

Forum: Environmental Committee

Issue: Regulating and leveraging the “Internet of Things” to enhance sustainable development

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INTRODUCTION

Since Kevin Ashton first coined the term “Internet of Things” in 1999, the aforementioned technology has steadily yet increasingly evolved into a sophisticated infrastructure with a wide array of promising applications. In particular, IoT (The Internet of Things) refers to an infrastructure in which billions of sensors embedded in common, everyday devices turn the latter into ‘smart things’ that are specifically designed to continuously record, process and transfer data. Based on the data collected by the devices, IoT entities offer applications and services based on the combination and analysis of the data that corresponds to the habits or activities of the user, such as fitness tracking.¹ IoT

hence relies on the principle of extensive data processing to measure the user’s environment or behavior. As a result, the related conclusions can decisively influence the future approach to the subjects under consideration.

In this sense, bearing in mind the tremendous need for immediate response to the devastating effects of industrialization, rapid population growth as well as the ever-growing tendency towards overconsumption and exploitation of the earth’s resources IoT certainly comprises a feasible mean towards effectively tackling these blights and alternatively enhancing sustainable development. It could thus be liable to serving as a catalytic factor with regards to achieving the United Nations Sustainable Development Goals by 2030 through promoting, among others, responsible water usage and sanitation, energy efficiency, smart cities, food security, efficient agriculture and healthcare.



IoT’S ROLE IN SUSTAINABLE DEVELOPMENT

¹ Voigt, Paul; Von dem Bussche Axel: “The EU-General Data Protection Regulation - A Practical Guide”. Cham, Switzerland. Springer Nature 2017.

However, despite its broad field of possible applications, the Internet of Things is still to this day a relatively new technology with limited existing implementations. All the more, the lack of an international framework regulating universal legal standards, common architecture, security vulnerabilities and the overall mystification of this technology, are issues that hinder IoT from developing towards its full potential.

DEFINITION OF KEY-TERMS

Sustainable Development

Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs while committing to social progress, environmental balance and economic growth.

Sustainable Development Goals (SDG)

The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for humankind. They address the global challenges the international community faces, including those related to poverty, inequality, climate change, environmental degradation, peace and justice.² The 17 Goals were adopted by the United Nations in 2015 and are all interconnected, thus meant to be collectively achieved by 2030.

Food security

Food Security indicates that individuals should at all times, have physical, social, and economic access to adequate, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.

Radio frequency identification (RFID)

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader.³

Gartner Hype Cycle

² "About the Sustainable Development Goals". United Nations.

<https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

³ "Radio-frequency Identification." Wikipedia, the Free Encyclopedia, Wikimedia Foundation, Inc, 15 Jan. 2003, en.wikipedia.org/wiki/Radio-frequency_identification. Accessed 11 June 2020.

Gartner's Hype Cycle is a graphical depiction of a common pattern that arises with each new technology or other innovation. Each year, Gartner creates more than 90 Hype Cycles in various domains as a way for clients to track technology maturity and future potential. The five phases in the Hype Cycle are Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment and Plateau of Productivity.⁴

Sensors

A sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor.⁵

Cyberspace

Cyberspace is a "virtual" world created by links between computers, Internet-enabled devices, servers, routers, and other components of the Internet's infrastructure. As opposed to the Internet itself, however, cyberspace is the place produced by these links.⁶

Cybersecurity

Cybersecurity is the practice of protecting systems, networks, and programs from digital attacks. These cyberattacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users; or interrupting normal business processes.⁷

Denial of Service attack

A denial-of-service (DoS) attack occurs when legitimate users are unable to access information systems, devices, or other network resources due to the actions of a malicious cyber threat actor. Services affected may include email, websites, online accounts or other services that rely on the affected computer or network.

BACKGROUND INFORMATION

⁴ "Hype Cycle." Gartner, www.gartner.com/en/information-technology/glossary/hype-cycle.

⁵ "Sensor." Wikipedia, the Free Encyclopedia, Wikimedia Foundation, Inc, 28 May 2003, en.wikipedia.org/wiki/Sensor. Accessed 11 June 2020.

⁶ "Cyberspace." Encyclopedia Britannica, www.britannica.com/topic/cyberspace.

⁷ "What Is Cybersecurity?" Cisco, www.cisco.com/c/en/us/products/security/what-is-cybersecurity.html.

