

**Smart Cities and Sustainability**

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### **Smart Cities and Sustainability**

Smart cities can sound like a path to urban planning enlightenment. The phrase conjures an image of a metropolitan fluidly connected, constantly revised, and teeming with life. Part of these vignettes are true. Smart technologies have documented positive results in terms of the environment — carbon footprints have reduced and water usage shrank in some cases. However, those environmental benefits can come at a cost and, for some, the price of nonconsensual surveillance is not worth it.

Like most technological advances, there are positive and negative effects from smart cities. A solar panel in a home that is connected to a “smart” city electrical grid would use less energy and have a smaller carbon footprint. On the other side of the coin, smart technologies often require massive surveillance that could be weaponized against historically marginalized communities. This paper will outline a few of the advantages and disadvantages of smart cities and assess those attributes through the three principles of sustainability.

### **Defining Smart Cities**

Smart cities are the oncoming mile markers in urban development. Increasingly, there are new strategies integrated into urban life and infrastructure with the goal of making our cities more connected to technology. Smart city technology varies widely in definition. It can be everything from a street light that only turns on when someone is near it to constant surveillance in the name of traffic decongestion. City planners and urban sustainability professionals are likely to see more “smart” technologies presented as a viable option to address increased urbanization.

Smart cities are urban spaces that use technology to further connect and integrate its systems. (Technology in this context refers to a modern definition and not tools — technically sewage systems are technology.) The way that smart cities work is by connecting physical pieces of urban infrastructure to the internet — allowing many pieces of information to be shared in real time. This connection between the physical and cloud networks is called the internet of things (IoT) (Abbas & Ali, 2018). As an example, IoT can be sensors or meters to collect data from various points all over a city. This seamless connection helps urban planning professionals identify bottlenecks or inefficiencies throughout infrastructure and allows them to create new ways of moving through and living in cities. A central element of smart cities is the capacity to share large amounts of information, instantly. By nearly all definitions of smart cities massive data surveillance is a core functionality.

### **Advantages of Smart Cities**

There are many positive outcomes associated with smart city technology, particularly when we examine the environmental impacts. For example, in Boston traffic patterns were assessed through Big Data to identify ways to make transportation more efficient (Picon, 2015). The result was less pollution from idle vehicles in traffic. This is a prime example of how data monitoring in smart cities can help improve the way that the city functions on a daily basis.

Barcelona is often called the smart “city on a hill.” For the last two decades the city has taken steps to accelerate technology as a crucial piece of urban infrastructure. A progressive independent media outlet called “edie” shares how the entire city has 19,500 smart meters to monitor and improve energy usage (Ogleby, 2018). The article goes on to explain how:

Households now deposit waste in municipal smart bins that monitor waste levels and optimize collection routes. In transportation, Barcelona has advanced the use of EVs and bike sharing, while new digital bus stops turn waiting for business into an interactive experience, with USB charging stations, free WiFi and apps to help passengers learn more about the city. (Ogleby, 2018)

The integration of technology into the physical infrastructure of Barcelona has proven successful for their objectives.

Many urban spaces have benefited from data tracking to improve emission levels, energy consumption, and even quality of life. Picon explains:

Our cities are on the verge of a radical transformation, a revolution in intelligence comparable in scale to the one that, in its time, brought about industrialisation.

The smart city, driven by digital technology, is poised to replace the typical networked city of the industrial era, whose success was built on its hard infrastructure, from roads to water supply and sanitation systems, not only as a technological optimum but also as a social and political project. (2015, p. 9)

Networked societies are rapidly changing the face of urban expansion to become more technologically sound. The primary question seems to be whether these transformations will occur in silos or as a strategic unified movement.

