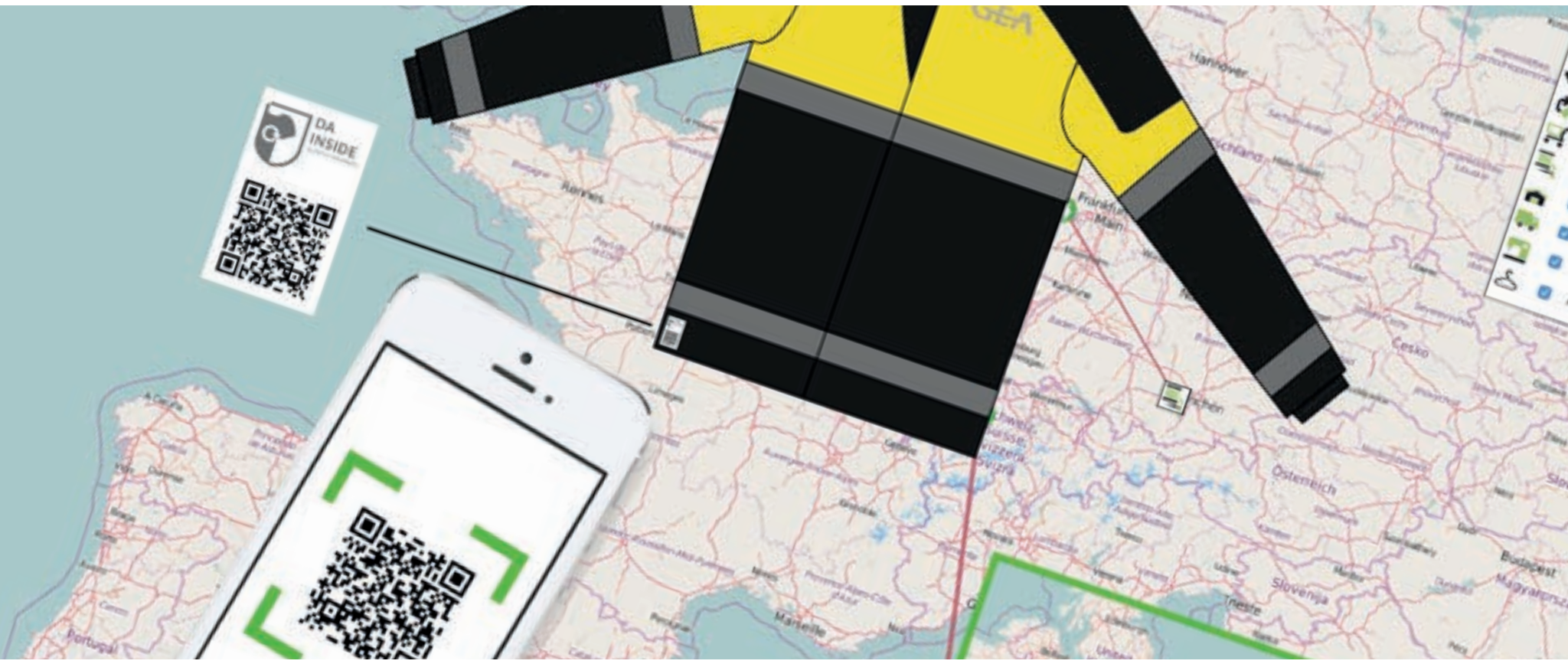

DUTCH AWEARNESS

Big data and the circular economy

The revolution will be circular

By Maxine Perella

The explosion in connected devices is getting the wheels of the circular economy turning

With up to 50 billion connected devices predicted by 2020, the emergence of what the World Economic Forum calls the fourth industrial revolution could finally unblock some of the bottlenecks that are hampering the transition towards a circular economy.

When applied to manufactured products, digital technologies have the capability to provide remote visibility and asset control – enabling the location, use, condition and value of materials to be tracked at every stage of their lifecycle.

There are clear benefits here for manufacturers seeking to offer more circular business propositions such as closed-loop processes, remanufacturing or product-as-service (servitisation) models. Manufacturing has long been a focal point of circular economy research as it offers lucrative potential. According to the Ellen MacArthur Foundation (EMF), materials savings in the EU alone in an advanced circular economy scenario could amount to $630bn a year.

These savings would primarily stem from extending the use cycle of assets, increasing their utilisation and "cascading" them – in other words, creating more opportunities for diversified reuse of products, component parts and materials. Through the application of big data analytics, manufacturers can

Manufacturing has long been central to the circular economy

get a better handle on predictive maintenance, real-time route optimisation, product use patterns and customer requirements.

