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An Addendum to

A Cashless Society- Benefits, Risks and Issues (2018 Addendum)

Issue 21- Environmental sustainability of a cashless society

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A Cashless Society- Benefits, Risks and Issues (Interim Paper) Addendum Contents

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Reading pre-requisites

This paper supplements the “Cashless Society- Benefits Risks and Issues (Interim Paper)”, and additional papers published by the cashless society working party on the Institute and Faculty of Actuaries (IFoA) website in December 2017.

Resource URLs:

- Interim paper: <https://www.actuaries.org.uk/documents/cashless-society-benefits-risks-and-issues>
- Cashless Society Working party: <https://www.actuaries.org.uk/practice-areas/finance-and-investment/finance-and-investment-research-working-parties/cashless-society-working-party>

Background

The Institute and Faculty of Actuaries (IFoA) is the UK's chartered professional body dedicated to educating, developing and regulating actuaries based both in the UK and internationally. The Institute promotes and supports a wide range of research and knowledge exchange activities with members, external stakeholders and international research communities.

A volunteer working party published an interim report in December 2017, sponsored by the Finance & Investment board at the IFoA, focusing on the "Cashless Society- Benefits Risks and Issues". It concluded: "A cashless society and its underpinning digital economy should open opportunities for most stakeholders in many economies, including the financially excluded. Yet the topic is divisive due to clashing stakeholder interests that lead this group to raise the importance of addressing substantial risks and issues for successful transition."

The working party documented a list of 20 major risks and issues that affect stakeholder groups differently:

Issues	Risks
Hidden agendas	A cashless society may not live up to its promises
Trust in banks	Displacement towards alternative means of payment
Trust in governments	Totalitarian regimes
Economics of money	Sovereignty risks
Financial exclusion	End to the right of a private life?
Change leadership	Innovation marketplace and user experience
Digital economy readiness	Lack of competition on payments market
Security of transactions, data and biometrics	Excessive reliance on technology
Social value of cash	Politics vs innovation
Removing cash may stall the economy	Financial stability

This addendum proposes a further issue should be added to the log, relating to the environmental sustainability of payment technologies: what are the life cycle environmental costs?

Key takeaways

- Transition from paper to polymer notes drives down the environmental cost of physical cash in the UK.
- The environmental cost of cotton paper notes has been assessed in a study at 1.3 to 1.5 times that of debit cards transactions.
- ATM and Point of Sale equipment shift the environmental impact of payments onto electricity consumption.
- Data oriented services through payment and social media place ever-increasing levels of demand onto ICT infrastructure such as data centres, known for their high environmental impact.
- Mining, involved in resolving cryptocurrency transactions under Distributed Ledger conditions, requires currently unsustainable levels of power, one of the threats to the scalability of decentralised currencies.
- QR code payments may disrupt the payments ecosystem for their sustainability potential.
- Generalised use of mobile payments may enable some circular economy virtuous cycles, such as the reach of recycling schemes and sharing platforms to reduce wasted capacity.

Keywords

cashless society; environmental sustainability; environmental impact assessment; environmental impact of coins and bank notes; environmental impact of card payments and Point of Sale (PoS) equipment; ATM energy use; smartphones and the environment; Distributed Ledger Technology and electricity consumption, QR code payments.

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Cashless Society – Benefits, Risks and Issues (Interim Paper)

Introduction to Addendum

The interim paper “ A Cashless Society: Benefits, Risks and Issues” assessed a number of key economic aspects with a view to balance the arguments, and documented a log of 20 risks and issues.

Now in its second phase of research, the Working Party is exploring further implications of a cashless society. This paper focuses on the environmental perspectives of a cashless society, and proposes to add a new issue to the register.

This paper explores four key areas:

1. What is the environmental cost of cash?
2. What is the environmental cost of cash alternatives? Will QR codes disrupt the ecosystem?
3. What are the synergies between a cashless society and a circular economy?
4. Drivers and policies towards a circular economy.

Section 1: The environmental cost of cash

Cash is currently key to the economy: as a resource, it keeps circulating until physically destroyed, by regulation, wear and tear, accidental damage or loss. Minters keep improving materials for durability. The interim paper (1) assessed the cash management activities cost as a % of GDP, generally around 0.5 to 1% of GDP in most developed economies, rising to 2% for Japan and 3.2% in India.

This section focuses on three key life cycle assessments that highlight different perspectives, yet are likely relevant across these countries.

1.1 The UK: Raw materials and impact of ATMs

UK coinage is made of a copper-nickel alloy and is recyclable (2). Bank notes have also evolved, mainly for security reasons, i.e. anti counterfeiting measures, and durability. The polymer notes launched in 2016 in the UK, last longer, so are more environmentally friendly than the older bank notes (3).

1.1.1 Significant issues for £5, £10 and £20 notes:

The Bank of England Lifecycle Assessment (3) summarises the key issues for the main notes in use in the UK:

“The results for most indicators are dominated by impacts associated with electricity generation required to operate ATMs. These are the same for both paper and polymer bank notes and have the effect of reducing the relative differences between the substrates that arise due to variations in production and end of life impacts. This effect is most marked for the £10 and £20 denominations where, respectively, 91% and 90% notes are sent to ATMs after sorting. For £5 notes the influence is slightly smaller as only 64% of these notes are distributed to ATMs. The UK grid mix is changing rapidly and is expected to become significantly less carbon intensive in future. Some forecasts estimate reductions of around 60% by 2030 compared to 1990 levels [Power Perspectives 2012, European Commission 2011]. Even if such large reductions are not realised it seems inevitable that there will be significant decarbonisation of the UK grid in the coming years. As such, the contribution of ATMs to the total life cycle impact is expected to reduce significantly in coming years and will make the impact of other life cycle stages more noticeable in contrast.”

1.1.2 Effects of raw material production:

For paper notes (3), raw material production has a significant contribution to:

- Global warming potential from biogenic sources, resulting in a credit due to carbon dioxide being removed from the atmosphere during plant growth than is returned at end of life (although, when considering fossil and biogenic GHG sources combined, this stage is not a significant contributor);
- Eco-toxicity potential due to the use of pesticides during cotton cultivation;
- Freshwater consumption due to the use of irrigation water during cotton cultivation;
- Renewable primary energy due to the energy embodied within the cotton; and for £5 notes, where the influence of ATMs is not as dominant as for £10 and £20 denominations, other life cycle stages gain more significance.

