Tech startups are booming everywhere, we argue in a recent special report. We invited Mariana Mazzucato, professor in SPRU at the University of Sussex and author of *The Entrepreneurial State: debunking private vs. public sector myth*, to comment on it. The startup boom, she says, is partly a result of the lack of high quality jobs in the "old economy". But it is also a result of policies based on myths around entrepreneurship and startups. Although these are a global phenomenon, her comments focus mainly on Britain, where she is an advisor to both government and opposition.

THE fascination with Tech City stems from a perception that Britain is missing the kind of "entrepreneurship" culture that fuels Silicon Valley. This idea nurtures a British infatuation with small and medium enterprises (SMEs) which dates back to the early 1970s and is based on the idea that economic growth is created by "entrepreneurial" small firms. The thinking has informed not only the Tech City project, but also recent policies aimed at increasing lending to SMEs. Unfortunately, there is little empirical evidence to support such policies.

SMEs and the startups that form part of this group are neither under-financed, nor are they particularly valuable to the economy—whether measured by jobs, productivity or innovation. Research at the University of Cambridge (Hughes 2008) suggests that the British government spends (directly and indirectly) close to £8 billion ($13 billion) annually on SMEs—more than it spends on the police and close to the amount it spends on universities. Is this warranted? How do we know it would not be better to simply direct

that money to teachers where there is plenty of evidence that quality education raises human capital and growth.

In fact, once you take into account the number of SME jobs lost after the first three years of their creation, there is very little net job creation by these firms. Only 1% of new enterprises have sales of more than £1 million six years after they start. Research at the University of Sussex shows that median sales of a six-year-old firm is less than £23,000 (Storey, 2006). These firms also tend to be the least productive and least innovative (R&D spending—the best measure we have for inputs in the innovation process—in Tech City is not higher than in other parts of London or Britain). Indeed, the few high growth innovative firms (about 6% of the total SME group, Nesta, 2011)—those that really should be supported—do not directly benefit from the hype that surrounds SMEs and startups: once they get the funds these are too diluted to make a difference.

The focus on *entrepreneurial ecosystems* is symptomatic of the misplaced obsession with SMEs and startups in terms of their ability to generate innovation and growth. What I believe should be emphasised is not startups or entrepreneurs in and of themselves, but the *innovation* ecosystems within which they operate and which they depend on if they are to become what does matter: high growth innovative firms (*of any size*) within that system.

Innovation-led "smart" growth has occurred mainly in countries with a big group of medium to large companies, and a small group of SMEs that is spun out from some of those large companies or from universities. These firms have benefited immensely from government funded research. Indeed, in my book I show how many firms in Silicon Valley have benefitted directly from early-stage funding by government, as well as the ability to build their products on top of government funded technologies. Every technology that makes the iPhone smart was government-funded (internet, GPS, touch-screen display, SIRI). Apple spends relatively little on R&D compared with other IT firms precisely because it uses existing technology. It applies its remarkable design skills to

these technologies, effectively surfing on a government-funded wave. Apple, Compaq and Intel also all enjoyed the benefits of early-stage public funds (SBIC in the case of Apple, SBIR in the case of Compaq and Intel). As for America's biotech boom (and the startups it has spawned), it was fuelled not by a random rise of genius and tinkering but by two fundamental factors: the 1980 Bayh-Dole act that allowed publicly funded research to be patented (which led to an exponential rise of spinouts based on such patents), and the massive funding of the underlying knowledge base. Between 1936 and 2011 the publicly funded National Institutes of Health spent $792 billion (in 2011 dollars), with last year's budget alone totalling $30.9 billion. Small innovative firms benefit immensely from interacting with such an ecosystem. Left alone they get preyed upon by an increasingly short-termist financial system.

Indeed, another obsession in the world of startups is venture capital and its role in nurturing innovation. Yet Silicon Valley firms were initially not funded mainly by venture capital. It came in after the ball had got rolling thanks to funding by the Department of Defence, the Department of Health and, more recently, the Department of Energy. In fact, there is increasing evidence that many startups are told by venture-capital firms to go first to SBIR and then come back (Block and Keller, 2013).Venture-capital funds are not providing the kind of patient long-term finance needed for radical innovations. They are too focused on a profitable "exit"—usually through an IPO or a sale to a bigger company—within 3-5 years. But innovation often takes 15-20 years. Only a few big firms today spent as much on basic research as companies such as Xerox and AT&T (Bell Labs) did in the 1960s and 1970s. Cisco spends as much on share buybacks (to boost stock options and executive pay) as on R&D, with Apple on its way to do the same. But an innovation ecosystem requires large and small companies to be co-financing innovation alongside the public sector—not just benefitting parasitically from it.