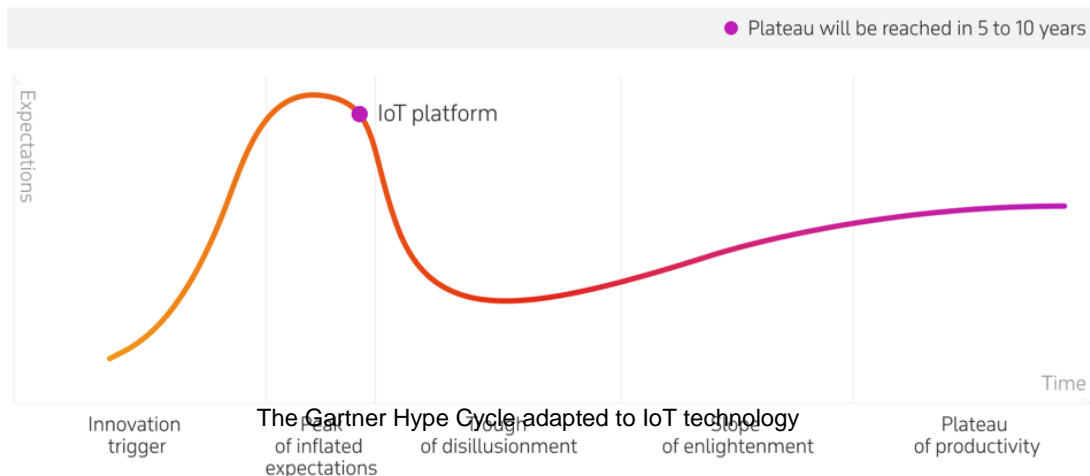
History of the Internet of Things

Past Events

Although the path towards developing the current Internet of Things began with the invention of the actual internet itself in the late 1960s, the year 1999 was perhaps the most significant for the history of the IoT. As previously mentioned, a visionary technologist, namely Kevin Ashton, first coined the term “Internet of Things” in this exact year. As he described IoT was a technology that connected several devices with the help of RFID tags for supply chain management. He intentionally used the word “internet” to draw attention to his statement seeing as the internet was just gaining popularity at the time. In spite of his idea concerning a RFID-based device connectivity fundamentally differing from today’s IP based IoT, Ashton’s breakthrough contributed greatly to the history of IoT and technological development altogether.

At the beginning of the 21st century, the term “Internet of Things” was adopted by the media, with outlets like The Guardian, Forbes, and the Boston Globe making use of the term. As interest in the IoT technology kept gradually increasing, popular demands led to the 1st International Conference on the Internet of Things held in Switzerland in 2008, where participants from 23 countries discussed RFID, short range wireless communications and sensor networks. However, it was only until the 2010s that the Internet of Things truly gained popularity once it was officially included in the Gartner Hype Cycle for emerging technologies in 2011.

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y IoT technology has been widely established in our everyday lives with multinational companies like Apple, Samsung, Google and Cisco investing in the production of IoT sensors and devices ranging from interconnected thermostats

and smart glasses to self-driving cars. Naturally, IoT is now considered an integral part of almost every industry, including manufacturing, healthcare, transportation, oil and energy, agriculture, retail and many more. Consequently, taking into consideration that IoT platforms maintain a firm position among the top trends in the current Gartner Hype Cycle, one can confidently expect this technology to reach its plateau of productivity within the next 5-10 years, hence comprising a contemporary and futuristic field of investment and research.

Objectives

As it was thoroughly analyzed IoT technology is a multidimensional and promising infrastructure. Therefore, regarding the promotion of sustainable development, the Internet of Things can be deemed useful, as previously mentioned, in a variety of applications aiming towards fulfilling the Sustainable Development Goals and thereby paving the way for a more sustainable future. The following section is going to outline the basic aspects, in which the IoT is mainly and actively used.

Healthcare

The IoT has the potential to improve health and wellbeing via providing greater efficiency and improved care in already existing healthcare systems. For instance, enabling a greater use of remote telehealth provision and enabling individuals to monitor their own health using non-specialist health tracking apps is just a small fragment of the options available. Other examples include the use of remote diagnostics systems that allow for community health workers to take measurements from patients and transmit the data to doctors or specialists elsewhere. Lastly, addressing immediate challenges in humanitarian response, such as the Ebola outbreak in Africa, becomes easier since sensor technologies and Analytics are designed to gather and send data to a central server platform in order for it to be monitored and analyzed over a long period of time and alert physicians of abnormal changes in a patient's behavior or health. In this way, IoT is able to monitor, predict, and protect Ebola patients.

Water and Sanitation

As far as water and sanitation are concerned, IoT technology usually aims at the improvement of clean water delivery and sanitation. The Internet of Things thus operates in this area through monitoring water quality, registering data on water usage and flow rates as well as providing clean water in rural places. These initiatives can prove to be of great importance since nearly one billion people in the world lack access to safe drinking water, while another billion have inadequate access to sanitation facilities.

