

## COVID-19 AND THE INTERNET OF THINGS

Smart networks of mechanical and digital machines have the potential to mitigate future pandemic risks. There are plenty of stumbling blocks, however.



Johannes Müller  
Head of Macro Research

IN A NUTSHELL

- \_ Conventional wisdom has it that Covid-19 will speed up familiar trends, such as those toward automation and digitization.
- \_ A closer look at one of the supposed beneficiaries, the Internet of Things, suggests a more nuanced picture.
- \_ The ultimate outcome may well look more like many varied networks of things, rather than one single Internet of Things.

How will Covid-19 influence the Internet of Things (IoT)? Conventional wisdom has it that the pandemic will speed up familiar trends, such as those toward the automation of ever larger parts of the production of physical goods, and the further digitization of goods, services and social interactions. This suggests a bright future for the IoT. We would define the term as cyber-physical systems, in which mechanical and digital machines exchange data in a network without requiring human intervention.<sup>1</sup> Such systems can make use of robotics, sensors, real-time analytics, machine learning and cloud computing in order to fully automate processes in corporate or consumer applications. All of these have lately become buzzwords. But a closer look at the prospects for IoT suggests a more nuanced picture.

The idea of physical devices forming networks with each other is arguably almost as old as the Internet itself. It probably all started with a single beverage vending machine at the computer science department of Carnegie Mellon University in the early 1980s.<sup>2</sup> Recent years have already seen the IoT spread into plenty of new areas. Smart manufacturing allows for shorter cycle times at lower inventory levels, decreased order times, higher production flexibility and more customized products.<sup>3</sup> Connected and automated assembly lines can exchange data, decide autonomously how to deal with unexpected problems and even predict

events, such as necessary maintenance before a machine ceases to work. In the long run, this should boost productivity growth and not only for large caps.<sup>4</sup> Already, many companies appear to see the current crisis as a chance to press the reset button and rethink their business processes.

Smart homes are another growing trend. Fire and flood sensors are already making houses safer. Insurance companies are paying attention – some of them are even adjusting premiums on contracts accordingly. Similarly, several cities, such as Cascais in Portugal, have long experimented with IoT networks to improve waste and traffic management. So far, these smart city projects may have been somewhat overhyped.<sup>5</sup> New technologies take time to spread. Having to work with cash-constrained and somewhat bureaucratic municipalities may not have helped matters, either. Still, the pandemic might well speed up the deployment of smart devices. Public spaces, especially airports and train stations, could be monitored with infrared cameras to detect fevers, for example. Software could also analyze video feeds to examine whether large offices are abiding by social-distancing measures.<sup>3</sup>

The coronavirus has forced societies to drastically reduce physical contact, leading to an unprecedented contraction in global economic output. Sadly, many epidemiologists assure us that Covid-19 is unlikely to be the last zoonotic pan-

<sup>1</sup> A good introduction to the concept and its history can be found in the article "As Objects Go Online" from "The Fourth Industrial Revolution: A Davos Reader," 2/12/14

<sup>2</sup> "The "Only" Coke Machine on the Internet," Carnegie Mellon University. [https://www.cs.cmu.edu/~coke/history\\_long.txt](https://www.cs.cmu.edu/~coke/history_long.txt)

<sup>3</sup> <https://www.mckinsey.com/industries/advanced-electronics/our-insights/coronavirus-industrial-iot-in-challenging-times>, 4/22/20

<sup>4</sup> <https://www.deutsche-bank.de/pk/investments/finanzmarktwissen/markt-und-meinung/automatisierung-und-robotik-die-industrie-der-zukunft.html>, 7/23/19

<sup>5</sup> Huber, Financial Times, "Internet of Things: Smart cities pick up the pace," 1/29/20

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demic.<sup>6</sup> In part, this is because humans claim ever more natural space, thus living in close proximity with animals. Any such disease would probably spread fast, once global trade and travel flows have recovered from Covid-19.

The IoT could prove one of the more potent ways to actively mitigate future pandemic risks. Covid-19 has shown how vulnerable we are, strengthening the case for making the post-crisis economy as contact-free, remotely supervised and automated as it possibly can be. This will require vast investment in digital infrastructure and automation.

Will this investment be forthcoming? Various bits of conventional wisdom suggest that the odds are quite good. A series of articles published by the World Economic Forum has tried to assess the impact of Covid-19. Among other things, it predicted a more integrated, wireless and contact-free economy.<sup>7</sup> This fits neatly with some other ideas, currently fashionable in Davos and elsewhere.

