Internet of Things

Using sensors for good: How the Internet of Things can improve lives
# Internet of Things

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Foreword:
The Internet of Things and its potential in International Cooperation

The Internet of Things (IoT) is growing. In urban centres of emerging countries – megacities such as Rio de Janeiro, Beijing or New Delhi – thousands of sensors are already monitoring air quality, traffic and water systems. Increasingly, local governments are using IoT technologies and the data analysis they enable to better manage resources while driving economic growth.

The potential for such economic growth is vast. A McKinsey report for example estimated the possible economic impact from traffic applications, smart waste handling, and smart water systems in urban areas at “100 billion to 300 billion US-dollars per year by 2025, assuming that 80 to 100 per cent of cities in advanced economies and 25 to 50 per cent of cities in the developing world have access to IoT technology by that time.” ¹ However, currently only a few stakeholders in international cooperation are specifically promoting IoT applications.

This report is a first attempt by the GIZ to understand and describe how the Internet of Things will impact developing and emerging countries – and how stakeholders in international cooperation should react.

Starting with case studies from Ghana, Kenya and Brazil, we will examine how IoT technology might be applied in the three key sectors healthcare, agriculture and disaster management (page 10). This will lead us on to an analysis of the key mechanisms through which IoT can create positive impact in developing and emerging countries (page 19). Based on these impact mechanisms we will finally propose measures by which international cooperation organisations can support the development of IoT to maximise this impact (page 21).

Introduction: The Internet of Things is already here

Over the last decade, a growing number of “things” have become connected to the Internet. The term “things” refers to a wide variety of devices, from cars with built-in sensors, to heart monitoring implants or smart thermostats in private homes. Sensors and network-connectivity allow these things to monitor their environment, report their status and location, receive instructions and even execute actions based on the data they receive. This giant and fast-growing network of physical objects, equipped with sensors and network connectivity, is what is meant by the term “the Internet of Things” (IoT). By 2020 an estimated 30 billion objects will be connected, but even this is only 15 per cent of all connectable things. In the coming years, the IoT revolution will affect every aspect of societies and economies around the world.

Up until now, the Internet has generally been understood as a network which manages information created and processed by people. But the Internet of Things now also allows objects to communicate with each other, make decisions and take actions – without any human intervention. By bringing devices and objects online, IoT creates new ways of managing and monitoring processes, companies and organisations.

The sensor technology which underpins IoT is developing quickly, and now ranges from basic identification tags to complex sensors. Basic radio-frequency identification (RFID) tags can be attached to almost any object. Sophisticated multi-sensors which transmit data about location, performance and environment are becoming more common. With new technologies such as micro electromechanical systems (MEMS), it is becoming possible to place such sensors in any object (even in humans). In its essence the Internet of Things can be imagined as a seamless flow of data between objects with sensors across different types of networks. Smart algorithms can learn from the data collected by sensors, make predictions, provide data-driven decisions in real time, and react to changes in environment.

Rapid growth of the Internet of Things in emerging and developing countries

It seems clear that the IoT offers an enormous potential for future economic income and prosperity in industrial countries: IoT applications are projected to create an income increase of 10.6 trillion US-dollars by 2030. Now the focus is shifting, and is no longer exclusively on industrialised contexts. As experts discussed during the IoT Solutions World Congress this year, IoT will also create substantial changes for populations in emerging and developing countries.

In some rapidly developing markets, such as in Asia, annual growth in IoT connections reached 55 per cent a year between 2010 and 2013, in contrast with Europe where it slowed to 28 per cent.

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3) Note that this definition goes beyond the Internet, i.e the global network of IP-addresses, and includes local area networks, intranets, etc.
5) Valerio (2015): IoT: Can It Bridge The Digital Divide To Fulfill Its Promise?
6) GSMA 2014: Understanding the Internet of Things.
The prospects for widespread implementation of IoT solutions in development contexts are helped by broader technological and social trends:

• Prices for sensors, an integral component of IoT applications, have declined by about 80–90 per cent over the past five years.