In addition to the indicators listed above, raw material production is also a significant contributor to acidification potential and eutrophication potential:

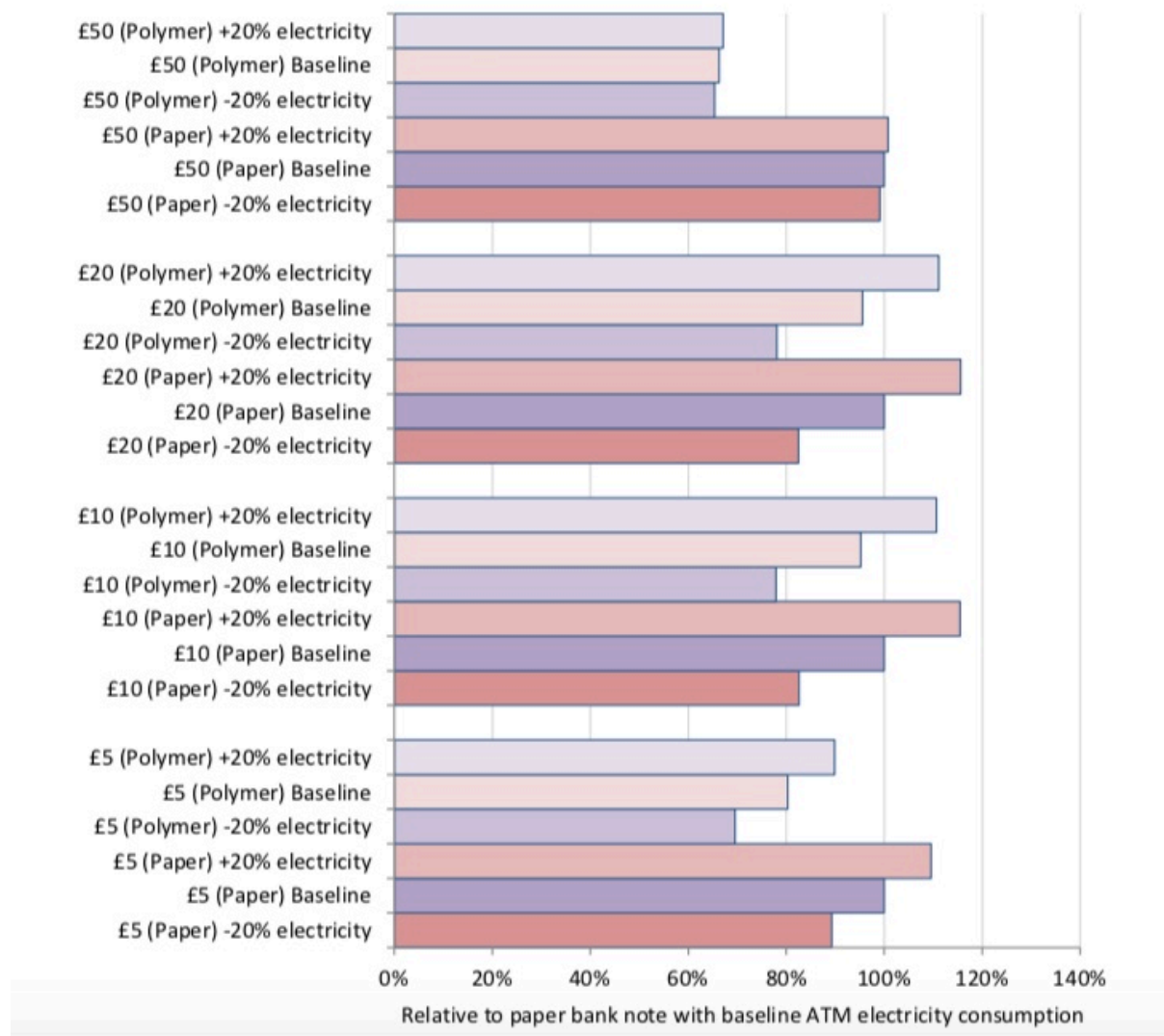
- The papermaking process is seen to have a significant contribution to eutrophication potential, global warming potential, photochemical ozone creation potential, human toxicity (cancer) potential, and non-renewable primary energy.
- For £5 polymer notes, substrate production has a significant contribution to the total life cycle impacts for:
 - Acidification potential and global warming potential from fossil sources due to emissions associated with combustion of fossil energy sources.
 - Global warming potential from biogenic sources but in contrast to the paper notes, this results in positive net GHG emissions.
 - Photochemical ozone creation potential due to VOC emissions during this opacification process.
 - Impacts relating to other life cycle stages such as printing, transport and end of life, are relatively small in comparison.

1.1.3 Energy impact of ATMs:

(3) “Energy consumption by ATMs is seen to be a dominant contributor to many environmental indicators assessed in this study. The default electricity consumption data used in this study is based on “typical” through the wall and lobby style ATMs with what are considered to be reasonable usage scenarios for the number of notes vended in a single transaction, and the number of transactions per day. However, ATMs come in many different styles with differing energy consumption and differing cash carrying capacity. Furthermore ATMs in different locations will see different patterns of usage. Hence, there is a significant uncertainty in the electricity data for ATMs used in the default scenario. Figure 1 shows the influence on the results of a change in ATM electricity demand of $\pm 20\%$.”

It is immediately clear that the results for the £10 and £20 notes are very sensitive to changes in ATM energy consumption. For these denominations, a 20% change in ATM electricity demand corresponds to an 18% change in overall GHG emissions. This is as expected given the dominance of ATM impacts seen in the main results. The effect is less marked for the £5 note due to lower number that are sent to ATMs after sorting but still results in a noticeable 13% change in overall life cycle impact. In contrast, the results for the £50 note show very little sensitivity to variations in ATM electricity demand as only 1% of these notes are sent to ATMs after sorting.”

Figure 1 Influence of variation in ATM energy consumption in the UK (Ref 3)



1.1.4 Conclusions

The UK environmental impact study (3) concludes:

- 1- Polymer bank notes have superior environmental performance compared to paper bank notes, for all categories considered in the lifecycle assessment.
- 2- Energy consumption of ATMs is a key contributor to most impact categories.
- 3- Further research may improve the waste management performance for polymer notes, especially for the £50 note, where the lifecycle impacts are not dominated by ATM energy use.
- 4- The Bank of England should investigate whether further environmental benefits could be achieved, by locating polymer substrate production in the UK, rather than importing substrate from Australia.
- 5- It would also be interesting to assess the impact of the average cash mix, rather than each denomination in isolation.

