The case for native Digital Product Passport tokenization

How can tokenization lead to a consumption revolution while responding to EU Digital Product Passport requirements?

Context

This report, co-written by Arianee and BCG, is a contribution to the reflection that has taken and will take place in the framework of the discussions around the European regulation of the Digital Product Passport. It aims to show the extent of the possibilities that could be unlocked by this new tool and encourage its adoption.

This report is the result of a collaboration between BCG and Arianee and is based on discussions between experts from both parties, comprehensive desk research, analysis of available third-party reports and interviews with experts and brand representatives.

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Executive summary (1/2)

1/

The Digital Product Passport (DPP) is a project initiated by the European Commission that aims to create a digital passport for products in order to provide consumers with transparent information about the origin, environmental impact, and safety of products

- As per latest information released by the European Commission, the DPP should provide consumers with transparent and detailed information about the products they purchase, to promote sustainability and circularity and to enable regulators to easily access and verify product information, which will help to ensure compliance with regulatory standards
- DPP implementation will start with car batteries, followed by the textile industry, construction products and electronic goods, etc.

2/

Our analysis shows that DPP can cover a wide spectrum of benefits, including and beyond the transparency on upstream product information (current focus of the European Commission), to help accelerate transition towards circular economy

- DPP can accelerate a consumption revolution by unlocking 5 main utilities: an access to product information, a certificate of authenticity and ownership, a product lifecycle management tool, a CRM tool and a virtual replica of a physical object
- Based on experience, any increase in DPP utilities is likely to foster adoption and usage of the DPP and must then be encouraged to ensure its success

3/

DPP implementation requires to progress on three key components

- Physical identifier: a QR code, RFID chip, etc., on the product or its packaging which should have a harmonized and internationally recognized standard, and be unique for each product
- Data storage and access system: a reliable platform, which ensures trust, confidentiality, easy access to the data and unlocks utility beyond pure access to upstream product information
- Harmonized standards: a set of taxonomy and layout principles for collecting and encoding the information in the DPP

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The report identifies three main architectures for the storage of, and access to, DPP

- Centralized DPP: passport data stored in centralized databases
- Permissioned blockchain based DPP: Passport data stored on a private or consortium blockchain and only accessible to platform members
- Tokenized DPP: passport data stored in an NFT imprinted on public blockchain

Executive summary (2/2)

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From both an operational and business perspective, tokenization can exceed other technology architectures available

- Tokenized DPP on a public blockchain creates trust, guarantees confidentiality of sensitive data and avoids complex IT integrations
- Tokenization unlocks all possible usages of a DPP with tangible benefits for brands and consumers beyond access to product information by reinforcing trust on second-hand markets, promoting access to add-on services, increasing brand engagement with minimal data sharing, and paving the way for bridging physical and digital worlds
- Operational and business benefits of tokenization are expected to further increase as the technology improves, especially on blockchain access speed, energy consumption – major progress already achieved - and interoperability

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DPP tokenization is targeted first at high perceived value/long life B2C products, but it should not stop at this product category

- No/Limited fit for low value / low durability products
- Early adopters expected among high perceived value/long durability B2C sectors (especially in the fashion and luxury industry) given cost/benefit analysis and ability to align incentives between brands and the European Commision
- Tokenization should then be used to extend the durability and value of other target product categories

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It's not an easy road ahead and several subjects still need to be discussed and solved by each stakeholder

- **The regulator** will have to decide on the **granularity of the DPP** across all the target industries and create incentives to **promote the implementation and interoperability of the relevant technologies**
- **Brands** will need to evaluate the technology architecture that maximizes the utilities (or use cases) they want to achieve through DPPs. In addition, they will need to carefully think about future customer journeys leveraging DPPs to boost circularity
- **Technology providers** will have to improve the scalability and interoperability of DLT (Distributed Ledger Technology) by providing a simple and cost-effective solution and by developing user-friendly tools to access the blockchain
- **All stakeholders** will have to work on technology acceptance by educating customers and staff on blockchain and its use

Definitions

Blockchain

Decentralized digital ledger used to record transactions across multiple computers. It allows users to securely and transparently transfer data and value without needing a trusted third party. Each block in the chain contains a record of multiple transactions that cannot be altered or removed.