• Internet penetration in developing countries is increasing. 35 per cent of people in developing countries now have access to the Internet. And the falling cost of smartphones is driving rapid uptake in Internet access in the developing world. Across emerging and developing countries, a median average of 24 per cent of the population now owns such a device.

• Due to the potential of the IoT, governments in developing countries are beginning to develop policies to support IoT innovations. The first ever Internet of Things Policy Document was released by the Indian Government in October 2014 and aims to create an IoT industry in India of 15 billion US-dollars by 2020. It also addresses the following goals:

  - To undertake capacity development (human and technological) for IoT specific skill-sets for domestic and international markets.
  - To undertake research and development for all the assisting technologies.
  - To develop IoT products specific to Indian needs in all possible domains.

• Programmers and designers from Accra to Singapore are developing low-cost, IoT applications that solve problems in their communities. The results of these initiatives can be seen in international challenges and awards, as UNICEF’s “Wearables for Good Award” or the White House’s “Maker Faire”.

In order to explore the potential of IoT for international cooperation, we will now consider three sectors – health, agriculture and disaster management – including examining existing case studies. These sectors are the most relevant in developing contexts as they are the most prone for positive economic impact through IoT applications. Additionally, drawing from the research database trendreport.betterplace-lab.org of more than 700 case-studies we have found that many innovations in IoT have already emerged in these sectors and could serve as models for scaling.

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9) betterplace lab: trendreport.betterplace-lab.org, consulted 09/09/2015
IoT in Healthcare: Improving care for those out of reach

Case Study: Vaccine Wastage Sentinel Monitoring System
The Internet of Things is likely to have more impact in healthcare than in any other sector. According to industry forecasts, around 40 per cent of the global economic impact of IoT applications will occur in healthcare. The availability of smartphone-based health apps (referred to as “mHealth”) is already growing rapidly in every part of the world, suggesting that there is a strong demand for IoT health applications once the technology is readily available. The range of possible IoT applications in healthcare is broad, from vaccine-monitors to so-called “wearables” – such as smart bandages, wristbands and even t-shirts that allow remote monitoring of bodily functions and wellbeing.

Remote monitoring improves treatment

Nearly three quarters of all deaths due to chronic diseases such as cancer, chronic respiratory diseases like asthma, and diabetes occur in low- and middle-income countries. And more than 95 per cent of HIV infections occur in developing countries, two-thirds of them in sub-Saharan Africa, where over 28 million people are currently living with HIV. These chronic diseases require uninterrupted care, which is frequently unavailable in poor countries, and particularly in rural areas. Remote diagnosis and customised treatment thanks to wearable body-sensors (“wearables”) and other remote technologies can help not only to expand coverage but also to improve treatment itself.

Pilot projects in countries such as India (Khushi-Baby), Philippines (Medifi) and Malawi (Supporting Life Project) are using sensors that read a patient’s vital signs at home and transmit the data to doctors. The information gathered and analysed through hand-held devices like smartphones allows health providers to make more informed decisions. This richer source of data also puts doctors in a far better position to detect emerging problems to allow swifter intervention before the patient’s condition deteriorates, possibly avoiding costly hospitalisation. Moreover, IoT enables patients to take an active role in managing their own health.

Sensors secure medicines

According to the World Health Organization (WHO), about 100,000 deaths a year in Africa are linked to the counterfeit drug trade, and international policing agency Interpol says that, counterfeit drugs cause more than one million deaths worldwide each year. Sensors on packages and bottles could let consumers ensure that their medications are legitimate.

Furthermore, IoT technology can be used to ensure that medical supplies are stored and transported correctly, to avoid wastage or administering ineffective treatments, as the next example illustrates.
Vaccine Wastage Sentinel Monitoring System

The regular supply of vaccines and their efficient management is crucial to the success of immunisation programmes. But in many developing countries, access to vaccines is limited, and levels of wastage are high. Thus an effective and efficient management system to monitor vaccine use in immunisation programmes is important. The Vaccine Wastage Sentinel Monitoring System, which was piloted starting in February 2014 in two regions in Ghana, addresses this need by monitoring vaccines with sensors.