Agriculture

In agriculture, IoT technologies can be used to increase, protect, and optimize crop production, as well as improve the storage and distribution of food. More specifically, the collected data can be utilized for a range of activities, including the dissemination of information to farmers on nutrient requirements, the prediction of weather patterns, and the provision of inputs into localized crop insurance schemes. Under these circumstances decisive steps are being made towards achieving the second (2) SDG concerning the eradication of hunger as well as the twelfth (12) SDG addressing responsible consumption and production. As a result, agriculture is among the most essential fields of application regarding the use of the IoT for sustainable development.

Natural Recourse Management

Protecting land and the environment from pollution and illegal logging, as well as protecting natural wildlife from poaching, are major natural challenges and the manual collection of information necessary to uphold this responsibility is

	Ex-post			Current			Future	
	Evaluation and Assessment			Measurement and Real-time Feedback			Prediction and Planning	
Financial Services	Mobile money agent placement			Algorithmic fraud detection	Social network analysis marketing	Agent network monitoring	Enhanced credit scoring	Algorithmic liquidity needs prediction
Economic Development	Income and poverty assessment	Mapping social divides	GDP estimates through mobile data	Migration monitoring			Text analysis economic downturn prediction	Text analysis commodity fluctuation prediction
Health	Assessment of mobility restrictions			Disease containment targeting	Migratory population tracking		Predicting outbreak spread	
Agriculture	Mobile data to track food assistance delivery			Geo-targeted links between suppliers/purchasers	Pests, bad harvest alerts		Agricultural yield/shock predictions	
Commercial	Campaign effectiveness	Social network delineated market areas					Predictive algorithms to anticipate product churn	Social network targeted marketing
Areas of highest potential impact across different sectors								
Other	Post-disaster refugee reunification	Sentiment analysis of public campaigns	Urban planning	Mobile disaster relief targeting	High frequency surveys	Crime detection	Social unrest prediction	

■ High
 ■ Medium
 ■ Low
 Pilot identified

undoubtedly hardly impossible. Contrary to manual labor, the appropriate IoT technology can, among others, track wildlife and monitor activity within protected areas as well as collect information from air and soil temperature.

Energy

According to the World Economic Forum report, so-called smart energy, or rather the energy used in IoT information networks and sensors for its storage and distribution, would enable greater efficiency, reduce the kW price and increase the use of renewable energy. All of this could lead to over 1.3 trillion MWh of energy savings from now until 2030. At the same time, large population centers will have to adapt to these innovative technologies. Buildings and infrastructure connected to the IoT, as well as smart and sustainable transportation, are projects that could reduce energy consumption, improve air quality and reduce CO2 emissions. In fact, as long as we use intelligent tools, we save energy. This technology is designed to conserve when working. For example, the thermostat might lower itself when no one is in the room. Lights might dim or shut off if the sensors don't detect movement.⁸

Improving living conditions in LEDC's

As expected, developing nations are the ones most vulnerable to water shortages as they lack the necessary basic infrastructures or efficient water management systems. The shortage of clean and safe water supply on a daily basis increases the spread of malnutrition, and severely affects food security and the population's health in general. Technology, and in particular the Internet of Things has proved to be a powerful tool in tackling this shortage challenge, and at the same time, promoting sustainable yet significant development of the nations. As a matter of fact, the most recurrent use of IoT technologies to date in developing countries is to address clean water distribution challenges and improve sanitary conditions but this only comprises a small fragment of the possible areas of application.

Challenges and Implications

Despite the various prospects the Internet of Things could possibly offer, it being a relatively new and underripe technology, poses certain challenges, implications and risks that need to be addressed. The following aspects are the main concerns currently surrounding IoT technology.

⁸ <https://www.information-age.com/energy-consumption-and-iot-technologies-what-to-know-123485884/>

Security Vulnerabilities

The IoT has already created significant security concerns that have drawn the attention of prominent tech firms and government agencies across the world. This fear was firstly realized with a massive denial of service attack that crippled the servers of services like Twitter, NYTimes and PayPal across the United States on October 21st, 2016. However, apart from the obvious security threat concerning industrial complexes' sensitive information and assets, our personal information and health can become the target of cyberattacks seeing as the IoT increasingly shifts into an inherent constituent of our every-day lives. As a result, these concerns have led to the mystification of the Internet of Things and all related technologies, hence shaping the public opinion negatively towards these allegedly dangerous, manipulative and mass-control technologies.