- **Public**: Open network, everyone can join without permission.
- **Permissioned:** Only nodes pre-approved by one governing body may join the blockchain

NFTs

Unit of document (token) that proves the ownership of a distinctive physical or digital asset. Accessible only by the person who has the private key for the wallet in which the NFT is stored.

Characteristic:

- **Ownership:** NFT is a digital ledger, stored on blockchain, which represents the ownership of the physical or digital assets
- **Provenance:** The blockchain technology allows NFT to be traced back to origin to prove authenticity of ownership and prevent fakes
- **Transferrable:** NFT can be transferred or publicly traded with the smart contracts

Wallet

A wallet is an address on the blockchain, defined by a public key, and a private one. The public key allows to send things to the wallet and read its content. The private key allows to do actions on the NFTs that are in this wallet. An NFT wallet allows to store, buy, sell, and manage non-fungible tokens

- **Custodial wallet:** type of wallet where the private keys are managed and held by a third party, such as an exchange or online wallet service
- **Non-custodial wallet:** type of wallet where the user holds the private keys and has sole control over them. This means that the user has complete control over their NFTs and can access them at any time, without needing to go through a third part

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Report structure

I. DIGITAL PRODUCT PASSPORT (DPP) VISION
initial EU requirements and broader perspective

II. FROM DPP VISION TO IMPLEMENTATION
key components & success factors

III. DPP ACCESS AND STORAGE
pros & cons of the different architectures available (centralized, permissioned blockchain, tokenized)

IV. ROAD AHEAD
next steps to kick-start the journey

European Commission's requirements for Digital Product Passport (DPP) currently focus on transparency of upstream product information

Description

The Digital Product Passport is a project initiated by the European Commission that aims to create a digital passport for products in order to provide consumers with transparent information about the origin, environmental impact, and safety of products

Objectives

- Help to promote sustainability and eco-friendly practices in the manufacturing industry
- Support consumers in making sustainable choices
- Allow authorities to ensure compliance with regulatory standards