“In Ghana, around 30 per cent of vaccines are lost due to mismanagement or destroyed by cold-chain interruption,” says Dr. Kwame Amponsa from Ghana Health Service.

Dr. Amponsa and his team aim to address this problem through the use of digital Vaccine Vial Monitors that communicate whether the vaccine is still intact or if the cold-chain has been interrupted during transport. Using an Android-based tracking system, health workers document when and where the vaccine deliveries arrive, and how many have been destroyed or lost. An online platform documents distribution and wastage in real time. In this way the use of IoT technology helps to increase the efficiency of the vaccination programme. UNICEF is currently piloting a similar programme in Laos.

Country: Ghana
Technology: Vaccine sensors + smartphone app + online platform
Partners: Ghana Health Services, “Expanded Programme on Immunization” (EPI) by WHO, Bill & Melinda Gates Foundation (Grand Challenges Fund)
IoT in Agriculture: 
Increasing smallholder productivity

Case Study: 
Kilimo Salama
The field of agriculture provides fertile ground for IoT applications. Faced with the acute challenge of feeding a world population expected to grow by two billion by 2050, investment in IoT agriculture solutions could prove vital. IoT applications have the potential to increase both the operational efficiency of farmers and the yield of the land. So-called precision farming systems (PFS) using data from sensors measuring crop yield, moisture levels, and terrain topography can enable the targeted application of fertiliser – this increases yields whilst reducing costs, and is more sustainable. Other PFSs can steer tractors using GPS data to cover a field more precisely and efficiently than a human driver could.

**Precision farming increases yields**

In developed countries, the precision agriculture is already advanced and widely used. In the United States alone, the market for IoT in agriculture is estimated to be around 1.3 billion US-dollars per year. Emerging countries like Argentina, Brazil, China, India, Malaysia, and others have begun to adopt some PFS strategies, especially on research farms, but the adoption is still very limited. In most developing countries, by contrast, there are no specific PFS programmes due to a lack of capital, knowledge and technologies.11 This could also be due in part to the general perception that PFS cannot be applied to small-scale farms of developing countries – a false conclusion, although developing appropriate PFS technology for small farms remains a greater challenge for scientists and engineers.

**Sensors help in responding to climate challenges**

Smallholder farmers produce around 80 per cent of the food consumed in Sub-Saharan Africa. How might IoT innovations develop to respond to their needs? They are confronted with challenges such as decreasing plot sizes, hostile environments (through drought, flood or soil erosion), unstable markets and the scarcity of water and energy. For many these problems are likely to intensify in the coming years and decades.

IoT innovations can offer viable solutions in some of these areas. For example, effective drought response requires precise real-time information to proactively manage water costs. Sensors and monitoring systems can help farmers to measure moisture and find leaks swiftly.

As our next case study demonstrates, IoT innovations in agriculture might also help in other, maybe unexpected ways, such as integrating farmers in markets and services (see page 15) where access has previously been limited.

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Kilimo Salama

Traditionally it has not been economical to offer insurance policies to rural smallholder farmers due to their remote location and the small sums involved. This left them extremely exposed, since one bad harvest due to drought or flooding could ruin their livelihood.

Kilimo Salama (Swahili for “safe agriculture”), allows smallholders to insure their crops against drought and floods for the first time, by using IoT technology to increase reach while lowering operating costs.

Farmers can purchase an insurance policy for their crops along with their seed, at a cost of five per cent of the sale price of the crop. Monitoring is carried out through a network of remote, unmanned weather stations which record levels of wind and rainfall. If an insured farmer’s local weather station records extreme weather like heavy rains or drought, they receive an automated payout for lost earnings on their crops through the mobile payment system M-Pesa. This eliminates the often lengthy claims process involving an agent visiting the farm to estimate losses.