Regulatory and legal issues

Until today the Internet of things does not fall under a universal jurisdiction and is not operating according to specific regulations protected under the international law. On the contrary, national and regional legislations have been established to some extent, however not fully covering the broad spectrum of applications and purposes IoT technology is utilized for. In this sense, the related regulations in place often limit or hinder IoT's possibilities and in other cases contradict data protection laws. This applies mainly to medical devices, banking, insurance, infrastructure equipment, manufacturing equipment, and in particular, pharmaceutical and food related equipment.

Technical problems

Technology standards and common architectural types which include network protocols, communication protocols, and data-aggregation standards, are the sum of all activities concerning handling, processing and storing the data collected from the sensors of an IoT device. The lack thereof certainly does not favor research and production, let alone international cooperation since every invention strives to become the internationally recognized standard.

Furthermore, the connectivity of so many devices will comprise one of the biggest challenges IoT will face in the near future seeing as it will defy the very structure of current communication models and the underlying technologies. Today we rely on the centralized, server/client paradigm to authenticate, authorize and connect different nodes in a network. Despite of this system being sufficient for current IoT applications, the overwhelming number of IoT devices interconnected in the future will not be collectively supported by these centralized systems bearing in mind the financial and technical issues that will arise. Consequently, the future of IoT will actually be dependent on decentralizing IoT

networks and thus the necessary technical capacity and investments are crucial for the aforementioned transition.

MAJOR COUNTRIES AND ORGANIZATIONS INVOLVED

United States of America (U.S.A.)

In July 2016, the Netherlands became the first country to have a national network for IoT traffic. Following Netherland's footsteps, the U.S. have also made considerable progress with regards to regulating and promoting IoT technology with two bills having entered into force. In particular, the Cyber Shield Act of 2017, which is intended for the Department of Commerce to create a voluntary grading system for IoT device security, likely resulting in a labelling system that would mark the level of cybersecurity of each IoT product and most recently, the Internet of Things Cybersecurity Improvement Act of 2019, which will require agencies within the federal government and vendors providing internet connected devices to the government to directly communicate any cybersecurity risks associated with IoT devices.

United Kingdom

The UK Government has recently launched a 'Secure by Design' voluntary code of practice (CoP) intended for IoT manufacturers and aimed at encouraging the same manufacturers to develop IoT devices designed with a baseline level of security. The UK Government is also pushing for a security label scheme. Whilst the framework is still under consultation, the aim of the UK government is that retailers will eventually only be able to sell products which adhere to such requirements, and which have obtained the security label, without stifling innovation.

European Union

The EU Cybersecurity Act (the "Act"), which came into force on the 27th of June 2019, caters for tailor-made certification schemes for specific categories of ICT products, processes and services. Each scheme must specify the categories of products and services including cybersecurity requirements, the type of evaluation (for example, self-assessment) to be carried out, and finally, the intended level of assurance. On this last point, a certificate will refer to either of three different assurance levels outlined by the Act.

Rwanda

In Rwanda, IoT technology is utilized for the sole purpose of ensuring the uninterrupted supply of water. The Sweetsense company uses sensors to monitor water pumps. In this case, the device identifies which pumps are in a malfunction state and alert the maintenance service accordingly. So far, similar devices have been deployed in several Development and Cooperation Initiatives across the world, such as monitoring cooking stoves in India, monitoring latrines in Bangladesh, water filtering in Indonesia, etc.

World Economic Forum

The WEF (World Economic Forum) has introduced a framework called “The World Economic Forum’s IoT for Sustainable Development project” aiming at encouraging the use of the Internet of Things to accelerate progress on the 17 United Nations SDG’s (Sustainable Development Goals). To achieve this goal, the project explores scalable and replicable models of business, investment and collaboration across industries and with public authorities to support the design of commercially viable IoT deployments that can maximize their social value potential. In addition, this agency of the United Nations has issued certain reports outlining guidelines concerning the IoT’s contribution to sustainable development.

Food and Agriculture Organization

FAO (Food and Agriculture Organization) has been analyzing the role IoT plays and can potentially play in the future of adapting agriculture to the guidelines of the Sustainable Development Goals. Based on the results of these analyses FAO in collaboration with the World Bank has been operating the IoT webinar series, namely seminars during which various topics including IoT applications in different sectors of agriculture are discussed.

International Telecommunication Union

The ITU (International Telecommunication Union) is the United Nations specialized agency for information and communication technologies. In this sense, it has passed a resolution covering important aspects that needs to be addressed in order for the standardization of Internet of things and the enhancement of smart cities and communities for global development.

