10 Policy Principles for Unlocking the Potential of the Internet of Things

By Daniel Castro & Joshua New | December 4, 2014

Summary: "The Internet of Things" encapsulates the idea that ordinary objects will be embedded with sensors and connected to the Internet. To date, most discussion of the Internet of Things has highlighted the technology; to the extent it has addressed policy, the focus has been largely negative (i.e. how to limit the supposed risks from deployment). In contrast, this report highlights principles that policymakers in all nations need to apply in order to maximize the considerable promise of the Internet of Things for economic growth and social well-being. Of two conflicting approaches to the Internet of Things, neither: the "impose precautionary regulations" nor the counter "leave it completely up to the market" will allow societies to gain the full benefits from the Internet of Things revolution. This report presents ten principles to help policymakers establish policies and programs to support and accelerate the deployment and adoption of the Internet of Things.

The success of the Internet today can be credited in part to policymakers actively taking a role to ensure its growth, and this same approach should to be applied to build the Internet of Things.

The Internet of Things encapsulates the idea that ordinary objects—from thermostats and shoes to cars and lamp posts—will be embedded with sensors and connected wirelessly to the Internet. These devices will then send and receive data which can be analyzed and acted upon. As the technology becomes cheaper and more robust, an increasing number of devices will join the Internet of Things. Though many of the changes to everyday devices may be subtle and go unnoticed by consumers, the long-term effect could ultimately have an enormously positive impact on individuals and society. A connected world is capable of anything from improving personal health to reducing pollution to making industry more

productive. The Internet of Things offers solutions to major social problems, but this vision of a fully connected world will not be achieved without initiative and leadership from policymakers to promote its deployment and avoid pitfalls along the way.

The potential size and scope of the Internet of Things is enormous, with over 16 billion devices estimated to be in use today, and many more to come.[1] By 2020, the total worldwide count is expected to reach over 40 billion.[2] This growth is visible across practically every industry. By 2020, the number of wearable devices will surpass 100 million, the number of Internet-connected cars will exceed 150 million, and the number of connected wireless lights will reach 100 million—to name just a few.[3]

The magnitude of the benefits brought by the Internet of Things is also impressive, and this technology may improve nearly every aspect of life. Consider the benefits of smart homes. Connected devices that automatically regulate electricity usage based on whether anyone is home can cut energy usage and bills.[4] Smart meters can send dynamic price signals to smart appliances to reduce peak energy consumption.[5] Connected sensors can improve home safety by detecting fires and other emergencies more quickly and reliably than traditional methods, alerting authorities sooner.[6] Blinds that automatically detect and filter out sunlight, smart heating and cooling systems that can maintain different rooms at different temperatures, and lighting that automatically adapts to time of day and can be controlled from a smartphone will make home life more comfortable than ever before.[7]

Connected devices can also provide consumers important new insights about their health and fitness. Companies are designing wearables for every stage of life from smart "onesies" with embedded sensors that help parents monitor their infants' health to activity sensors that allow elderly adults to live safely and independently. Wearable biometric monitors can help individuals track their health, monitor chronic medical conditions, and improve health care outcomes.[8] In addition, fitness trackers such as FitBit and Nike FuelBand can help consumers be more active and engage in healthy behaviors.[9]

Local leaders can help build smart cities by integrating the Internet of Things into public buildings and infrastructure, including roadways, transit systems, and utilities. These technologies can help make cities safer, more sustainable, and more resilient while also providing new economic opportunities for their residents. For example, networked sensors can monitor the structural integrity of bridges and highways in real time to prevent catastrophes from happening and encourage cost-savings through timely preventative maintenance.[10] And, intelligent transportation systems

can make roads safer, facilitate traffic flow, and make public transportation more efficient.[11]

Industries that restructure their practices around the Internet of Things can improve productivity and sustainability. With everything from networked assembly lines that track every screw turn to ensure quality control and safety to connected supply chains that reduce downtime and ensure transparency in material sourcing, the Internet of Things will increase industry competitiveness.[12] The increased capacity for data collection from the Internet of Things brings benefits as well. Insurers can use actuarial models that factor in data from connected devices to better understand risk and reduce costs for their customers. Companies can monitor and enhance the safety of their workers in real time and prevent accidents.