Target outcomes and key data required per stakeholders

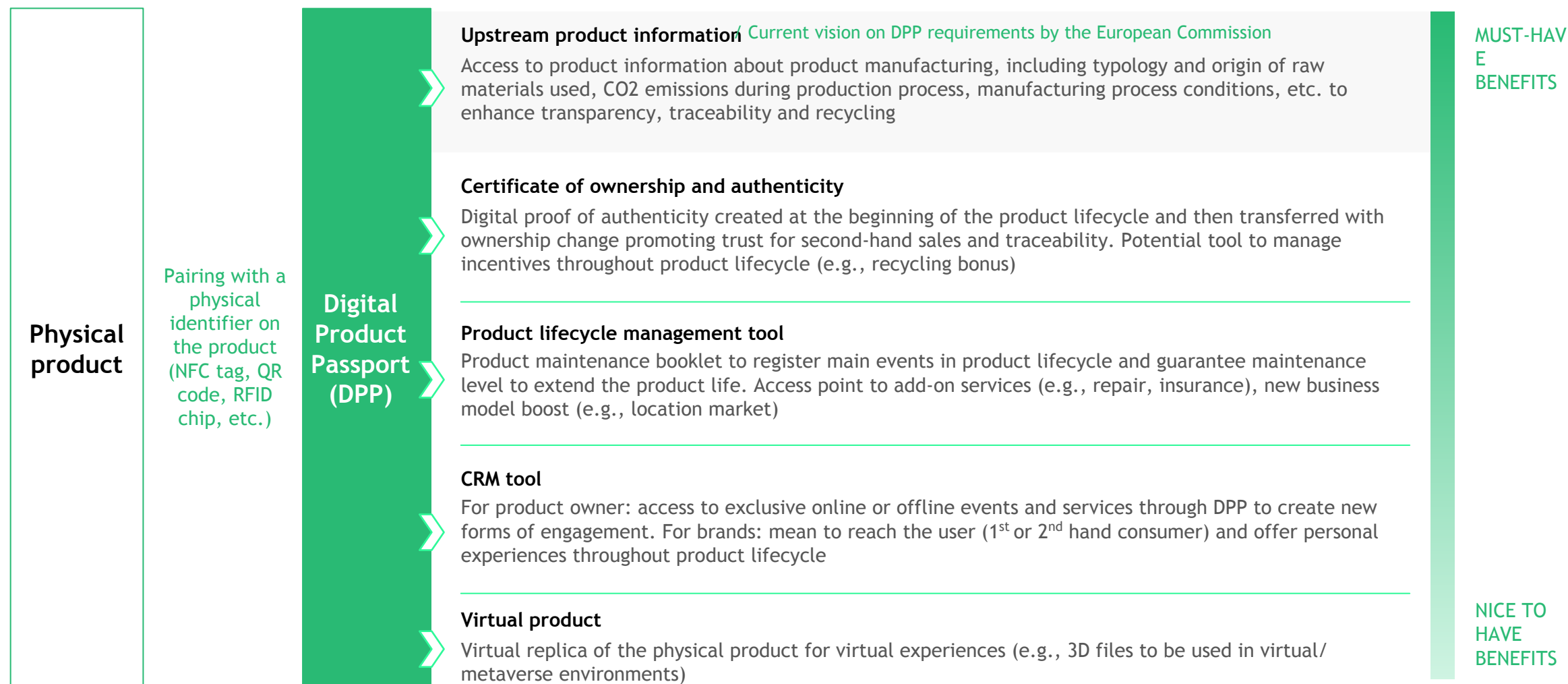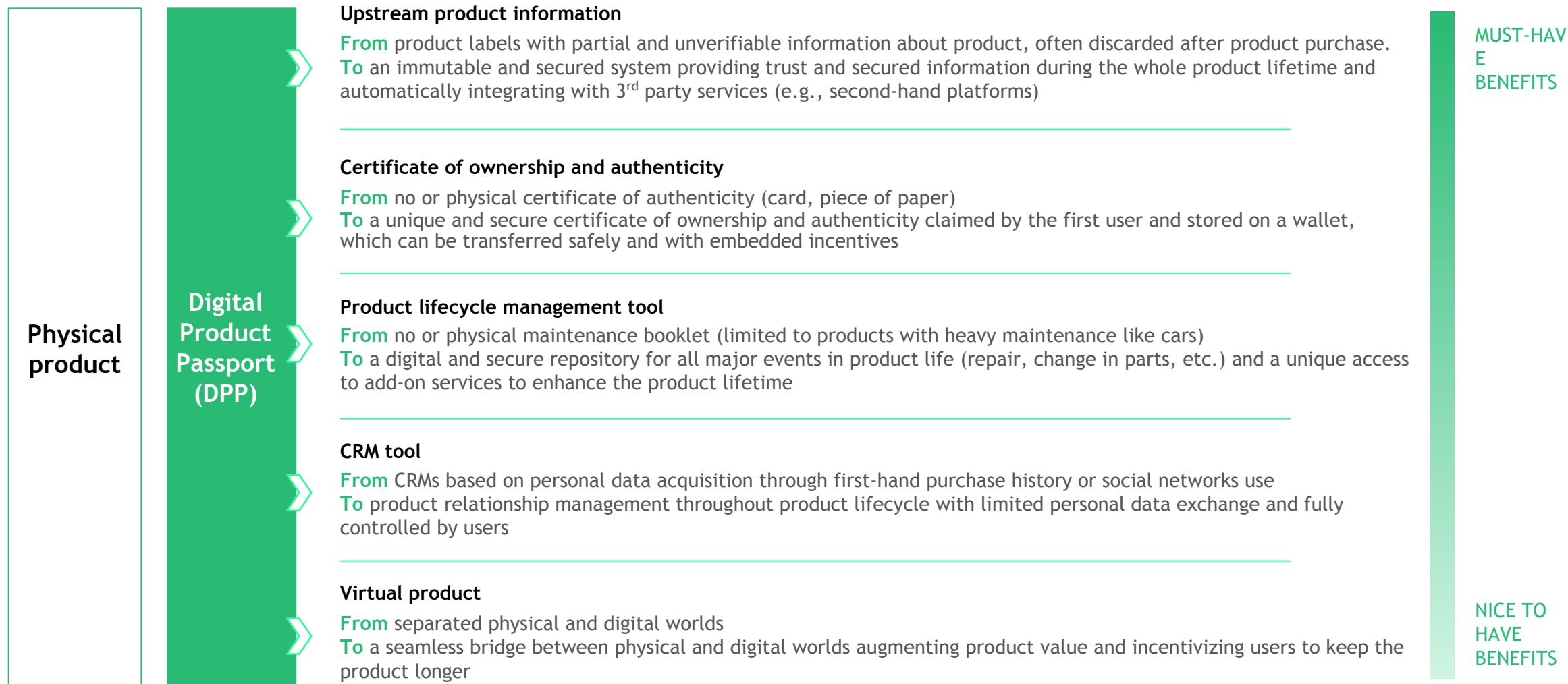| Stakeholders	Target outcomes	Key data required
Manufacturers, recyclers and brands	• Provide traceability and build a transparent supply chain • Add information on process conditions • Turn waste into high quality feedstock	• Raw materials: design location, typology and origin of raw materials used • Production: manufacturing process conditions, CO2 emission, production location, material mixtures, transportation means, etc. • Harm potential: product hazardousness or material toxicity • Use: user manuals • Recycling: specification for sorting and recycling method to be used
Users and consumers	• Learn about product's provenance and environmental footprint • Incentivize sustainable behavior	
Regulator	• Implement a European regulation for sustainable production in key industries (e.g., car batteries industry, textile industry, home appliance industry, etc.)	

