60% overall are investing, according to our survey. This could also reflect lower citizen awareness of these more sophisticated technologies.

% of tweets by technology

Technology	%
Digital & mobile	26.4
Artificial Intelligence	21.0
Blockchain	20.8
Data analytics	15.3
Robotics	4.4
Cloud Services	2.7
Autonomous vehicles	2.6
Data security/privacy	2.4
IoT & sensors	2.0
Augmented/virtual reality	1.3
Biometrics/facial recognition	0.8
Geospatial technology	0.3

Where cities are making large investments

Technology	%
Cloud	88%
Mobile	86%
IoT	84%
Biometr...	74%
AI	66%
Blockch...	56%
Robotics	54%
Autono...	43%
AR/VR	17%

Weighing positive and negative sentiment on the SDGs

The tracker gauged whether sentiment on the SDGs was positive or negative. Among the 17 SDGs, city dwellers were most positive about education, health, and sustainable cities. Overall, citizens are satisfied with the efforts made by their local governments in these areas.

By contrast, citizens were most pessimistic about issues related to the SDGs on no poverty, peace and justice, reduced inequality, and climate action. These concerns stemmed from the adverse impact of the pandemic on the economy, and particularly the poor, as well as rising social discontent.

Auckland | Education

19:42 - Mar 29, 2021

Event day! Let's go! I absolutely love running #conferences focusing on New Zealand's #education sector. It is so refreshing to see how the schooling system is changing and really focusing on the 21st century learner. https://t.co/rISL1RVZL1

Amsterdam | Sustainable cities

16:13 - Mar 24, 2021

😌 Clean air is fundamental to achieving a healthy city. 🚲 To tackle air pollution, walking and cycling should be a cornerstone of city-level mobility. 🚗 Personal vehicle use must be denormalised in urban areas. https://t.co/HuM9LwCtwD

SDGs attracting most positive and most negative sentiment

Education	65%	No poverty	40%
Good health	62%	Peace and justice	34%
Sustainable cities	62%	Reduced inequality	32%
Life on land	61%	Climate action	29%
Industry and innovation	60%	Consumption, production	25%
Gender equality	58%	Clean energy	25%
Clean energy	57%	Partnerships	24%

San Diego | No poverty

21:25 - Mar 25, 2021

"The pandemic disproportionately affected graduates of low income, high poverty, and high minority high schools, with their enrollments dropping more steeply than their more advantaged counterparts." https://t.co/rSxyJheNyw

Bogota | Climate action

23:00 - Mar 17, 2021

#CambioClimático Advierten que proyectos de fracking no solo aumentarían exponencialmente las emisiones de GEI, sino que traería consecuencias ambientales como la contaminación de fuentes de aguas y de campos agrícolas de las poblaciones

👁 read more

Citizen views on the upside and downside of tech

Citizens were most positive about autonomous vehicles (a surprising 77% of related tweets), IoT, and geospatial technologies, tools that can provide benefits for citizens living and traveling in cities. AI drew the greatest negativity, with 50% of tweets displaying pessimism, largely because of concerns around job loss, ethics, and privacy.

The fear of losing jobs to machines also accounted for the pessimism around robotics. The increasing use of technology in cities is also leading to greater anxieties around data security and privacy.

Technologies attracting most positive and most negative sentiment

Technology	Positive	Technology	Negative
Autonomous vehicles	77%	AI	50%
IoT and sensors	70%	Robotics	27%
Geospatial	68%	Data security	25%
Data analytics	61%	Digital/mobile technologies	24%
Augmented/virtual reality	61%	Blockchain	22%
Blockchain	59%	Cloud services	22%
Cloud services	55%	Augmented/virtual reality	21%

Amsterdam | Autonomous vehicles

13:10 - Feb 05, 2021

Autonomous vehicles are no longer just a vision of the future. Constellation has paved the way for these emerging AV technologies to reach their true potential. $DAG @Conste11ation @stardustco11ect https://t.co/HWeFOzXcok

New York | IoT and sensors

12:03 - Feb 14, 2021

Air quality monitoring has long been costly, difficult, & geographically limited. But new lower cost IoT sensors are enabling air quality testing by governments, NGOs, and even concerned citizens. We surveyed 9 diverse sensor options for air quality

read more

Vancouver | AI

17:15 - Mar 27, 2021

The UK Trades Union Congress (TUC) has warned about what it calls "huge gaps" in UK employment law over the use of artificial intelligence at work. The TUC said workers could be "hired and fired by algorithm", and new legal protections were needed.

read more

Barcelona | Robotics

08:26 - Feb 20, 2021

Los humanos están siendo gestionados en un sistema de robots que trabaja a un ritmo de robot, la nueva ola de automatización no nos libera del trabajo monótono como piensan los tecnooptimistas, pero cada vez afecta a más personas https://t.co/rwc0wnJIDm

read more

ESITHOUGHTLAB

A leader in evidence-based research

ESI ThoughtLab is an innovative thought leadership and economic research firm providing fresh ideas and evidence-based analysis to help business and government leaders cope with transformative change. We specialize in analyzing the impact of technological, economic, and demographic shifts on industries, cities, and companies.

ESI ThoughtLab is the thought leadership arm of Econsult Solutions, a leading economic consultancy with links to the academic community.

For more information, please visit: www.esithoughtlab.com

For further information about this study and other thought leadership programs, please contact:

Lou Celi, Chief Executive Officer
917-459-4616 | Lceli@esithoughtlab.com

Barry Rutizer, Corporate Director
917-251-4190 | Brutizer@esithoughtlab.com

Steve Wray, Vice President, Strategic Initiatives
215-717-2777 | wray@econsultsolutions.com