Overall, global spending on the Internet of Things is predicted to grow to approximately $3 trillion by 2020.[13] Of course, any capital equipment represents a cost, not a benefit. In that businesses and consumers purchase technology only if benefits exceed costs and because many benefits extend beyond the immediate purchasers to the entire network, the overall economic benefits from the Internet of Things will be even more significant.[14]

As technological barriers decrease and adoption of the Internet of Things takes off, its potential benefits depend in part on how policymakers respond to this technology. There are four main approaches policymakers could employ regarding the Internet of Things:

1. Precautionary regulations: Some policymakers focus on the potential risks associated with the Internet of Things and want to regulate it accordingly. These policymakers believe that preemptive regulations will increase consumer trust and therefore increase adoption, but the reality is that heavy-handed rules would likely imposes costs, limit innovation, and slow adoption.

2. No intervention: Some policymakers resist laws and regulations for the Internet of Things because they believe the free market operating independently of government interventions achieves the maximum possible consumer benefit. However, by avoiding all interventions, policymakers miss the opportunity to proactively support the deployment of the Internet of Things.

3. Indigenous innovation: Some policymakers view the Internet of Things as an opportunity to create export opportunities for domestic firms. These policymakers may endorse policies that hinder foreign companies from competing in the domestic market, such as

adopting national technical standards rather than adopting international ones.[15] Such policies are anti-competitive and create fragmented markets for the Internet of Things.

4. Technology champions: Some policymakers have taken a proactive role in accelerating the development and deployment of the Internet of Things, such as by funding research on sensor networks, creating pilot projects for smart cities, preventing over-regulation of wearable health technologies, and providing incentives for smart grid deployment. These policymakers see government as a critical partner in promoting the benefits that come from using these technologies.

Recognizing the inherent shortcomings and limitations of some of these approaches is crucial to developing sound policy for the Internet of Things. The status of the Internet of Things as an emerging technology necessitates a policy framework that is fully cognizant of its benefits, allows for future innovation, and responsibly protects against misuse without restricting its capacity to deliver social, civic, and economic benefits.

10 POLICY PRINCIPLES FOR THE INTERNET OF THINGS

1. CHART THE COURSE FOR ADOPTION

Every nation should develop a strategic roadmap to guide the deployment and adoption of the Internet of Things. In addition to a comprehensive roadmap, national agencies involved in specific sectors can develop targeted action plans for particular industries. In the United States, for example, the Department of Housing and Urban Development should develop an action plan to promote smart homes, and the Department of Energy should develop a plan to improve energy efficiency with connected devices. The private sector will be more likely to embrace the Internet of Things if government leaders are paving the way for deployment.

Policymakers should actively work to overcome barriers to adoption, such as security risks or a lack of interoperability. For example, electronic health records should be able to integrate data from wearable medical devices and the government can promote industry adoption of voluntary cybersecurity principles to protect consumer data. Since many of the benefits from the Internet of Things will occur with widespread adoption, policymakers should promote efforts to develop global, industry-led standards and oppose efforts to develop nation-specific standards. To maximize the potential benefits of data analytics, developers should also

be able to easily share and integrate data across organizational, political, and geographic boundaries.

2. LEAD BY EXAMPLE

The government should be an early adopter of the Internet of Things to demonstrate the benefits of the technology. From sewers to streetlights, government agencies should make "smart" the default for all new investments and allocate funding for smart city demonstration projects. For example, all government infrastructure projects should incorporate the Internet of Things into their design. Investing in smart technology for public infrastructure projects will increase safety, reduce maintenance costs, and improve operations. In addition, these projects will generate valuable data that should be made available to the public.

To maximize the benefits of the Internet of Things, government agencies should restructure their practices around the new capabilities offered by the technology. Public services that incorporate connected sensors can provide important benefits to the public. For example, the city of Buffalo, New York uses sensor-equipped snow plows to respond to citizens' snow-clearing requests more quickly and to target problem areas more efficiently.[16] And, government agencies that perform inspections of equipment and facilities can use the Internet of Things to perform their duties more quickly and effectively. For example, the U.S. Department of Agriculture (USDA) approved new regulations to allow advanced imaging sensors to evaluate food safety and quality. As a result, a single poultry food safety inspector can now process 175 birds per minute, up from a previous speed of 35 birds per minute, a substantial gain in efficiency.[17]