The total removal of cash would eradicate the environmental cost of cash. Does this suggest a less cash economy would reduce the environmental impact accordingly? It may do so, if the number of ATMs decreases, leading to lower storage and processing costs. Alternatively, leveraging spare ATM capacity for additional uses may be a way to increase ATM productivity, hence reducing their relative impact.

1.2 The Netherlands: Debit cards vs. Cash

The ECB assessed the environmental impact of cash payments in 2003: “As euro banknotes are designed to be used on a daily basis, their environmental impact was compared with the impact caused by other everyday activities. The assessment concluded that the total environmental impact caused by the 3 billion euro banknotes produced in 2003 was equivalent to the environmental impact of each European citizen driving a car for one kilometre or leaving a 60W bulb switched on for 12 hours.” (4)

The DeNederlandscheBank assessed the environmental cost of cash and concluded (5), with many limitations/ caveats:

“[...]Hanegraaf (2017) and Larcin (2017) analyse the environmental impact of an average cash payment in the Netherlands in 2015. It turns out that the total environmental impact of an average cash payments amounts 700 μ Pt [as global eco-index] and has a GWP [Global Warming Potential] of 5.0 gram CO₂-equivalents. These results indicate that the total environmental impact of a cash payment is 1.5 times higher and that its GWP is 1.3 times higher than of a debit card payment. The relatively higher impact of cash on the environment as a whole rather than on climate stems, among others, from the fact that the metal depletion for coin production affects the environment, but does not affect climate. The somewhat higher environmental impact of cash payments on the environment as a whole and on climate compared to debit card payments suggests that the substitution of cash by debit card payments, which takes place in many countries, may enhance the sustainability of the POS payment system.”

1.3 Switzerland: Supply chain impacts

The Swiss National Bank banknote lifecycle assessment undertaken in 2000 (6) provides us with extensive insights on the production process and environmental impacts of their banknote assets, as per their eighth banknote series. We reproduce some key charts of the paper below for awareness of the Swiss banknote lifecycle, their lifespan, as well as their environmental measures.

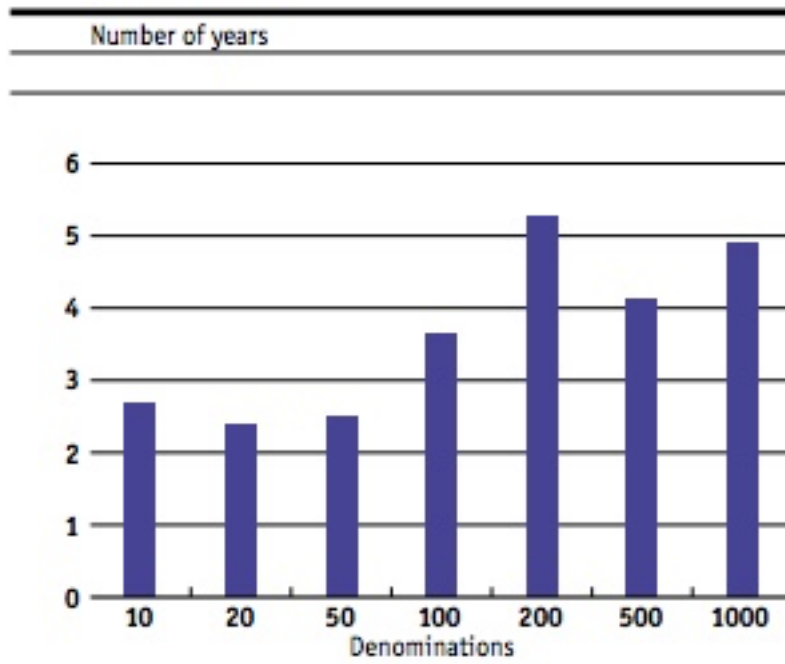


Figure 2 Switzerland life span of the banknotes (Ref 6)

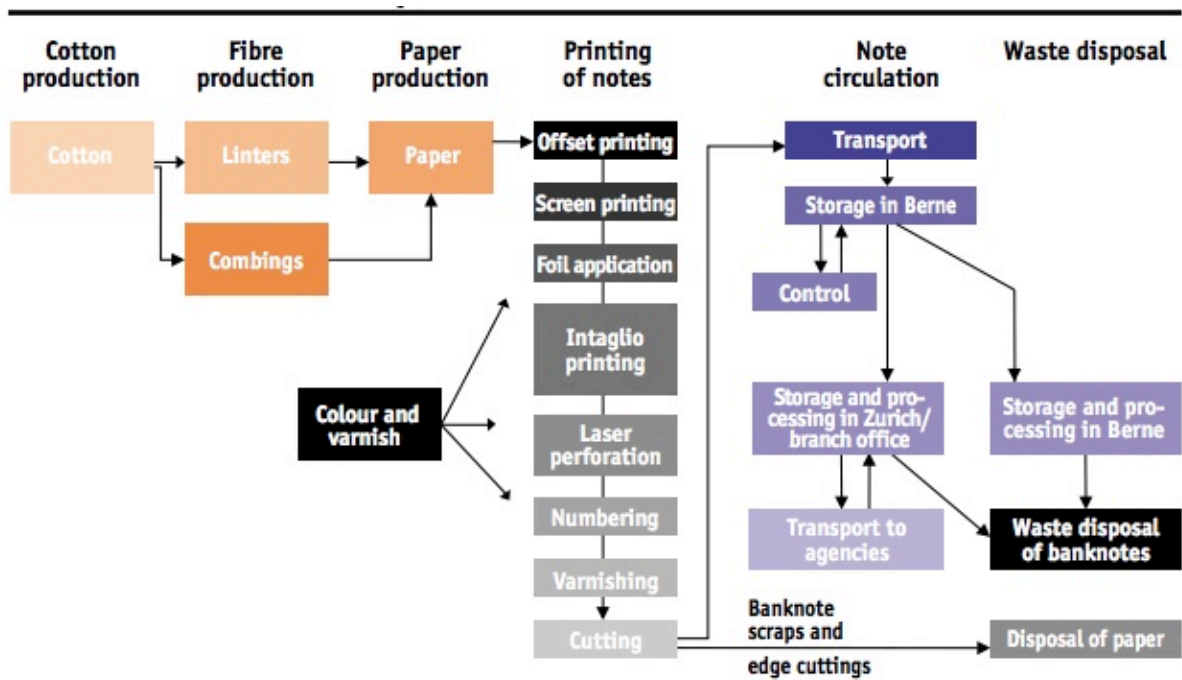


Figure 3 Switzerland Process chart of the bank note life cycle (Ref 6)