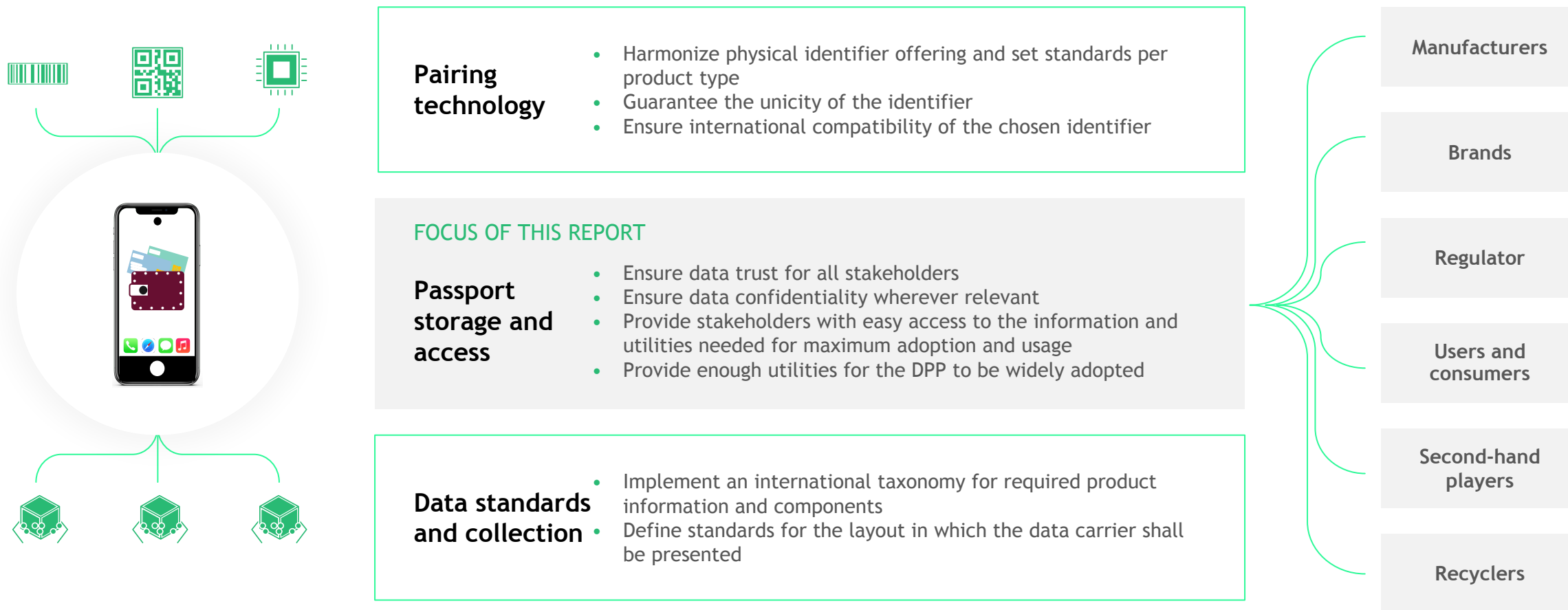Source: Desk research; European Commission (2022, November 21); Regulation (EU) No 2019/1020; Regulation (EU) No 305/2011

The benefits of DPPs can go far beyond the current EU target, including enabling high product circularity and extending product lifecycle

Physical product

Pairing with a physical identifier on the product (NFC tag, QR code, RFID chip, etc.)