3. LOOK TO PARTNERSHIPS TO OVERCOME OBSTACLES

Many Internet of Things projects will benefit from government agencies establishing partnerships with both the private sector and others in government. In particular, funding these types of projects can be challenging for cities with limited budgets. For example, a city may not have the budget to install smart streetlamps, even if they would end up paying for themselves in energy savings. Innovative partnerships whereby the private sector pays for, builds, and manages certain technology projects while receiving a portion of the savings can allow local leaders to deliver the Internet of Things and its benefits in situations where budget constraints would have otherwise impeded progress. For example, the city of Mumbai, India partnered with a smart metering company to help with its failing water infrastructure that was leaking 50 percent of its water a day. For the same amount of money the government would have spent patching new leaks without ever improving the overall integrity of the system, the partnership with the metering company cut the water loss in half.[18]

4. REDUCE REGULATORY BARRIERS AND DELAYS FOR GETTING SMART DEVICES TO MARKET

A lengthy and cumbersome regulatory review process that increases the time to market for smart devices can discourage entrepreneurs from developing new and potentially lifesaving products. Wearable technologies can allow individuals to spend less time in the hospital, receive better treatments, and more easily monitor their personal health. Since subjecting these technologies to lengthy regulatory review processes can delay these benefits from reaching consumers, policymakers should work to ensure that these processes are as efficient as possible. Moreover, most of these technologies will undergo continuous innovation and improvement and the regulatory review process should allow for, and encourage, upgrades. In a clear example of a review process with room for improvement, it takes on average over two and a half years for the U.S. Food and Drug Administration to approve a low-risk medical device, compared to an average of seven months in Europe.[19] These delays can cost a company an average of $500,000 per month and discourage entrepreneurs from bringing products to market.[20] While consumer safety should remain a top priority, the human cost of delaying lifesaving technology should not be ignored.

5. MINIMIZE THE REGULATORY COST OF DATA COLLECTION

Policymakers should create laws and regulations that allow businesses and governments to build products and services efficiently, using the highest quality, most complete data possible. For example, obtaining explicit consent for data collection would be an unnecessary cost for the vast majority of applications of the Internet of Things that pose no real threat to consumer welfare. Regulations requiring individuals manually to give consent to data collection would impose costs on companies that ultimately would be passed on to consumers. Instead, the standard method of data collection for the Internet of Things should be "opt out"; this would ensure that the data is accurate, complete, and useful, yet still provide those who wish not to share their data that option.

Similarly, policymakers should recognize that consumers do not benefit from being inundated with notices, especially since most data collection would be routine and insignificant. Rather than require that all devices directly notify consumers of their policies and terms of service, companies should simply make this information available to those who wish to read it. This type of shift is especially important since many devices that will make up the Internet of Things will have only a small display or no display at all.

6. MAKE IT EASY TO SHARE AND REUSE DATA

The Internet of Things will generate an unprecedented quantity of data, and policymakers should be careful not to equate simple data sharing with harmful misuse. Data collected from connected devices offer a myriad of potential benefits to consumers, clinicians, researchers, government agencies, and commercial entities, and if these datasets are shared, these benefits are multiplied. There may be one primary reason to collect data, but one hundred good applications of this data beyond its initial purpose. In order to maximize the social and economic benefits of information, data users of all kinds acting in good faith must be able to share and reuse data with ease.

As governments at the municipal, state, and federal levels integrate connected devices into public infrastructure and government services, the de-identified data they collect should be treated as a public resource and shared with the public accordingly. Making this data easy to access, such as through portals and application programming interfaces (APIs), and free to reuse without restrictions creates tremendous opportunity for private-sector innovation, academic research, and improvements in government transparency.[21] The city of Chicago, which has been integrating the Internet of Things into city infrastructure and services as part of its Array of Things project, has made over 600 machine- and human-readable datasets freely available online.[22] With this new resource, citizens have been able to more easily navigate public transit, the city's pest-control agency has reduced the rat population, and the police have created predictive models to fight crime more effectively.[23]

Since the full potential benefits of the Internet of Things will not be realized until data from interconnected technology are widely used, policymakers should incentivize both individuals and the private sector to share data. For example, governments can support the development of new tools and techniques to properly de-identify different types of data so that they are still useful for analysis.[24] Where possible, companies should be encouraged to provide consumers access to their data to stimulate the development of new applications. For example, the U.S. Department of Energy's green button initiative gives consumers access to their energy usage data and allows them to share their data with third-party developers who provide services such as virtual energy audits.[25] Policymakers should also work to ensure data can flow across borders and eliminate digital barriers to trade, such as data residency requirements and other localization policies.