The trauma of recent supply-chain disruptions follows several years of growing trade tensions, notably between the U.S. and China. Tensions over Hong Kong may further reinforce doubts in Western boardrooms over their companies' dependence on China as a manufacturing hub. The ongoing struggle over technological leadership could prove to be an unexpected motor of even faster development and adoption of cutting-edge technologies.<sup>8</sup> In the short term, it is also likely to increase pressures to shift away from complex global supply chains, in favor of localized production.<sup>9</sup>

Moves to bring back production closer to end markets would help avoid the repetition of the supply-chain standstill companies experienced this spring. It is an open question, though, whether this will be a sustainable solution. Partly, it will depend on the relative costs of capital and labor after Covid-19. The history of deadly pandemics, notably the Black Death in medieval Europe, suggests rising wages, as workers become scarcer.<sup>9</sup> However, the effects of the current pandemic might well be different. As for financing capital expenditures, current conditions certainly look likely to remain cheap for now. Plenty of the freshly passed fiscal packages include support directed at technological development.<sup>10</sup> On top of that, central banks have indicated that interest rates will stay low for several years to come.<sup>11</sup> However, someone will eventually have to pay for all the fiscal largesse.

Assuming that wages remain high in the United States and Europe and capital remains cheap, automating production would indeed be one way to keep costs low.<sup>12</sup> This would have added advantages during future lockdown scenarios. After all, machines can be switched off, often slowing their asset depreciation, while employees would still have to be paid or laid off just to be hired again once production restarts. Another factor facilitating automation might be falling costs of capital equipment partly driven by lower commodities prices. Commodity prices (as tracked by the Bloomberg Commodity Index) are currently about 40% below their 10-year average and had been relatively low even before Covid-19.<sup>13</sup> That is oddly reminiscent of commodity-price trends before and during the industrial revolution in the British Empire towards the end of the 18th century.<sup>14</sup>

Alas, that historic parallel also suggests one way in which investors' current infatuation with the IoT could end badly. The social upheaval during the industrial revolution gave rise to a backlash, which transformed politics and economics in Britain and elsewhere.<sup>15</sup> This literally included workers attempting to smash up machines – the so-called Luddite uprisings in the East Midlands. Since then, vivid narratives of automation threatening jobs have been a regular feature in many countries, especially during economic downturns.<sup>16</sup>

More broadly, the Covid-19 pandemic will probably change plenty of attitudes in lasting ways that are hard to foresee. According to Karl Mannheim's "sociology of generations," this is especially true for those experiencing it during youth.<sup>17</sup> If so, the pandemic is likely to cast a long shadow, given its far-reaching effects on everything from schooling and job prospects to family life.

Already, there are signs of a permanently stronger role of government in the private sector. Concerns about climate change are also running high among digital natives. At first glance, the proliferation of IoT, going hand-in-hand with an increase in smart devices and therefore growing energy consumption, is not reconcilable with climate change. However, research institutes are developing electronic circuits with more integrated elements to recuperate energy dissipation from heat or vibration. Companies are also working on devices with the ability to harvest energy from radio waves and other common frequencies.<sup>18</sup>

<sup>6</sup> <https://www.pnas.org/content/pnas/111/52/18519.full.pdf>, 12/30/14

<sup>7</sup> <https://www.weforum.org/agenda/2020/05/how-the-fourth-industrial-revolution-can-help-us-handle-the-threat-of-covid-19/>, 5/7/20

<sup>8</sup> [https://www.bofaml.com/content/dam/boamlimages/documents/articles/ID20\\_0467/the\\_world\\_after\\_covid.pdf](https://www.bofaml.com/content/dam/boamlimages/documents/articles/ID20_0467/the_world_after_covid.pdf), 5/5/20

<sup>9</sup> C.W., *The Economist*, "Plagued by dear labour," 10/21/13

<sup>10</sup> For example, the European Union's envisioned 750bn recovery plan aims to build a "modern, clean and healthy economy." See: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_20\\_940](https://ec.europa.eu/commission/presscorner/detail/en/ip_20_940), 5/27/20

<sup>11</sup> Fed: <https://www.federalreserve.gov/monetarypolicy/files/fomcminutes20200610.pdf>, 6/10/20; ECB: <https://www.ecb.europa.eu/pub/economic-bulletin/html/eb202004.en.html>, 6/18/20

<sup>12</sup> Joyce, Orr, Kelly, Kendal, Deutsche Bank Research, "Life After COVID," 05/2020

<sup>13</sup> Bloomberg Finance L.P. as of 7/15/20

<sup>14</sup> <https://www.economics.ox.ac.uk/materials/papers/12767/allen115.pdf>, 06/2013

<sup>15</sup> Polanyi, K. (1957 ed.) *The Great Transformation*, First Beacon Paperback. See esp. chapter 7, on early resistance to the Industrial Revolution.