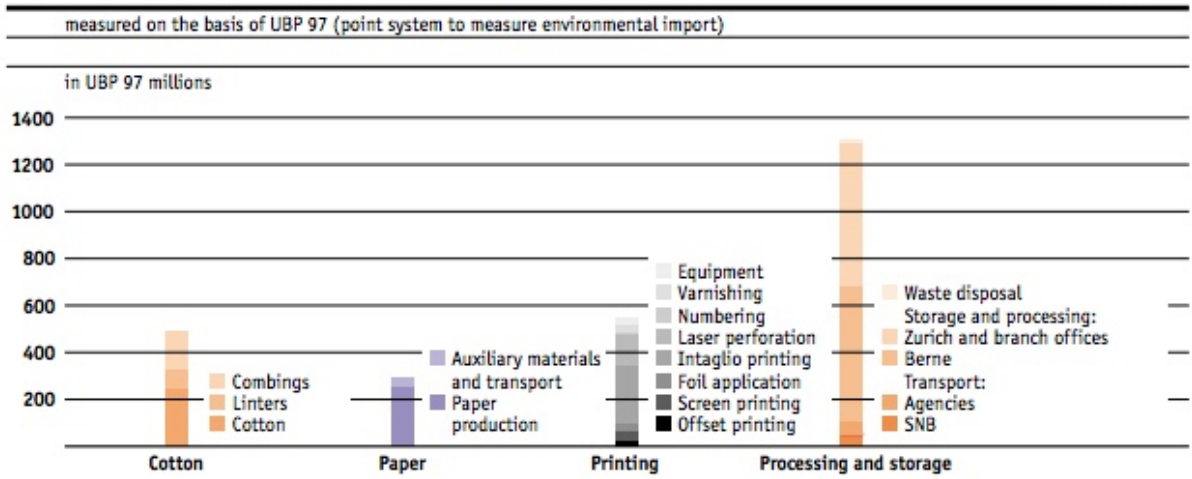


Figure 4 Switzerland Yearly environmental pollution (Ref 6)

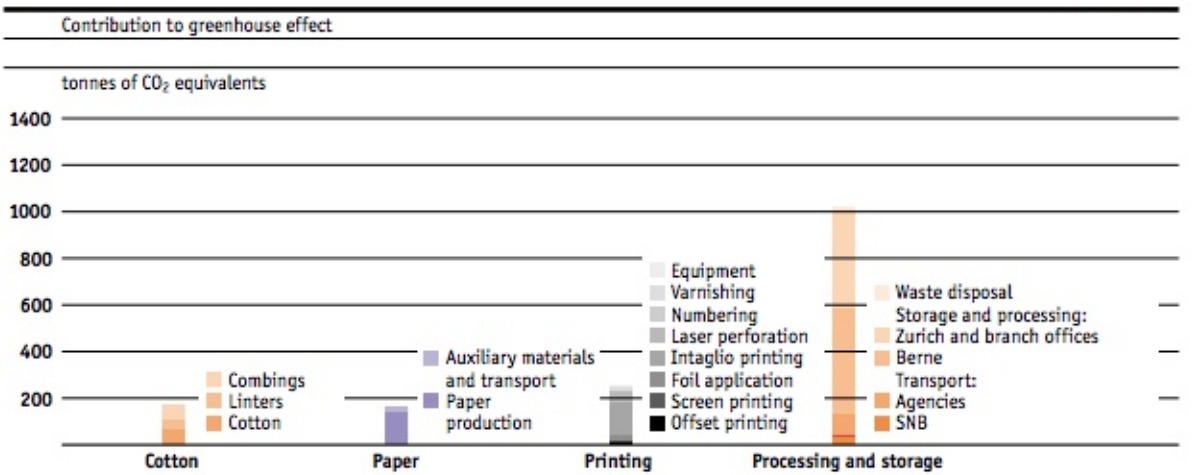


Figure 5 Switzerland contribution to greenhouse effect (Ref 6)

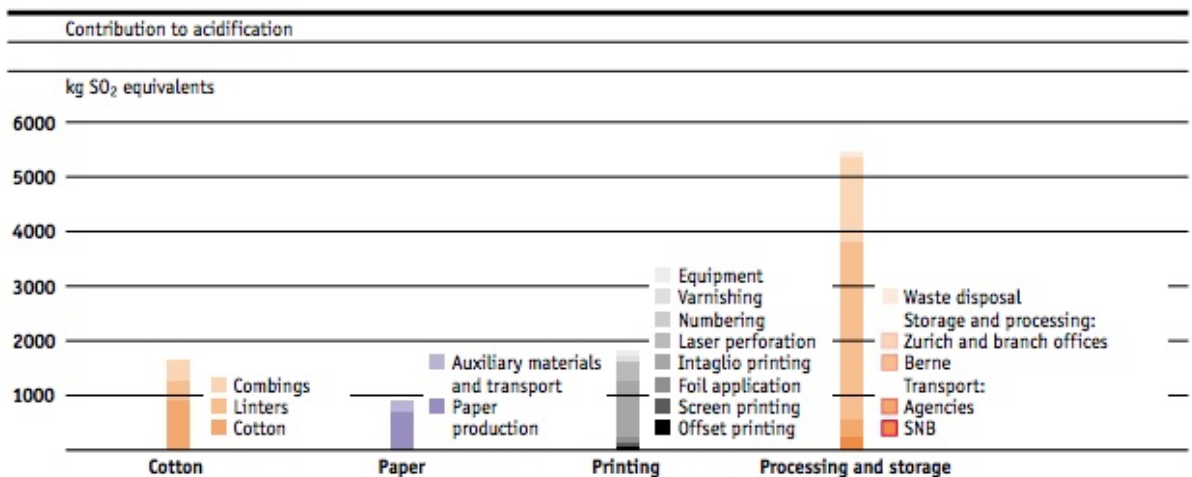


Figure 6 Switzerland contribution to acidification (Ref 6)

