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Compared with the smokestack industries of yesteryear, the IT industry enjoys a squeaky clean image, reinforced by recent initiatives from vendors designed to stress the "green" credentials of their businesses or products.

But just how green is the IT industry and how sustainable is the lifestyle and work culture it promotes?

Until recently, few would have bothered to ask the question. The grassy campuses and laid-back working conditions of Silicon Valley are the envy of other industries and in terms of environmental impact, chip plants and computer factories seem the epitome of clean.

But just because the IT industry leaves few obvious signs of its presence does not mean that we should not be concerned at its broader environmental impact, says Peter Arnfalk, associate professor at Sweden's International Institute for Industrial Environmental Economics.

He was researching sustainability long before "green living" became fashionable and while acknowledging the key role played by IT in helping create a more sustainable society, he is critical of the often simplistic treatment given to complex environmental issues by IT vendors.

"No one is going to single out the IT industry on its environmental record, which is generally good. But because of the size of the industry and its pervasive nature, we need to look beyond the direct environmental impact of its products," he says.

Take the example of two factories in China. One is a hi-tech facility producing mobile phones that would not look out of place in Silicon Valley. The other produces cement and belches thick smoke.

China's heavily polluting primary industries are an easy target for environmentalists as an all-too-visible symbol of the high environmental price being paid for China's galloping economic development.

But one could argue that the mobile phone factory is partly responsible, at least morally, for China's soaring greenhouse gas emissions.

"That's because the mobile phone industry needs the cement that the Chinese factory produces," says Mr Arnfalk.

Less cement would mean fewer cities and roads in China, which would mean less mobility and less need for mobile phones. As China is now the world's biggest mobile phone market, with almost 500m users, mobile phone companies need China's cement factories, like it or not. "Its all inter-related," Mr Arnfalk says.

Nevertheless, few businesses want to take responsibility for the sins of others, and so IT vendors' environmental initiatives have traditionally been limited to minimising the direct effects of their products and processes - making them easier to recycle or eliminating toxic chemicals, for example.

These initiatives have recently been reinforced through standards such as the Energy Star 4.0 regulations on energy consumption or the WEEE directive on recycling.

Mr Arnfalk says compliance-based initiatives are laudable so far as they go, but they do not go far enough and a more holistic approach is needed.

"The industry needs to go beyond simply ticking the boxes and look not just at the direct effects of using its products but also the indirect and system effects," he says.

One well-researched indirect effect of modern IT and communications technologies is transport substitution. Teleworking and videoconferencing technologies make it possible for people to work remotely and potentially reduce the need for so much commuting and business travel - a key source for CO<sub>2</sub> emissions.

An example of a system effect is banks and other customer-facing businesses relocating their headquarters to out-of-town locations because much interaction is now done electronically or by phone.

The IT industry claims the indirect and system effects of an information-based society are generally positive for the environment. But Mr Arnfalk warns against drawing simplistic conclusions.

"If you compare the energy used in commuting to the energy used when working from home, then there is greater [environmental] benefit in the latter," he says.

But if the teleworker needs an extra room at home to work in, then you have to factor into the calculation the cost to the environment of building and heating that extra room.

In the US, 40 per cent of the nation's energy consumption is for heating and cooling buildings, and Mr Arnfalk says IT systems have had a significant positive impact in reducing the energy bill with so-called intelligent building systems that save energy.

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In terms of overall energy consumption, then, a central building with good transport links and the latest energy-saving technologies may work out to be a greener choice than allowing people to telework from home.

Despite the apparent energy savings from creating less congested roads at peak commuting times, teleworking suffers from so-called "rebound" effects that may negate any potential benefits.

Mr Arnfalk says that one surprising rebound effect is that teleworkers can end up making more car journeys than if they were commuting to the office.

They take advantage of their independence to break up the day with school runs, shopping trips and leisure activities. And because teleworkers often live in out-of-the-way locations, they can use a litre of petrol just to buy a litre of milk.

Mr Arnfalk acknowledges the complexities inherent in calculating the overall environmental impact of an IT-based society. "It all depends on where you put the system boundaries. I've looked at a number of examples and each case is unique," he says.

Nevertheless, the IT and telecoms industries are waking up to the need to look at sustainability in a more holistic way.

He gives the example of Sweden's Telia, which has reduced CO 2 emissions by 50 per cent in three years by reducing office space, working more flexibly and eliminating all but essential business travel, 80 per cent of which was for routine internal meetings.

"The vendors are starting to walk the talk but I think the industry still needs a fundamental rethink," he says.

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