Thanks to the network of sensors, the insurance service also doubles as climate monitoring and warning system. Data from the weather stations is evaluated so that regional weather trends can be monitored and analysed. This information is passed on to the insured farmers by text message, who can adjust their plans and crops accordingly and protect or improve their harvests.

As well as increasing overall productivity through information and support services for insured farmers, Kilimo Salama has also helped to re-build farmers’ trust in the insurance sector, which is now under pressure to offer more products, such as livestock insurance.

The initiative grows from a small pilot programme in 2009 to become the largest agricultural insurance programme in Africa and the first to use mobile phone technology to speed access and payouts to rural farmers. It has expanded its scheme to other African Countries such as Rwanda, Tanzania, Zimbabwe and Nigeria reaching over 150,000 farmers.

**Countries:** Kenya, Rwanda, Tanzania, Zimbabwe, Nigeria  
**Technology:** Weather sensors + mobile payment system (M-Pesa)  
**Partners:** Syngenta Foundation, UAP Insurance, Safaricom, Kenya Meteorological Department
IoT in Disaster Management: Saving lives with early warning

Case Study: Rio Operations Centre
Due to high population density, poor evacuation infrastructure and exposure to severe weather events, developing countries are disproportionately exposed to the risks of natural disasters, and often have limited means to mitigate their effects. As a consequence, according to a World Bank study, more than 95 per cent of all deaths caused by disasters occur in developing countries.\(^{13}\)

**Compensating for scarce infrastructure**

IoT technologies can’t stop disasters from happening, but can be very useful for disaster preparedness, such as prediction and early warning systems. In this way, IoT can compensate for a poor infrastructure that puts developing and emerging countries in a particularly vulnerable position.

Take for example the monitoring of forest fires: sensors on trees can take measurements that indicate when a fire has broken out, or there is a strong risk, e.g. temperature, moisture, CO2 and CO levels. If there is a critical combination of these parameters, early warning systems alert the local population and request help. The firefighters when they arrive have detailed information about the location and spread of the blaze.

Other IoT applications are being developed for different kinds of disaster: microwave sensors that can be used to measure earth movements before and during earthquakes, for example, or infrared sensors that can detect and measure floods and movements of people.

**An alternative means of communication**

IoT innovations could not only help in disaster preparedness, but also disaster resilience. The vast deployment of IoT-enabled devices (often battery powered and able to operate and transmit wirelessly) could bring benefits in terms of data network resilience in face of disaster. IoT devices could enable limited communication services (e.g. emergency micro-message delivery) in case the conventional communication infrastructure is out of service.\(^{14}\) Hence, even though disaster resilience is not their primary purpose, this side-effect of providing a viable alternative communication infrastructure could prove extremely valuable in locations where the conventional infrastructure is weak, vulnerable or non-existent, as the following example shows.

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## Rio Operations Centre

Built in reaction to the fatal landslides in spring 2010, the Rio de Janeiro City Hall Operations Centre was launched in December of the same year, and is still the state-of-the-art intelligence centre in the world. In cooperation with IBM, the city of Rio built the centre to manage complex city environments, incidents and emergencies. The centre monitors the city 24 hours a day, seven days a week.

To be prepared for critical incidents like landslides and flooding, sensors contribute to data feeds about weather, traffic, police and medical services in real-time. They anticipate problems and put defences in place to mitigate their impact. An IBM weather and forecasting programme can predict emergencies up to two days in advance. If an emergency occurs, people and communities are alerted via social media, conventional media channels and SMS. In high-risk areas, sirens are also used to evacuate the population.