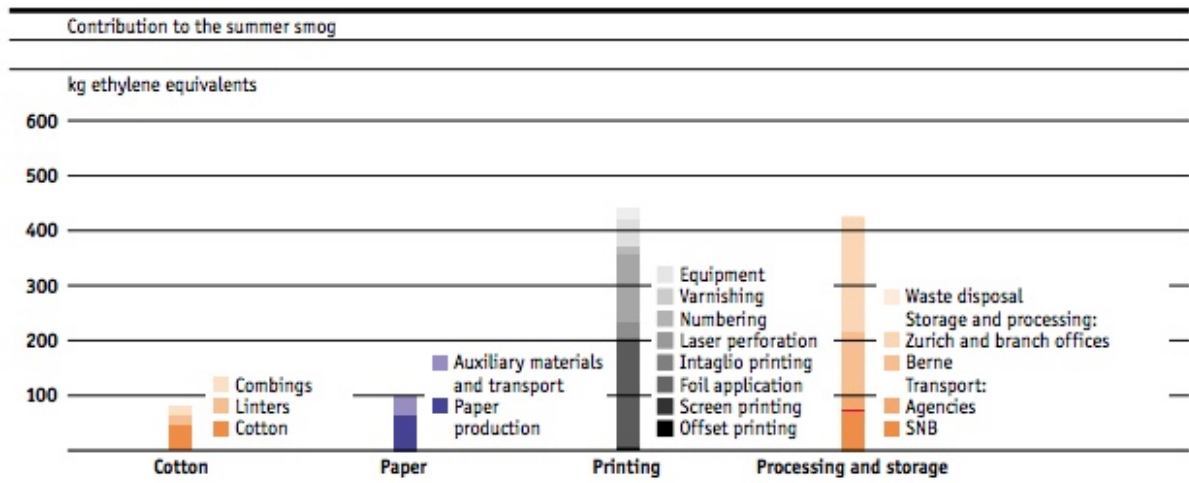


Figure 7 Switzerland contribution to the summer smog (Ref 6)

Section 2: Environmental costs of a cashless economy

It seems natural to hypothesise that cashless payments are greener, based on the premise that stopping the use of physical cash would save on the environmental cost of cash as detailed in the earlier section. The DeNederlandscheBank study (7) suggests debit cards carry a lower environmental footprint, with potential for further improvements.

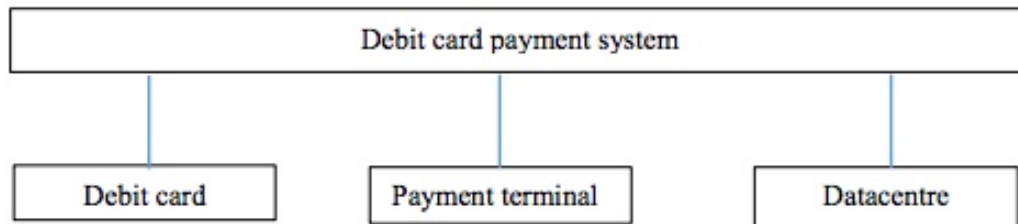


Figure 8 Netherlands schematic view of the debit card payment system (Ref 5)

2.1 Debit cards

The key study (5) provides insights on the environmental impacts of debit card payments in the Netherlands. Their results:

“One Dutch debit card transaction in 2015 is estimated to have an absolute environmental impact of 470 μ Pt [as global eco-index]. Within the process chain of a debit card transaction, the relative environmental impact of payment terminals is dominant, contributing 75% of the total impact. Terminal materials (37%) and terminal energy use (27%) are the largest contributors to this share, while the remaining impact comprises datacentre (11%) and debit card (15%) subsystems. For datacentres, this impact mainly stems from their energy use. Finally, scenario analyses show that a significant decrease (44%) in the environmental impact of the entire debit card payment system could be achieved by stimulating the use of renewable energy in payment terminals and datacentres, reducing the standby time of payment terminals, and by increasing the lifetimes of debit cards.”

2.2 Smartphones

However, we must consider the broader context of the reliance on underlying payments infrastructure, with the associated network and other technology services required for data processing (7) such as data centres and their associated electricity costs, the environmental impact of smartphone production: (8)

“We found that the ICT [Information and Communications Technology] industry as a whole was growing but it was incremental. “Today it sits at about 1.5%. If trends continue, ICT will account for as much as 14% for the total global footprint by 2040, or about half of the entire transportation sector worldwide.”

“For every text message, for every phone call, every video you upload or download, there’s a data centre making this happen. Telecommunications networks and data centres consume a lot of energy to serve you and most data centres continue to be powered by electricity generated by fossil fuels. It’s the energy consumption we don’t see.”

Among all the devices, trends suggest that by 2020, the most damaging devices to the environment are smartphones. While smartphones consume little energy to operate, 85% of their emissions impact comes from production.

A smartphone’s chip and motherboard require the most amount of energy to produce as they are made up of precious metals that are mined at a high cost.

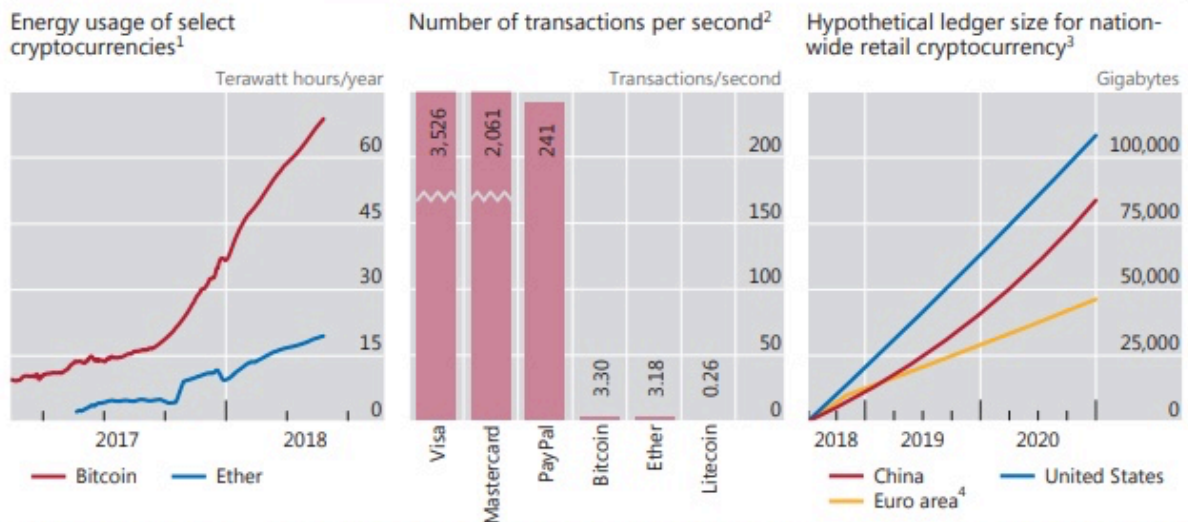
Smartphones also have a short life, which drives further production of new models and an extraordinary amount of waste.