Non-destructive reuse

"The recurring theme will be about identifying and segregating items and materials in ways that destroy as little as possible of the value and the embedded energy," says circular economy consultant Sandy Rodger, who previously led Project Mainstream at EMF. "That's why information-based solutions have an advantage over purely chemical or mechanical solutions, which tend to be energy intensive in themselves and also generally work by breaking things down."

One internet-of-things (IoT) approach that is showing early signs of promise is the use of radio-frequency identification (RFID) tags and QR codes for closed loop clothing models. The EU-funded EcoProFabrics project is exploring the potential to commercially scale up "circular workwear" using a 100% recyclable polyester-based fabric built around a circular supply chain, which can be tracked and traced at every stage.

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Dutch Awearness retains ownership of its 'circular workwear'

The clothes are offered on a use and performance contract, enabling the manufacturer – in this case, Dutch Awearness – to retain ownership of the garments. At the end of their use, worn out garments are collected, shredded, spun and woven into new materials and garments without any apparent loss of quality.

The closed loop process is facilitated by a circular content management system (CCMS) that captures data from all partners in the supply chain, via unique barcodes embedded into the raw materials and products. By scanning the codes, customers can access information on traceability, certification and lifecycle indicators such as reduced carbon and water use.

Dutch Awearness uses the CCMS system to keep track of the garments, particularly through their use and return phase, to help prevent material flows leaking out of the system. "The system gives you real-time data of the supply

'Information-based solutions can segregate materials without destroying their value'

chain. It shows us exactly where the clothing is, and who is wearing it. If it's not returned to use, we can send them a message to send it to us," says Dutch Awearness founder Rien Otto.

By scanning barcodes customers can get information on traceability

Extended model

The Extended Closed Loop model proposes a similar concept, with a leaning towards more consumer fashion. Led by German textiles designer Ina Budde, the aim is for digital codes to be individually embedded into fully recyclable garments. Once scanned, each code links to a product-specific website that contains a wealth of data including material composition, sourcing, traceability and instructions for dealing with the garment at end-of-life to ensure optimum reuse or recovery. The information is intended to be accessible to key stakeholders along the value chain – designers, manufacturers, recyclers and consumers.

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Dutch Awearness founder Rien Otto

For larger manufacturers such as information technology and communications firms that already offer fairly mature IoT-enabled solutions and infrastructure, opportunities around remanufacture beckon. Canon's EMEA sustainability and compliance specialist Norah Lewis says that big data is now a key focal point for the company's sustainability team.

"For a long time we've had networks and printers that are smart, that record data, that can send documents and information to people automatically," she says. "We're now trying to link up all of that data collection, all of that technology, with the circular economy. We're asking how we can utilise our existing systems and infrastructure in a different way."

Lewis sees Canon's business-to-business portfolio as being initially easier to target as corporate assets tend to be larger, retain higher value over time and are easier to get back. "With the B2B offering, we're already focused on servicing and leasing. We have a big existing infrastructure with regards to service engineers, spare parts, refurbishment and remanufacturing so we have a lot of these activities in place," she says.

"I would like to see more tracking and traceability of those assets through the system because that will enable us to identify the best end-of-life scenarios for these machines and try to get them through a cascading circular hierarchy built around reuse, refurbishment and recovery."

CANON

Connectivity of devices could unblock the circular economy

Big data is now a key focus for Canon's sustainability team

How long in the loop?

Data interpretation will be key. Lewis says much of the data Canon gathers to assist with environmental compliance issues such as producer responsibility obligations on packaging and e-waste could be mined further. "What we're really interested in learning about is the product journey, how many times we can circulate a product and keep it in use, and ultimately what we do with those assets once they are at the end of their serviceable life."

On a wider level, the UK-based High Speed Sustainable Manufacturing Institute (HSSMI) is investigating the potential for manufacturers to build circular value chains. Susanne Baker, who overlooks sustainability, environment and compliance programme for trade group techUK, says the HSSMI is already testing IoT-enabled devices on manufacturing equipment in an attempt to predict failures in equipment, "something that can be incredibly costly for manufacturers to manage".

Harnessing such data also opens up the possibility for more manufacturers to remotely fix equipment, which would avoid the need for third-party servicing or returning assets back to a retailer or refurbishment warehouse. EMF's Intelligent Assets report takes this one step further, suggesting that the need for human intervention to maintain, reuse or recycle materials is being minimised.