Much of smart city technology consists of data monitoring through IoT. Simply tracking and sharing utility or infrastructure usage however does not make a city inherently greener. According to a report by the McKinsey Global Institute:

Air-quality sensors do not automatically address the causes of pollution, but they can identify the sources and provide the basis for further action. Beijing reduced deadly airborne pollutants by roughly 20 percent in less than a year by closely tracking the sources of pollution and regulating traffic and construction accordingly... Applications such as building-automation systems, dynamic electricity pricing, and some mobility applications could combine to cut emissions by 10 to 15 percent... Findings indicate that smart technologies could improve key indicators by 10–30 percent once introduced, and that using the current generation of smart city applications could effectively help cities make significant or moderate progress toward meeting 70 percent of the Sustainable Development Goals. (Woetzel, et al., 2020)

### **Disadvantages of Smart Cities**

The nervous system of smart cities is Big Data; it provides the interconnection and is how the collected data is turned into useful observations. When we consider the power of Big Data the question arises — who owns the data that is collected? There is an unfathomed concentration of power placed in the hands of the companies that collect and interpret the data tracking our every movement. Data gathered from smart city technology has immense value. It is the information that holds the key to customer behavior. The financial gain that companies can acquire from this kind of data dwarfs any product sales imaginable. A consolidation of power has historically never benefited those farthest from that status quo. This logic leads us to one of the primary concerns regarding Big Data — the amount of control it can have over our cities and even individual rights when owned by the few instead of the many.

Smart cities must consider the wellbeing of all people in order to be sustainable. One of the ways to do this is to allow diverse communities (those that are outside of the typical cisgender, white, and male that often make up tech companies) to be part of the building process. Donna, Janice, and Dyah (2020) show that all should be included in the creation and implementation of smart cities to ensure they are truly being used to benefit the entire community and not just a small few. They go on to say that this involvement cannot be achieved without a “gender-responsive approach.” This research utilizes literature studies, online surveys, and structured interviews as their methods of data collection. The results of this research reveals that gender-responsive approaches to planning and city management are necessary to create a sustainable future, which includes social justice.

Social innovation done in smart cities requires an understanding of technology users through community empowerment, especially for women. Women and men should have equal rights and opportunities in the application of technology. Therefore, various capacity building efforts for women must take place on multiple levels, with the integration and support from the collaboration of all stakeholders. This amounts to a paradigm shift in both the planning policies, regulation and management of smart cities. Cooperation among all parties is critical, whether in partnership or collaboration between government and private parties and other institutions that prioritize public services for the community. (Donna, Janice, & Dyah, 2020)

The objective of this study was to create social frameworks for participation in smart cities. It also serves as a **cautionary tale to the detrimental effects if these systems are not created**

as gender-, racial-, religious-, able-, and economically-responsive. A potential inhibitor to smart cities being sustainable is only making them sustainable for a small group of the population. When “progress” is made without the backbone of equity, even when it is in the name of sustainability, it is merely another tool of the extractive economy and ultimately a step further down the path to environmental and social destruction.

Research conducted by Abbas and Ali (2018) discusses the social and technical impacts of IoT on both people and cities. Their research focuses on the risks that IoT creates in the realm of privacy. Surveillance, even when intended for good, comes with a valuable data set that can be a taunting prize for those with malicious intentions. Community privacy is not only a financial and security issue, it is a moral one that concerns all areas of urban society.

Moreover, the IoT systems may rob people of some of their humanity, infringing on their privacy, because people are also regarded as “things” in the IoT paradigm. Given the social trepidation surrounding IoT implementation, local and international associations related to IoT privacy, and legislation and international laws, are needed to maintain the personal right to privacy and to satisfy the demands of institutional privacy in urban contexts. (Abbas & Ali, 2018)

The study by Abbas and Ali (2018) aimed to connect people outside of the IoT field, like other technologists, architects, and sociologists. They conclude that all of these fields need to consider the impacts of IoT upon privacy. The study addresses the early proposals of IoT and urbanism in the context of current challenges. They then go on to share research that supports IoTs inherent connection with insecure systems. The study also defines privacy and explains how IoT impacts family security.