Digital Product Passport (DPP)

MUST-HAVE BENEFITS

Upstream product information *Current vision on DPP requirements by the European Commission*

Access to product information about product manufacturing, including typology and origin of raw materials used, CO_2 emissions during production process, manufacturing process conditions, etc. to enhance transparency, traceability and recycling

Certificate of ownership and authenticity

Digital proof of authenticity created at the beginning of the product lifecycle and then transferred with ownership change promoting trust for second-hand sales and traceability. Potential tool to manage incentives throughout product lifecycle (e.g., recycling bonus)

Product lifecycle management tool

Product maintenance booklet to register main events in product lifecycle and guarantee maintenance level to extend the product life. Access point to add-on services (e.g., repair, insurance), new business model boost (e.g., location market)

CRM tool

For product owner: access to exclusive online or offline events and services through DPP to create new forms of engagement. For brands: mean to reach the user (1st or 2nd hand consumer) and offer personal experiences throughout product lifecycle

Virtual product

Virtual replica of the physical product for virtual experiences (e.g., 3D files to be used in virtual/ metaverse environments)

NICE TO HAVE BENEFITS

Source: BCG and Arianee analyses

DPPs could reconcile compliance and marketing departments and foster a consumption revolution encouraging sustainability and circularity

Physical product

Digital Product Passport (DPP)

Upstream product information

From product labels with partial and unverifiable information about product, often discarded after product purchase.
To an immutable and secured system providing trust and secured information during the whole product lifetime and automatically integrating with 3rd party services (e.g., second-hand platforms)

Certificate of ownership and authenticity

From no or physical certificate of authenticity (card, piece of paper)
To a unique and secure certificate of ownership and authenticity claimed by the first user and stored on a wallet, which can be transferred safely and with embedded incentives

Product lifecycle management tool

From no or physical maintenance booklet (limited to products with heavy maintenance like cars)
To a digital and secure repository for all major events in product life (repair, change in parts, etc.) and a unique access to add-on services to enhance the product lifetime

CRM tool

From CRMs based on personal data acquisition through first-hand purchase history or social networks use
To product relationship management throughout product lifecycle with limited personal data exchange and fully controlled by users

Virtual product

From separated physical and digital worlds
To a seamless bridge between physical and digital worlds augmenting product value and incentivizing users to keep the product longer

MUST-HAVE BENEFITS

NICE TO HAVE BENEFITS

Source: BCG and Arianee analyses

Selecting the right storage and access architecture while progressing on pairing technology and data standards is key to ensure DPP success

Pairing technology

- Harmonize physical identifier offering and set standards per product type
- Guarantee the unicity of the identifier
- Ensure international compatibility of the chosen identifier

FOCUS OF THIS REPORT

Passport storage and access

- Ensure data trust for all stakeholders
- Ensure data confidentiality wherever relevant
- Provide stakeholders with easy access to the information and utilities needed for maximum adoption and usage
- Provide enough utilities for the DPP to be widely adopted

Data standards and collection

- Implement an international taxonomy for required product information and components
- Define standards for the layout in which the data carrier shall be presented

Manufacturers

Brands

Regulator

Users and consumers

Second-hand players

Recyclers

Source: Desk search; GS1 and BCG analyses

DPP storage and access architecture must create trust, guarantee confidentiality of sensitive data, enable easy access & unlock utilities

Major stakeholders	Trust	Confidentiality	Access	Utility
Producers, recyclers and brand owners	• Provide correct and EU compliant data • Trace back easily the person or company that edited the data	• Disclose only relevant data to the relevant stakeholder and protect confidential data about the supply chain	• Minimize cost and timing for implementation (e.g., limit impact on legacy IT) • Easily edit DPP whenever relevant/authorized	• Leverage DPP to unlock direct and indirect business value (beyond regulatory)
Users and consumers	• Access reliable product information to make better informed consumption choices / decisions	• Keep control on personal data (e.g., purchase history)	• Enjoy a seamless user experience without having to use multiple / complex technology solutions	• Use the DPP for other interests than a classic product label (e.g., services, access, content)
Regulator	• Easily access reliable and trustable information about the product to implement fair controls, taxes and regulations	• Protect confidential data in order to protect both brand innovation strategy and user personal data	• Promote wide adoption of the EU standards and easy monitoring • Create analytics about product manufacturing and components	• Maximize adoption of the DPP by providing incentives to stakeholders