TIMELINE OF EVENTS

DATE	DESCRIPTION OF EVENT
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1965	The internet is invented
1993	First meeting of the UN Commission on Sustainable Development
1999	Kevin Ashton coins the term “Internet of Things”
2000	UN Millennium Summit: The largest-ever gathering of world leaders agrees to a set goals, known as the Millennium Development Goals, combating poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women - to be achieved by 2015
2002	World Summit on Sustainable Development
2008	1st International Conference on the Internet of Things held in Switzerland
2011	IoT is included in Gartner Hype Cycle for emerging technologies
September, 2015	UN Sustainable Development Summit – The SDG’s are adopted by world leaders

RELEVANT UN RESOLUTIONS, TREATIES AND EVENTS

Resolution 98 (Hammamet, 2016) - Enhancing the standardization of Internet of things and smart cities and communities for global development

As indicated by its thorough title this resolution by the International Telecommunication Union aims at enhancing the standardization of the Internet of Things and smart cities and communities for global development.

Harnessing the Internet of Things for Sustainable Development

This report by the World Economic Forum outlines the various possible applications IoT can have within the margins of enhancing Sustainable Development, the challenges these applications face in developing countries as well as suggestions for the promotion of IoT for Sustainable Development.

Internet of Things – Guidelines for Sustainability

Similar to the title the content of this report by the World Economic Forum outlines the guidelines in regard to making use of IoT technology in multiple sectors of life so as to promote Sustainable Development.

Webinar Series: Internet of Things for Agriculture

As previously mentioned, the Webinar Series, conducted by the World Bank in cooperation with FAO are specifically designed to assist farmers in utilizing IoT technology in order to shift agriculture towards sustainability.

PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

In today's technological climate, little to no effort has been devoted to essentially enhance the deployment of the Internet of things so as to promote sustainable development both on a national and international level. Nevertheless, separate actions have indeed been taken by member states and organizations, accordingly, mainly focusing on tackling the security concerns, the absence of standardization and the mystification surrounding IoT technology.

Concerning the latter, agencies of the United Nations, such as the World Economic Forum and FAO have actively contributed towards enlightening and educating people about the fields of application and the benefits of IoT. In this way, conspiracy theories and the overall skepticism stigmatizing IoT are at least partly discouraged, while investment opportunities are on the other hand significantly raised.

On a national level, countries like the U.K., the United States and entities like the European Union have been making considerable effort towards minimizing security concerns and promoting standardization. These strides have been achieved through

introducing labeling systems based on cybersecurity percentages and standards for IoT devices within the state.

Evidently, multilateral as well as unilateral initiatives are still nowadays underdeveloped with only few projects abstractedly addressing the issue to a small extent.

POSSIBLE SOLUTIONS

Upon examining the strengths, weaknesses and prospects of IoT technology one can easily determine the key-areas that are in need of further attention. It is thus, without a doubt, clear that the IoT still comprises a young yet emerging technology, which requires direction and guidance.

Under these circumstances, standardization is crucial to ensure appropriate protocols of Conduct, minimum standards of architecture and safety measures but above all a common ground of shared knowledge for further technological advancement. Nevertheless, the aforementioned progression requires multilateral cooperation within the international community and overcoming the constant competition currently surrounding the IoT.

On that note, promoting IoT technology in LEDC's is crucial for sustainable economic growth and the improvement of the current living conditions. Technological assistance as well as joint initiatives are certainly crucial bearing in mind the scarce financial and institutional recourses available.

Directly related to standardization is the need for extensive and thorough research in order to create the necessary technological background for the future establishment of a wide IoT landscape. As it was ascertained before, the contemporary centralized paradigm supporting connectivity will not be capable of facilitating an effective bus for all the existent IoT related devices. Innovative and creative alternatives, based on decentralizing IoT networks, are hence of great importance alongside with investments in this field.

Other than that, addressing the security vulnerabilities of current IoT technology is another issue in desperate need of attention. Protecting sensitive data from cyberattacks and security breaches is crucial to ensure the safe utilization of IoT, especially bearing in mind that it increasingly transitions into an inherent tool in our everyday lives and the size of the impact a malfunction could consequently have.



In addition, the existing margin for possible cyberattacks and the misuse of personal data and sensitive information has led to negative stigma in regard to IoT with a significant number of people accusing this technology of promoting mass-controlling, secret surveillance and more. Lifting the veil of mystification and skepticism is of course another important step towards leveraging IoT for sustainable development. Raising awareness campaigns through social media and organized projects both on a national and international level are more than welcome.

Lastly, establishing universal as well as national regulations protected under the international law is perhaps the most prominent matter at the time. By combining all current reports, related guidelines as well as national legislations a clear path towards a more safe, beneficial and innovative utilization of the Internet of Things is guaranteed.

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