By coordinating all these activities, Rio de Janeiro is coming close to integrating all the functions of a city in one single command and control system.

| Country: | Brazil |
| Technology: | Various sensors (e.g. traffic, weather) + geo-reference system + operations centre |
| Partners: | City of Rio de Janeiro, IBM |
How IoT works in emerging and developing countries
How can we encourage IoT innovations in development contexts that further development goals? Drawing from the analysis of case studies above, recent studies and articles\textsuperscript{15} we have identified three impact mechanisms by which IoT is particularly suited to improving living conditions in emerging and developing countries. We suggest these as guiding principles when considering future IoT projects.

\textbf{Compensation for scarce infrastructure:} IoT applications can provide viable ways to overcome deficits in infrastructure. This can serve to improve critical supply chains such as vaccine provision (see case study page 12). Furthermore, in areas vulnerable to natural disasters, a network of IoT sensors can help to give early warning to affected populations, and even provide emergency communication channels (see page 18).

\textbf{Integration in markets and services:} Some population groups in developing countries, e.g. smallholders or seasonal workers and their families in rural areas, remain underserved by certain services such as insurance and healthcare. IoT-enabled technology can present radically new ways to bring these services to underprivileged markets by increasing reach while simultaneously reducing operating costs (see case study page 15).

\textbf{Increasing productivity:} Low productivity due to lack of resources and knowledge holds back economic development. IoT projects can prove beneficial here, above all in the area of precision agriculture, leading to higher yields for smallholder farmers (see page 14). This could contribute significantly to both economic development and food security.

\textsuperscript{15} e.g. see Purdy/Davarzani (2015)b: The Internet of Things is now a Thing.
Realising IoT’s potential in International Cooperation
Realising IoT’s potential in International Cooperation

We have explored some of the most important areas where IoT applications can have a beneficial role in developing and emerging countries. Although IoT is still in early stages of adoption in these markets, it is rapidly gaining momentum: “[The Internet of Things] started earlier in developed markets but now it is another area [where] the developing world has overtaken the developed world,” says Anne Bouverot, GSMA’s Director General.16

Growth is a start, but by itself it is not enough for the successful proliferation of IoT in international cooperation. Attention needs to be paid to how IoT infrastructure is rolled out and how projects are implemented in order to maximise the positive impact that IoT offers. Based on expert interviews and the impact mechanisms outlined above, we make three recommendations for realising IoT’s potential.

1) Supporting local innovations

IoT services and products should be specifically designed for the population group that they are aiming at. There are several reasons why a service might be developed for which there is no demand. It might be developed with insufficient consideration for the sometimes low levels of technology literacy and internet penetration. Alternatively it might be based on a misreading of the needs and desires of target groups and use business models that are not suited for the context.

In the words of Erica Kochi, founder of Unicef Innovation: “We’re looking for entries that are scalable and sustainable, with business models that work. We don’t want something that is a neat idea, but there’s no marketplace for it.”17

One important strategy for avoiding this is to promote local innovation. Innovators who are close to and have an affinity with the target groups are better positioned to understand their needs as well as the constraints to the local infrastructure, environment, etc. And as The IoT Design Manifesto, a guideline for IoT innovators, stresses: “Value comes from products that are purposeful. Our commitment is to design products that have a meaningful impact on people’s lives; IoT technologies are merely tools to enable that” (IoT Design Manifesto).

Local communities and innovation hubs

“The development of this so-called Internet of Things is owed in large part to hackers and makers”

USAID (2014): Mobilizing ‘Makers’ for a Better World

Communities of local innovators and “makers” already exist or are emerging in many developing and emerging countries, and involving these people in project development, as well as giving them the means to pilot their own projects, is likely to lead to better results, in terms of both social and economic impact, than a purely top-down approach. As described in the Technology Hubs Report, published by GIZ, new industries and technologies driven by the Internet require physical space in which to evolve.19 In countries where such industries are still emerging, Innovation Hubs can play a crucial role in fostering innovation and the exchange of knowledge and experience. Hubs can also create a contact point linking technicians with community organisations, development agencies, governments and investors.