7. RELENTLESSLY PURSUE BETTER DATA

With ever-higher-quality sensors and an increasing number of them, the Internet of Things allows for the capture of an unprecedented quantity and

quality of data. Policymakers should continue to invest in opportunities to collect more granular, timely, and complete data. Government agencies should use better data to better monitor internal processes and improve productivity and outcomes. For example, police departments can use sensors to better monitor the safety of their officers in real time and to hold officers responsible for their actions. Port authorities can use sensors to better protect the border by tracking containers and shipments coming into the country. Better data enables not only a more effective government, but a more transparent one as well.

8. REDUCE THE "DATA DIVIDE"

Policymakers should encourage widespread adoption of connected devices, from wearable fitness trackers to sensors on street corners, to close the "data divide"—the social and economic inequalities that may result from a lack of collection and use of data about an individual or community.[26] The goal of policymakers should be to ensure that no groups are systematically excluded from data collection activities so that all individuals have the opportunity to obtain the social and economic benefits of data. Policymakers should work to develop programs to ensure that all communities can benefit from the Internet of Things. For example, funding for smart city infrastructure should be made available to a diverse set of neighborhoods, including low-income ones.

9. USE DATA TO TACKLE HARD PROBLEMS

While the Internet of Things offers many economic benefits, policymakers need to ensure that opportunities to use these devices to address important social issues, such as health care and public safety, are also a top priority. For example, aggregate data from personal fitness devices can provide health officials with unprecedented insights into public health. Tracking changes in biometric readings across a city could even help identify the spread of deadly outbreaks, helping public officials better contain diseases and start treating sick individuals earlier. As Google's CEO and co-founder Larry Page has noted, public squeamishness over mining of health data likely costs around 100,000 lives a year.[27] Policymakers should support efforts to collect and aggregate data on a large scale to solve collective problems.

Networked sensors can detect flooding and trigger emergency responses more quickly.[28] Wearable technologies and sensors on street corners can give new insights onto air quality on a block-by block- basis and help develop strategies to curb pollution.[29] The list of ways public welfare could be enhanced by the Internet of Things is long, but if it is to be fully effective in addressing these problems, policymakers should shift their focus to the problem-solving capabilities of smart devices.

10. WHERE RULES ARE NEEDED TO PROTECT CONSUMERS, KEEP THEM NARROW AND TARGETED

Many technologies are often met with fear, uncertainty, and doubt, especially by those who are unfamiliar with them or opposed to change. Policymakers cannot afford to succumb to these forces if they expect to enable society to take full advantage of the Internet of Things. In particular, policymakers should be extremely cautious about regulating on the basis of purely speculative concerns that might not even come to pass, especially when doing so might curtail substantial economic and social benefits, many of which are already being realized today.[30] Most hypothetical concerns are likely to never become realities if factors such as market forces, cultural norms, and new technologies, intervene. In addition, existing laws, such as anti-discrimination statutes, often protect individuals from certain types of abuses and harms.

However, policymakers should intervene promptly if specific problems arise. In doing so, they should be careful to ensure that their rulemaking targets specific, demonstrated harms. Attempting to erect precautionary regulatory barriers for purely speculative concerns is not only unproductive, but it can discourage future beneficial applications of the Internet of Things. For example, privacy activists raised objections when several cities made plans to install gunshot detection equipment in public spaces. However, the effectiveness of these technologies in reducing gun crime has proven to be incredibly valuable to law enforcement.[31]

CONCLUSION

These ten policy principles serve as a blueprint for Internet of Things policies that promote adoption, increase the value of data collected from connected devices, and maximize the benefits of the Internet of Things for consumers, government, and industry. While many of the future challenges of the Internet of Things may still be unknown, a policy framework built around these principles should maximize the benefits from the Internet of Things. The success of the Internet today can be credited in part to policymakers actively taking a role to ensure its growth, and this same approach should to be applied to build the Internet of Things.

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