“Anyone can acquire a smartphone, and telecommunications companies make it easy for people to acquire a new one every two years. We found that by 2020 the energy consumption of a smartphone is going to be more than that of PCs and laptops.” (8)

2.3 The impact of Distributed Ledger Technology

With the development of financial technology, dubbed “Fintech”, the lure of cryptocurrencies and Distributed Ledger, or Blockchain technology may also imply that electronic payments are “clean”, as their environmental impact is not immediately visible. However, as summarized by the Bank for International Settlements, cryptocurrencies are untold catastrophes for the environment, through their electricity demands:

“Individual facilities operated by miners can host computing power equivalent to that of millions of personal computers. At the time of writing, the total electricity use of bitcoin mining equalled that of mid-sized economies such as Switzerland, and other cryptocurrencies also use ample electricity (Graph V.4, left-hand panel). Put in the simplest terms, the quest for decentralised trust has quickly become an environmental disaster.” (9)



¹ Estimated. ² 2017 data. ³ The displayed hypothetical size of the blockchain/ledger is calculated assuming that, starting from 1 July 2018, all non-cash retail transactions of either China, the United States or the euro area are processed via a cryptocurrency. Calculations are based on information on non-cash transaction numbers from CPMI (2017) and assume that each transaction adds 250 bytes to the ledger. ⁴ BE, FR, DE, IT and NL.

Sources: Committee on Payments and Market Infrastructures, *Statistics on payment, clearing and settlement systems in the CPMI countries*, December 2017; www.bitinfocharts.com; Digiconomist; Mastercard; PayPal; Visa; BIS calculations.

Figure 9 Energy consumption and scaling issues (Ref 9)

2.4 QR codes as a means of payment

The following graph summarises the impact of the various means of payment we have discussed: it highlights the pressures on emissions, raw materials and energy use, as well as the relative recycling maturity of UK coins and notes. A new item deserves discussion: payment with QR codes.

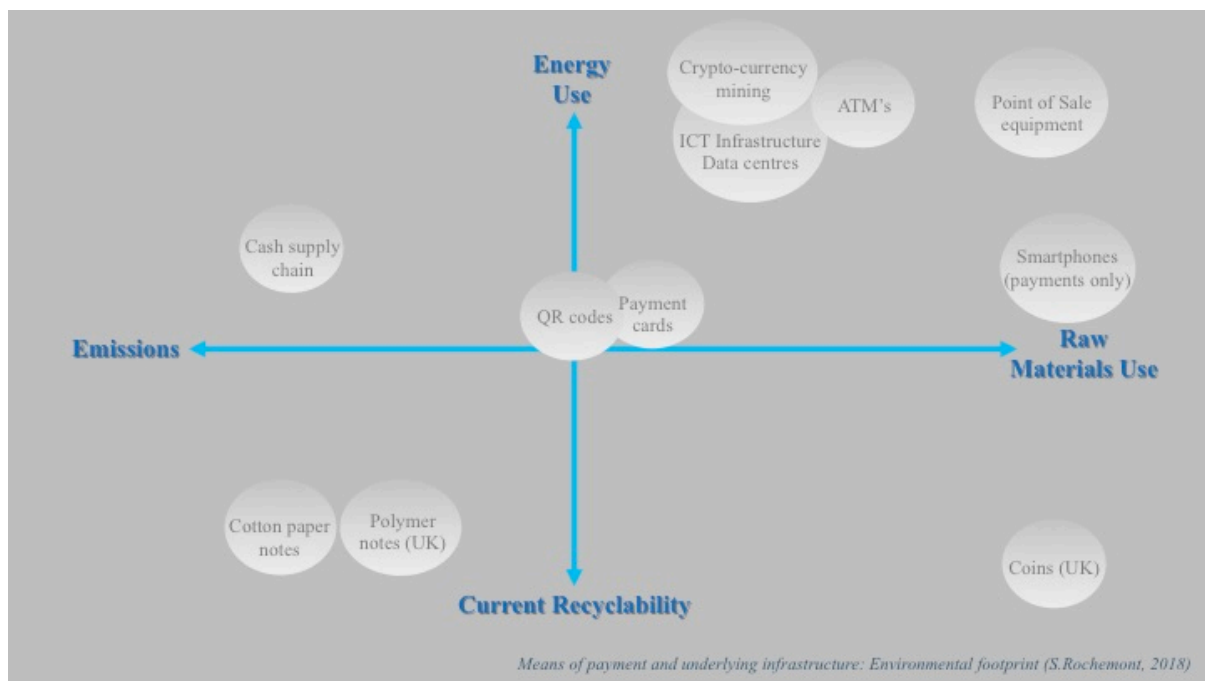


Figure 10 Means of payment and underlying infrastructure: Environmental footprint

2.4.1 Background of QR codes

A Quick Response (QR) code is a software-generated type of matrix [16], i.e. two-dimensional barcode, invented for production tracking in the automotive industry in 1994 and gradually adopted in other industrial quality processes.

Its encoding modes enable efficient and almost limitless data storage, leading to a wide range of applications, including product tracking, item identification, time tracking. It has been widely used for marketing practices, enabling consumers to access product and brand information through direct (via Internet) connection to commercial websites.

The tracking functionality is widely used to enable environment conscious consumers to access product tracing information and make purchasing decisions based on comprehensive product information [18, 19], instead of relying on eco-labels.

2.4.2 QR code payments

The use of the QR code as a means of payment was envisaged in 2012 for the Single European Payments Area [20], with the definition of the content that could initiate money transfers.

Guidelines for data capture followed in 2013, and gradually drove adoption. QR standardisation efforts are also in progress in Asia [21].