### **Assessing Smart Cities Through Urban Sustainability**

A sustainable urban space is synonymous with wellness in every aspect. In a sustainable space, the environment and natural world can exist in a sustaining healthy cycle, the exchange of goods and ideas is accessible for everyone, and people are able to live in healthy ways.

Sustainability connects economy, ecology, and equity to systems that promote ongoing wellness.

Smart cities must be assessed through these three lenses when evaluating their sustainability.

#### **Economy**

The economic health of a city should not be measured in GDP or other capitalistic identifiers of positive growth. Instead, when we consider the economy we must view it as the ongoing exchange of goods, services, and information between people. Economic stability requires efficient markets just as much as it does accessible education.

There are two examples given in *Smart Cities and Sustainability Models* that document the positive economic impact of smart city technology (Lorena, 2011). In the city of Bari, fishing boats often have a smart application installed that allows fishermen enter the type of fish and connect instantly with the markets regarding that day's catch (Lorena, 2011). This helps the markets meet demand and the fishermen sell all of their fish from the day. Because economic function requires ongoing exchange, smart city technology is extremely helpful in boosting the economic health of a system since smart technology must share information to function efficiently. If we consider information exchange as a symptom of economic well being, in this sense we can view necessities such as healthcare as indicators of prosperity. Spain Public Health Service is one of the few cities that has a regionally integrated healthcare system. Patients can go



to multiple healthcare facilities and know that their doctor is seeing an up-to-date chart for their care. This connection helps people receive better treatment and allows information to be freely exchanged. In the realm of economic function, smart cities rarely have downfalls.

### **Ecology**

Proponents of smart cities often will point to environmental benefits of large scale data surveillance. Real-time observations can positively influence the ebb of systems like transportation and yield environmentally sustainable results. **Intelligent transport systems helped Stockholm reduce traffic by 20 percent and emissions by 12 percent** (Lorena, 2011).

In our age, sustainable development depends on access to more and smarter solutions. This will determine less consumption of non-renewable resources and at the same time increase the production of new resources like solar energy. All of this will improve the quality of life and the efficiency which are related with the definition of sustainability. (Lorena, 2011, p. 85)

**Smart cities can help reduce emissions and even guide urban behavior to make more sustainable decisions. However, the technology of smart cities is often built to perpetuate the pieces of an extractive economy instead of replacing it with a regenerative system that would create more environmentally friendly urban environments.**

### **Equity**

Smart city technology is pulled between the duality of equitable interaction and access and the inherent exploitation that comes with Big Data. On one hand, smart cities usually allow nearly anyone to access and be integrated into a more technologically forward city.

Using cloud computing in schools, each pupil or student can access the most advanced educational content, software and computing resources and storage....Through a smart educational system, according to the latest data published by IBM in 2010, teachers can analyze student data electronically — from academic results, to information on mobility and presence. This information will help teachers identify individual student needs and to individualize instruction as to improve the process of their results, while retaining confidentiality. Smart systems are also ensuring that universities do not bear alone the burden of education but also to other interested parties. (Lorena, 2011, p. 85)

Access to information can greatly improve a city's equality for its residents, but the backbone of that information system can exploit marginalized communities. Data surveillance comes with privacy, security, and human rights risks. Currently the way smart cities must exist is under the controlling hand of Big Data, which as a fast growing capitalist sector, puts profit before people. Cities that utilize smart technology exist within a duality when assessed through the lens of equity.

### **Conclusion**

Many smart city technologies do not move us away from an extractive economy. These integrated technological systems offer small environmental benefits without the transparency and

collective oversight that would create a truly sustainable space. Sustainability cannot exist without intersectionality. By definition something that is sustainable must be part of renewable economic, environmental, and equitable systems. The findings of this research conclude that smart cities are not as a whole sustainable because they do not meet all of the criteria for urban sustainability. Further research is needed to document and assess the longevity of smart cities and their impact on economic, environmental, and equitable wellness.

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