Patient long term funding does exist in China where the government's 5 year plan includes spending $1.7 trillion on sectors

including new generation IT and environmentally friendly technology, and where the China Development Bank (CDB) is investing tens of billions of dollars in the emerging green economy ($26 billion in 2012 alone), as well as lending billions to new high tech stars like Huawei. Indeed, across the globe it is public investment/development banks—such as the CDB, Germany's KfW, the EIB, and Brazil's BNDES—that are financing many renewable energy projects, including the related R&D. Recent data from Bloomberg New Energy Finance shows that in 2012 total investment by state investment banks in renewable energy totaled $80 billion, compared to a mere $12.5 billion by the private sector. Startups in the emerging green innovation ecosystem will likely thrive in those countries where the public sector is able and willing to fund the high-risk investments that create the technologies and platforms which startups can then thrive on. And as private finance has retreated from financing the real economy, preferring to finance itself, the role of such public financial institutions is only growing. But not everywhere—and this is what will very likely differentiate the impact of startups across the world. It is very likely that startups will be more successful in the few countries that have resisted pressures to cut publicly funded R&D, such as Germany, which has increased the amount since 2009 by 20%, or China that has increased R&D spending by 170% over the last 10 years. The sequester, which is already impacting US publicly funded R&D, will no doubt be bad news for future startups in America.

Silicon Valley's latest hero, Elon Musk, launched Tesla, a successful maker of electric cars, with a $500m guaranteed government loan. (This is the same amount received by Solyndra, the now-defunct solar-panel maker, but we only hear about the public losses of course). But the startup communities in both Silicon Valley and Britain are all-too-slow to recognise such support, and instead lobby to get more generous tax breaks for investors.

The problem is that entrepreneurs that benefit from state funding are often the first that bash the state as an impediment to their creativity (Peter Thiel—whose PayPal would not exist without the

once government-sponsored internet, supports the idea of entrepreneurs moving to a boat off the coast of California so they do not have to pay any taxes). Such emphasis on tax reductions, mixed with pressures for government to make cuts across the board, is putting at risk the wave that America's VCs have surfed on for the past 50 years. Their business was boosted by the massive public funding for IT and biotech which has attracted more than 80% of total venture-capital investments in recent years. Government investments created the low-hanging fruit VCs could pick. Tax reductions sure make them richer in the short term, but won't help them make good investments in the long run.

Another key element of a healthy *innovation* (not entrepreneurial) ecosystem is the links between different elements of that system. In Germany such links are created by well-funded Fraunhofer Institutes. In Britain these are being imitated through the Catapult centres, which in theory should be linked to Tech City-type projects, either through procurement policy or via learning. Currently there are no links between these. And whereas the Fraunhofer system has an annual research budget of €1.8 billion ($2.4 billion) and a network of 20,000 staff across 60 centres (in 2010), Britain's Catapult centres were given just £200m to spend over 4 years. When the Tech-City gurus in Number 10 Downing Street criticise the Technology Strategy Board, which is in charge of the Catapult strategy, for not being more like Darpa, they ignore the very different size of TSB's budget in comparison with Darpa—and even more the fact that the TSB does not have the market creating potential that Darpa does.

Even more problematic is the fact that public-private partnerships, which the Catapult centres are trying to set up, require an engaged business sector. If startups remain small, and low spenders on R&D, they will not be engaged partners. And a core problem across the EU is a lack of business R&D spending by larger firms. Whereas business spending on R&D (as a proportion to GDP) is relatively high in both Germany (2.5%) and America (2.6%), in Britain and the Netherlands it is only 1.7%, significantly below the OECD average of 2%. The lowest spenders are precisely those

that also have the lowest public spending on R&D: Portugal, Italy, Greece and Spain. The constant lobbying for tax incentives and subsidies in Britain and across Europe is a symptom of the problem: a non-engaged private sector.

What we need if we are to avoid the much-feared “secular stagnation” is not many small startups—or an obsession with financing “SMEs”–but an innovation ecosystem in which these new firms are made relevant through a dynamic interaction of public and private investments. This requires a public sector able and willing to spend large sums on education, research and those emerging areas that the private sector keeps out of (because of high capital intensity and high technological/market risk); large firms which reinvest their profits not in share-buybacks but in human capital and R&D; a financial system that lends to the real economy and not mainly to itself; tax policy that rewards long run investments over short run capital gains; immigration policy that attracts the best and the brightest from around the world; and rigorous competition policy that challenges lazy incumbents rather than letting them get away with high prices and parasitic subsidies.

Unfortunately the current situation is a very lonely one for the startups. More revolution, less celebration is needed.