Service Tag:	BCD
Version:	001
Character set:	1
Identification:	SCT
BIC:	BPOTBEB1
Name:	Red Cross of Belgium
IBAN:	BE72000000001616
Amount:	EUR1
Reference:	Urgency fund
Information:	Sample QR code

Figure 11 Sample QR content for money transfers in the SEPA area (Ref 21)

A payment can be performed by scanning a QR code with a mobile application, enabling an electronic funds transfer at point of sale without a payment terminal. The customer scans the QR code displayed by the individual or merchant, enter the amount to pay, and enter their security PIN code.

The payment client application generates a payment instruction, which is relayed to the backend transaction and settlement system for processing.

2.4.3 Sustainability of QR code payments

Scanning enables a Peer-to-Peer money transfer, thereby avoiding the associated traditional payments infrastructure, such as payment cards, payment networks, payment terminal and merchant accounts. QR code payments do not require expensive chips as used for Near Field Communication payments with some mobile wallets [25], limiting technical requirements.

They may be one of the most environmentally neutral means of payment. Are QR code payments the best retail solution? The manual QR transaction process involves more consumer steps (entering amount and security number), so may be less time efficient than cash or contactless card payment, unless the retailer uses an optional scanner [22].

Businesses that enable customers to generate their own online transaction QR codes would require a scanner, hence reducing the environmental savings from Point of Sale equipment; yet this would potentially maintain customer experience on a par with contactless card payment.

Payment networks have also been integrating QR code payments within their merchant services, and been deploying these mainly in Asia and Africa to support digitisation of payment in areas short of infrastructure, with resulting fast adoption.

QR code payments are assessed as more secure for remote transactions, such as online or other remote payment situations. Account details are not revealed, reducing the likelihood of fraudulent use. Growing maturity of the QR code payment solutions is leading to improvements in security vulnerabilities. An example is India with the deployment of security features in its UPI 2.0 payments platform [23].

	Model 1: Customer Scans Code	Model 2: Merchant Scans Code
Who has the code	Merchant has a designated code (e.g. SnapScan).	Customer has a designated code (e.g. Allpay) or generates a transaction specific code (e.g. Starbucks app).
What the code contains	Merchant payment details (static).	Customer payment details (static) + specific transaction details (dynamic).
Customer experience	Scans merchant code à Enters amount to be paid + PIN à makes payment. (-) Does not significantly reduce steps compared to other channels e.g. STK.	Generates own QR code à Presents to merchant for scanning à makes payment. (+) Can be a very smooth experience as money taken directly from account.
Merchant device	Merchant does not need a special device to accept funds as customer scans code. (+) Can be a cost effective way to acquire merchants.	Merchant needs a special device to scan individual QR codes generated by customers. (-) Can pose a significant barrier for merchant acquisition.
Security	(-) Could be compromised by hacking or simply sticking fraudulent QR code on top of genuine one.	(-) Could be compromised by hacking or simply sticking fraudulent QR code on top of genuine one.

Figure 12 QR code payment scanning models [Ref 22]

2.4.4 Additional benefits of QR code payments

Merchant scanners may deliver optimal customer experience, saving on the number of steps required, and may be needed for more digitally integrated businesses that enable customer generated codes.

However, scanner free solutions could enable digital payments for small or start-up businesses that cannot afford terminal and merchant resources, or mobile/ remote businesses such as market traders that cannot rely on a source of energy. It could therefore be considered a useful tool in the planning for a less cash society, enabling digital inclusion of some categories of cash based businesses.

In addition, the use of QR codes for direct payments into business bank accounts supports the European Payment Services directive (PSD2), through “payment initiation services which allow consumers to pay via simple credit transfer for their online purchases, while providing merchants with the assurance that the payment has been initiated so that goods can be released or services provided without delay [24].

QR code payments may also provide a backup solution for times when part of the payment networks infrastructure is unavailable, or during power outages that are local to the merchant, helping to manage the technology related risks of a less cash economy.

2.4.5 Market potential

Card payments, increasingly contactless or low value transactions, deliver the most convenient user experience in developed countries; yet the potential benefits of QR code payments may be valuable, in particular to support the digital inclusion of some categories of businesses, and person-to-person payments.

Could other businesses replace their merchant services with printed QR codes on display? Businesses that have implemented QR code technology for other customer experience or operational purposes would keep or choose to introduce scanners. Yet, cost and market pressures may result in the re-assessment of their payment facilities to save on energy, fees and equipment.

As consumers are increasingly environmentally savvy, some businesses may decide to rationalise their systems and communicate adoption of QR code payment facilities as part of their green credentials.

Section 3: Synergies between a cashless society and a circular economy

Environmental Impact Assessments (10) are typically project driven and defined; they focus on physical developments and their impacts on the material environment. These models are restrictive for the topic of a cashless society, most concerned with societal and underlying technological revolution leading to a digital economy. The concept of a life cycle assessment (11), as applied in the above studies provides us with a forward thinking and integrated approach of the sustainable management of resources.

3.1 Linear vs circular economy concepts

Alongside the engineering approach, a circular economy (12) is about decoupling of economic growth from extraction and consumption of constrained natural resources. The concept has been around for a few decades. It has moved from a specialist concept discussed in think tanks and academic institutions to a movement beginning to be understood by businesses and governments alike. It aims to eliminate the concept of waste, through the recognition that everything has value. Circular approaches are an evolution from linear production systems: they keep resources in productive use as long as possible, turning waste into wealth. (13) This identifies new business models, made scalable through a number of disruptive technologies that are most relevant to the topic.

*"[13] The linear economy is a term for the current economic growth model, where "linear" refers to the "cradle to grave" flow of most natural resources (also described as "take-make-waste"). **This linear flow is the consequence of historically cheap and abundant resource supplies leading companies and nations to focus on supplying customers an ever-increasing throughput of goods.** In the linear model, environmental impact is largely unaccounted for and incentives to minimise waste during use and product end of life are weak. Little attention is paid to ensuring discarded goods are put into new use or back into a production process as raw material.*

*The circular economy is a generic term for an economy where growth is decoupled from scarce resource use. The model is regenerative by design. Material use is of two types: biological (renewable) materials, designed for reuse and ultimate return to the biosphere; and technical (non renewable) material, designed to move back and forth between production and consumption with minimal loss off quality or value. **Companies in a circular economy are primarily focused on value creation based on managing resources in the markets, as opposed to managing resources solely in production.** Ultimately, the circular economy results in zero waste value chains powered by regenerative (renewable) energy, and natural resources are used in connected loops rather than consumed and discarded in linear flows."*

3.2 A circular economy vs a cashless society?

The Internet of Things is a possible catalyst for this cultural shift towards a more sustainable resource model, as it may simultaneously improve the customer value proposition through different consumer experiences, removing customer trade offs between short-term desirability and long-term viability. Customers make the most out of products; companies facilitate trade between users, supply services that monetise goods not in use, offer convenient buyback solutions, and sell services instead of products.