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17) UNICEF Innovation (2015): Bringing the Personal Internet of Things to the Poor.
2) Enabling Public Private Partnerships

Public Private Partnerships (PPP) are an important instrument for introducing IoT technology into public services in developing and emerging countries. If well managed, these partnerships create effective and efficient IoT solutions, ensure skill transfer and lead to national champions that can run their own operations professionally.

As the main operators of public services, governments will be among the major adopters of IoT applications in the coming years. But government agencies often lack the technical expertise necessary to implement such projects, making cooperations between public authorities and private sector partners essential. This is already the case in many IoT projects: Every case study examined in this report is the result of a cooperation of private and public entities: between IT Company IBM and the City of Rio de Janeiro; between the telecommunications company Safaricom, UAP Insurance and the Kenya Meteorological Department; and between Ghana Health Service and a small local provider of IT solutions.

Avoiding pitfalls of PPPs

“Problems start where large, international IT-companies negotiate contracts about IoT projects with national governments when there is no scrutiny of the actual cost structure, continues where high-end tech is costly but not sustainable, or data is used without making customers aware of their value or privacy guidelines.”

Avoiding such frustrations and failures in PPPs requires that the government partner has a good awareness of practical and technological pitfalls, so that it can make well-informed decisions in constantly changing circumstances. Given the rapid pace of technological change and the long-term and complex nature of many of these projects, it is difficult to identify all possible risks and problems that may arise. It is thus important to recognise the need for flexibility in the partnership arrangements if circumstances should change. “While some of these issues will be able to be addressed in the PPP agreement, it is likely that some of them will need to be managed during the course of the project”. 20

“Mentorship and acceleration programs enabling new partnerships between public and private sector will be crucial for the success of IoT innovations and their possibilities to scale. These knowledge-exchange-platforms aren’t there yet. The first movers, meaning the first IoT businesses, always need a lot of help!”

Jeevan Gnanam, CEO of Orion City, Innovation Park in Colombo

An international forum which brings IoT Industry leaders (Bosch, Cisco, IBM, etc.), together with governments and NGO could help building the necessary framework and create an exchange platform for efficient PPPs in IoT. Encouraging the adoption of open standards is also important – see next point.

3) Encouraging Open Standards

So far the Internet of Things is not one single system but consists of many separate smaller networks. Some of these can be accessed by all devices, but many of them are proprietary. This causes problems in terms of cost, dependency and interoperability.

Above, we described the benefits of governments partnering with private companies in the implementation of IoT projects. However, an important risk of such an arrangement is creating a dependency, if the government does not have the ability to maintain the system – or becoming “locked into” proprietary hardware and software.

This is a problem not just because it reduces the government’s future freedom to act and may tie them into unwanted costs, but also because it can make it difficult or impossible for two IoT systems to interact and be connected with one another. Particularly in an urban context where several systems overlap, combining them can be very valuable (see case study on page 18), and building IoT applications with interoperability in mind is desirable.

In the words of Rob van Kranenburg, founder of the IoT Council: “IT companies have been installing the latest and most recent technologies in developing countries (for example reading license plates in Karachi) with dedicated costly service contracts and proprietary software, offering so-called tailor-made solutions. These systems then fail because of lack of interoperability, new governments and lack of local expertise.”

Hence we would recommend the adoption wherever possible of open standards. This both helps to avoid the risks described above, but also allows greater adaptation and innovation, since the systems will be more accessible for all to work with.

There are already several industry and non-government initiatives that are promoting and developing open source technologies and standards, such as Oasis, Eclipse, the Open Interconnect Consortium and the AllSeen Alliance (see list on page 31). Supporting open standards would also be in line with leading companies in IoT like Bosch, IBM or Samsung; the latter is currently investing 100 million US-dollars to create an open operating system for devices and sensors. Uniting these different initiatives and bridging their various approaches would accelerate the development of generally accepted open standards in IoT.

“I consider open source software as the only appropriate approach to develop IoT standards and protocols. There are no more viable arguments to not fund open source.”