"Imagine a world in which all high-value assets belong to their manufacturer, who is incentivised to maintain and improve them on an ongoing basis. Not only your car, but computer, washing machine, lighting system, fridge – they all have the inbuilt ability to securely communicate with their manufacturer," the report states.

According to Dax Lovegrove, former director of sustainability and innovation at Kingfisher, owner of European DIY chains including B&Q, the placing of intelligent, connected assets in the home could not only help shape more responsive product repair and replacement services, but also open up a

closer relationship between manufacturer and end user. “That’s where it gets exciting,” he says. “The opportunity is there. It’s whether manufacturers want to move more into the wider society with those sorts of technologies.”

The digital deficit

Such scenarios are still a long way off, however. The manufacturing trade group EEF notes that while there is a high level of appetite among British manufacturers to embrace new technologies, many lack a deeper understanding of the implications of the digital revolution.

“Recent discussions with our members indicate they are not fully aware of what the fourth industrial revolution could mean for their businesses,” says Finella Elliott, the EEF’s climate and environment policy adviser. She points to a number of barriers, one being a pressing need for cost-effective digital infrastructure.

A recent EEF survey found that businesses are having to pay a premium to ensure high-speed internet access and are concerned that poor digital connectivity may limit future growth. While 44% said their internet connection costs have risen in the past two years, more than half said their current internet connection will not meet their expected needs over the next five years.

“Manufacturers are likely to continue to face a number of challenges in the future that they are grappling with now, such as access to finance, regulatory burdens and uncertainty in available technologies. These can serve to limit the extent to which new technology can be adopted,” says Elliott.

OSVEHICLE

The Nika open-source electric vehicle

The survey also highlights that investment in new technology is not being matched by investment in managing risk, meaning concerns around cyber security and governance are likely to intensify. Elliot points out that if security issues are not adequately managed, a single cyber breach could potentially discourage other manufacturers from adopting similar technologies.

One solution to help address data security risks associated with asset tracking could be database technologies such as Blockchain, which act as tamper-proof ledgers of digital transactions between different parties. Provenance, a software platform that allows consumers to trace the provenance of products, is looking to incorporate Blockchain thinking into its asset-tracking platform.

“If we are tracking all our stuff, we need to find ways of anonymising the data without losing its specificity,” says Sandy Rodger. “Ultimately a company picking up a used item for reuse needs to know an address and details of the item itself, and be able to make a payment to an individual. There’s no escaping the potential for this to become very intrusive.” ■

There are concerns that poor internet connectivity in the UK may limit growth

Open source: code for collaboration

Open source, an approach that taps into free knowledge sharing, co-creation and collaborative problem-solving, is gaining traction in the circular economy field. Opening up intellectual property in particular could widen the potential for various activities such as third-party disassembly, repair and remanufacture.

"Most players in the circular economy field are struggling with a similar set of problems, and open source provides an effective methodology to collaborate together," says Sam Muirhead, an open source consultant and one of the team behind OSCEdays, a global open source circular economy hackathon.

Muirhead says that while proprietary business models tend to focus on a single product or an individual company, open source business models look at the financial sustainability of the entire ecosystem in which a product exists.

"The ecosystem perspective is what we need in order to build a real circular economy, not just circular products," he says, emphasising that this involves going beyond employing standard methods.

"We can't solve a problem without accurate information about it, and we can't assume that we have all the right people in the room already. Opening data about materials, resource flows and manufacturing processes is the first step; publishing information and giving anybody the permission to use it and contribute to a solution."

Levi's is cutting water usage

Those, like Muirhead, who advocate open source are cautious about how the terminology is used, as currently not many circular projects adopt a genuinely open approach, in which information or data is shared publicly through an open source licence, giving explicit permission for anyone to use it for any purpose.

Muirhead points to Levi's as one manufacturer that is sharing a lot of its research and experience on reducing water usage in textile manufacturing, despite not having an open source licence. "They are setting a precedent and taking the first step in what can become a reciprocal process of other textile manufacturers reporting back on their experience with these processes and improving them," Muirhead says.

Another leading example is OSVehicle's Tabby Evo, a hardware open source platform for electric vehicles, which is free to use. Anyone can use the framework to create their own vehicles, enabling businesses and startups to design, prototype and build custom electric vehicles and transportation services.

Projects on OSVehicle include BusyBee, the first road-legal city car built on the open platform; FabCar, a vehicle that can be built entirely inside a FabLab; and Nika, the first connected car made specifically to enable the development of apps, so that readings such as speed can be shown on a mobile device rather than on traditional dials.