A cashless society may contribute towards a circular economy through several mechanisms:

- De-cashing would save the physical resources and materials used in the making and distribution of notes and coins, as well as wasted or destroyed coins and notes. It would also save on transportation of notes and coins to and from banks, and ATMs' power consumption.
- Efficiency of sharing platforms through unused capacity in existing payment systems: should most transactions be digital for a geographic region, the underlying infrastructure would gain in efficiency, possibly through a better use of capacity. Some countries, mainly in Asia, have proactively deployed national platforms (1) in order to promote a competitive payments landscape and drive efficiencies to control retail transaction charges, a barrier to de-cashing. In Africa, Kenyan authorities have demanded that Safaricom, the M-Pesa operator, opens up its platform to competitors as it dominates the payments market through infrastructure monopoly (14). In addition to opening up the network to competition, it encourages efficient use of resources through maximising use of existing capacity, hence minimising idle resources. This will also presumably lead to further income to Safaricom in lieu of spare capacity.
- Efficiency of recycling schemes and reward payments: processing of products waste returns would be facilitated and broadened if most payments were digital. Generalised access to electronic and mobile payments would enable growth and access to recycling schemes for the financially excluded, as well as improve efficiency of such schemes.
- Payments data: whilst civic groups resist the use of their payments data for financial exploitation and discrimination, anonymised data may deliver substantial insights for the development and improvement of circular supply chains.
- Unmet needs and wasted productive potential: in the interim paper, we identified a clear link between access to bank accounts, financial exclusion and difficulty of doing business. If unmet financial needs are barriers to doing business, this suggests waste of human resource as productive potential on a grand scale.

3.3 The circular economy advantage

Within a global context of strained natural resources, and political factors such as protectionism threatening just-in-time supply chains, organisations that reduce their dependence on external resources will likely gain competitive advantage, beyond PR and compliance interests:

*“[13] The circular advantage is the competitive edge gained by organisations adopting circular economy principles as a core element of their growth strategies. **By decoupling scarce resource use and growth, organisations protect themselves from rising and volatile commodity prices, become more resilient to supply disruptions and reduce their environmental footprint.**”*

Section 4: Drivers and policies for a cashless economy

The question of potential synergies between a cashless society and a circular economy raises a query on the role of the banking sector and public policy in the circular business model.

4.1 Role of the banking sector

Issues with a cashless society are associated with interoperability and cost of transactions. Financial services technology has gradually shifted to cloud computing, reducing waste of infrastructure capacity whilst enabling elastic environments.

As competition from Fintech players challenges established banks, could traditional payment providers be convinced to open up their infrastructure to new entrants to open up spare capacity? Or is the traditional infrastructure too technically obsolete to consider such platform sharing?

Access to mobile devices, in particular smartphones with internet access are fast becoming prerequisites to financial inclusion in most western economies: economically and energetically unsustainable, the network of bank branches and ATMs shrink in some western countries such as the UK. Banks remain inaccessible in many developing countries, hence the level of unbanked citizens. Should traditional banks consider delivering smartphone payment packages to those missing a local branch and ATM? Or should the banking network co-finance the provision of restricted use smartphones to vulnerable groups to resolve access issues, to compensate against the closure of bank branches in underserved areas?

4.2 Shifts in development and tax models

The interim paper and later addendum on the benefits, risks and issues of a cashless society (1) demonstrated, the “Cashless World is in Motion”. As many developing countries in Africa and Asia drive the digitisation of payments, is the “circular” design considered as part of national plans? Would this avoid past errors of economic development?

Public policy is a key driver for change of behaviours and priorities. Over a few years, countries or groups such as the EU (15), Denmark, Japan, China, Singapore, have already adopted policies towards the circular economy:

“In 2013, the European Commission recommended to 11 members states to further shift the tax burden away from income and toward resource use or pollution. They complemented the roadmap in 2014 with a circular economy package.” (13)

“Current regulations give the linear growth model an unfair advantage by making it more financially attractive by expanding resource use. Changes to these regulations are needed to level the playing field and allow circular and linear models to thrive on their own merits. One such change is to shift taxation from labour to resources. Today, the tax on workers is far greater than that on virgin resources. This encourages companies to continue extracting resources instead of investing in people and processes to get greater productivity from resources already in use.” (13)

Taxation models have also become a challenge in the context of a digital economy with new business models that can be seen as seeking to avoid labour costs. In the event of restructuring these to prevent tax evasion/ avoidance, and simplify tax collection, would an Automated Payment Tax also be able to target consumption of natural resources through differential rates? (1)

Conclusion

A less-cash economy may well save some non-renewable and visible resources and facilitate some of the potential systemic benefits of sharing platforms and recycling schemes for broader circular economy benefits.

However, we must be cautious with regards to the indirect or less visible environmental cost of technologies that underpins cashless payments: whilst debit cards may be greener with further potential for efficiency, smartphones present substantial environmental cost at production, and their use impact demand on data centres, major consumers of electricity. Cryptocurrencies place unsustainable demands on the grids, even as use of these decentralized ledgers is still limited.

Yet we must consider the opportunities for improving the environmental footprint of non-cash payments: QR codes may enable digital inclusion of some businesses, and may prompt others to re-assess their payment infrastructure as part of their financial and sustainability reviews. In addition, we may wish to study the potential for deploying new functionalities to ATMs in order to raise their productivity and resulting sustainability, as their cash-dispensing role diminishes.

We will consider this as issue 21 to be added to the interim paper: the Environmental sustainability of a cashless society. Smartphone impacts are the highest priority due to their urgency and global impact. Other technical limitations might curb cryptocurrency growth, limiting their impact.

This new issue should be linked to existing risks such as the excessive reliance on technology, the readiness for a digital economy, security, and change leadership. The latter is crucial and reaches beyond the topic: leadership should assess the rising energy requirements at national and supranational levels to plan for a growth in demand from electronic services as well as the transformation from fossil fuel to more renewable sources of energy for domestic, industrial and transportation uses.

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