Rob van Kranenburg, Founder IoT Council
Summary:
Make the most of IoT
The world is becoming more connected every day and opportunities for IoT innovations are expanding rapidly – and not only in the developed world, but especially in emerging and developing countries (see p. 8). This report shows that IoT applications in healthcare can, for example, increase the efficiency of vaccination programs (see p. 12), integrate smallholders into important services such as crop-insurance (see p. 15) and compensate for weak emergency infrastructure in urban disaster management (see p. 17). Although the possibilities of IoT applications are vast, the Internet of Things is also posing new questions and challenges for international cooperation: Which software standards ensure interoperability between different devices and networks? How are needs-based and efficient IoT applications best developed? Which kinds of partnerships support sustainable IoT programmes?

Drawing from interviews with experts from industry, academia and innovation, we have shown that promoting local innovations (see p. 22), enabling Public Private Partnerships (see p. 23) and supporting open source as common standard (see p. 24) are promising ways to help ensure that IoT realises its full potential in international cooperation. Turning these principles into workable policy guidelines and providing the necessary knowledge-exchange platforms are essential first steps.
About this Report
About the Authors

Franziska Kreische graduated with an MA in Peace and Conflict Studies and gained experience in German development cooperation while working as a student assistant at the KfW Development Bank. After her studies she lived in Uganda where she worked for various development projects.

Angela Ullrich holds a PhD in Economics and has worked in academia and as a financial analyst. Today, Angela works as a lecturer on non-profit sector economics and as a part-time researcher in the betterplace lab.

Kathleen Ziemann graduated with an MA in Politics and Cultural Sciences, and more recently trained as a Design Thinker at the Hasso Plattner Institute. After her studies she worked as an editor at Médecins Sans Frontières before joining the betterplace lab as trendresearcher.

About the Sector Project Digital World

Digital transformation radically changes the implementation of development cooperation projects. BMZ / GIZ’s new sector project “Digital World” is here to explore those new opportunities that arise with the increasing digitisation of the society as a whole. By this we aim to make German development cooperation fit for the challenges of the 21st century. As a global sector project we work in two thematic action areas. Firstly, we actively scout and identify innovative digital solutions that could be scaled in order to increase the efficiency of German development cooperation. In the second action area we broker new partnerships with the private sector in order to develop new and innovative cooperation formats.

About the betterplace lab

betterplace lab is a German think-tank on social tech. We aim to uncover, understand and champion digital-social innovation worldwide. Our research takes concrete form in numerous publications, as well as in workshops, articles for mass media outlets, and our annual conference. Our central project is the Trendreport, a database of the most innovative social tech projects we have found worldwide. Our database currently contains over 700 projects, ordered by “trends”, denoting important developments in the sector. The lab was founded in 2010, growing out of betterplace.org, Germany’s largest online donation platform, with whom we still share an office. This connection and history means that, even though we have not been direct grant-givers before, we have several perspectives on the varying financing needs of social projects.
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You want to find out more about the Internet of Things?

Here are some useful and interesting resources, conferences and institutions:

- Auto-ID labs: http://autoidlabs.org/wordpress_website
- iiLab: http://iilab.org
- Internet of Things Council: http://www.theinternetofthings.eu
- Institute of Electrical and Electronics Engineers: http://iot.ieee.org
- Bosch IoT lab: http://www.iot-lab.ch

These bodies work on Standardization in IoT:

- AllSeen Alliance: http://www.allseenalliance.org
- Open Interconnect Consortium: http://www.openinterconnect.org
- Threadgroup: http://www.threadgroup.org
- Center for Policy on Emerging Technologies http://www.c-pet.org
- Industrial Internet Consortium http://www.iiconsortium.org
- OASIS: http://www.oasis-open.org

Events and other resources:

- http://www.iotsworldcongress.com
- http://www.iotivity.org
- http://www.thethingsnetwork.org
- http://www.sociotal.eu
- http://www.iotnewsnetwork.com
- http://www.iot-dynamic-coalition.org