<sup>16</sup> Schiller, R. (2019) *Narrative Economics*, Princeton University Press. See esp. chapter 13, on "labor-saving machines replace many jobs," as one of several "perennial economic narratives."

<sup>17</sup> Mannheim, K. (1928), "Das Problem der Generationen," In: *Kölner Vierteljahreshefte für Soziologie*, 7. Jg., H. 2; S. 157-185; first translated into English in 1952 as "The Problem of Generations"

<sup>18</sup> Twentyman, *Financial Times*, "IoT drives progress towards low-power technology," 1/8/18

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Perhaps most consequentially, Covid-19 might prompt policymakers to think more carefully about all sorts of low-probability and high-impact events, not just future pandemics. Ominously, the IoT has already shown itself to be highly vulnerable to hacking with potentially catastrophic consequences. The omnipresence of smart devices, all connected to the internet, would be accompanied by a high dependence on and arguably a potentially dangerous vulnerability created by this system. If nuclear plants, dams and hospitals all go online, security becomes a major concern. The dangers of IoT become apparent in much less sensible environments already: In 2016, the "Mirai" botnet<sup>19</sup> used a collection of connected consumer appliances like home routers to launch attacks on company websites.<sup>20</sup>

In the post-Covid environment, voters and policymakers may even be less willing to accept systems shown to be fragile. Other concerns include privacy and data protection, as well as how to roll out 5G telecoms networks, without becoming dependent on equipment makers from China. None of these concerns will necessarily prevent some of the phenomena currently fashionable under the label of IoT from becoming business success stories. After all, old sys-

tems may be at least as, if not more vulnerable to security breaches. But the ultimate outcome may well look more like many varied networks of things, rather than one single Internet of Things. Such fragmented, but perhaps interlinking networks may be less vulnerable to attacks.

Either way, we believe those who provide the infrastructure and the services necessary for the adoption of this interconnected, yet mostly contact-free, economy are likely to benefit. On the hardware side, this ranges from 3D printing for additive manufacturing and assistive industrial robots ("cobots") to semiconductors and sensors. On the software side, it includes data security and data storage as well as cloud systems to coordinate and oversee factory processes. Also likely to be among the winners are specialized consulting services, promising clients to enhance their enterprise's IT capabilities or guide them through the transformation towards an integrated, data-driven entity. Identifying the precise beneficiaries within any given sector, however, will probably be even trickier than usual. Understanding underlying technological, social and economic trends in the aftermath of Covid-19 are likely to be key success factors for any investor wishing to benefit.

## GLOSSARY

The **Bloomberg Commodity Index (BCOM)** traces 23 commodities and reflects commodity futures price movements.

**Capital expenditure (Capex)** are funds used by a company to acquire or upgrade physical assets such as property, industrial buildings or equipment.

**Cloud computing** encompasses technologies and services that offer the dynamic and flexible use of a third party's IT infrastructure.

In relation to currencies, **depreciation** refers to a loss of value against another currency over time.

**Fiscal policy** describes government spending policies that influence macroeconomic conditions. Through fiscal policy, the government attempts to improve unemployment rates, control inflation, stabilize business cycles and influence interest rates in an effort to control the economy.

**Large cap** firms generally have a market capitalization of more than 10 billion dollars.

## APPENDIX: PERFORMANCE OVER THE PAST 5 YEARS (12-MONTH PERIODS)

	06/15 - 06/16	06/16 - 06/17	06/17 - 06/18	06/18 - 06/19	06/19 - 06/20
Bloomberg Commodity Price Index	-13.3%	-6.5%	7.3%	-6.8%	-17.4%

Past performance is not indicative of future returns.

Sources: Bloomberg Finance L.P., DWS Investment GmbH as of 7/17/20

<sup>19</sup> A botnet is a network of often secretly hijacked machines (e.g. personal computers or smartphones) that tend to be used for malicious purposes without the knowledge of their owners.

<sup>20</sup> Kuchler, Financial Times, "Three plead guilty to causing massive US cyber attack," 12/14/17

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