UPSTREAM PRODUCT INFORMATION

OTHER BENEFITS

Source: Desk search; BCG and Arianee analyses

3 distinct technological architectures are available today for DPP access and storage

Centralized Digital Product Passports

- Passport available on a webpage or application via the physical product identifier
- Passport data stored in centralized databases (either one single third-party managed database or multiple databases accessible through links on a passport third-party managed portal)
- Access and editing rights managed by third-party platform

Permissioned blockchain Digital Product Passports

- Passport access thanks to a physical identifier and stored in a custodial or brand central wallet
- Passport data stored on a private or consortium blockchain and accessible to platform members
- Passport usage limited to a closed ecosystem
- Access and editing rights managed by ecosystem owner(s)

Tokenized Digital Product Passports

- Tokenized passport claimed by a physical identifier and stored in a custodial or non-custodial wallet
- Passport data stored in an NFT imprinted on public blockchain
- Passport usage in an open ecosystem
- Access and editing rights managed via encryption keys
- Interoperable passport with standardized format

Source: Desk search; BCG and Arianee analyses

Business-wise tokenization natively unlocks opportunities beyond the possibilities of other technologies

Utility	Market opportunities	Illustrative market size	Why it matters?	Centralized DPP	Permissioned blockchain DPP	Tokenized DPP
Product information	• Second-hand market: Seamless product listing (pre-filled product information) allowing increasingly secure supply	€7B[1] 2H fashion market in France	30%[2] of non-sellers on 2H market haven't found the time to list their goods	✅	✅	✅
Proof of authenticity and ownership	• Second-hand market: Reassurance on product authenticity and ownership boosting resale conversion	€16B[1] 2H luxury global market in 2020	34%[1] of luxury consumers are afraid of counterfeited goods	◐	✅	✅
Product lifecycle management tool	• Add-on services: Facilitated access to additional services, like insurance or repair services • Second-hand market: Reassurance on product conditions boosting resale conversion	€10B[3] Home appliance market in France	30%[3] of appliance consumers are open to interact with brands for repair solutions	❌	◐	✅
CRM tool	• Customer lifetime value: Reduction in customer acquisition and retention costs and CLV boost (purchase rate increase, up/cross-sell, etc.)	5-10%[4] Brand revenues are invested in marketing	X5[4] increase in consumer engagement with web3 marketing toolbox	❌	◐	✅
Virtual product	• Virtual economy: Increased product desirability and usage through unique replica of a physical product for virtual environments	€55B[5] digital fashion in metaverse by 2030	75%[6] Roblox users willing to spend money on digital fashion	❌	◐	✅

DPP owners have the token within a closed environment. All the utilities are unlocked but not transferrable to another platform

✅ Fully unlocked   ◐ Partially unlocked   ❌ Not unlocked

1. True-Luxury Global Consumer Insight 2020 (BCG);); 2. What an Accelerating Secondhand Market Means for Fashion Brands and Retailers (BCG x Vestiaire collective); 3. Creating the consumer DNA, 2022 (BCG); 4. BCG analysis 5. Luxury in the metaverse? It could become a €50 billion market, MarketWatch / Steve Goldstein, 2021 6. Parsons and Roblox Partner to Educate on Digital Fashion and Trends

Tokenized Digital Product Passport will likely require only a marginal additional investment compared to other architectures

	Data collection, validation and standardization	Additional cost depending on the technology chosen[1]
Centralized DPP		
Permissioned blockchain DPP		
Tokenized DPP		

COST OF IMPLEMENTATION

1. Examples of additional cost: for centralized DPP, data storage; for closed blockchain, encryption on the blockchain; for tokenization, product tokenization
Note: Early technologies, cost estimation difficult to determine precisely
Source: BCG and Arianee analyses

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Incremental cost for tokenization can largely be offset by the additional value unlocked by tokenized DPP

ROI

Tokenized DPP

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3

Private blockchain DPP

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Centralized DPP

1

Product lifetime
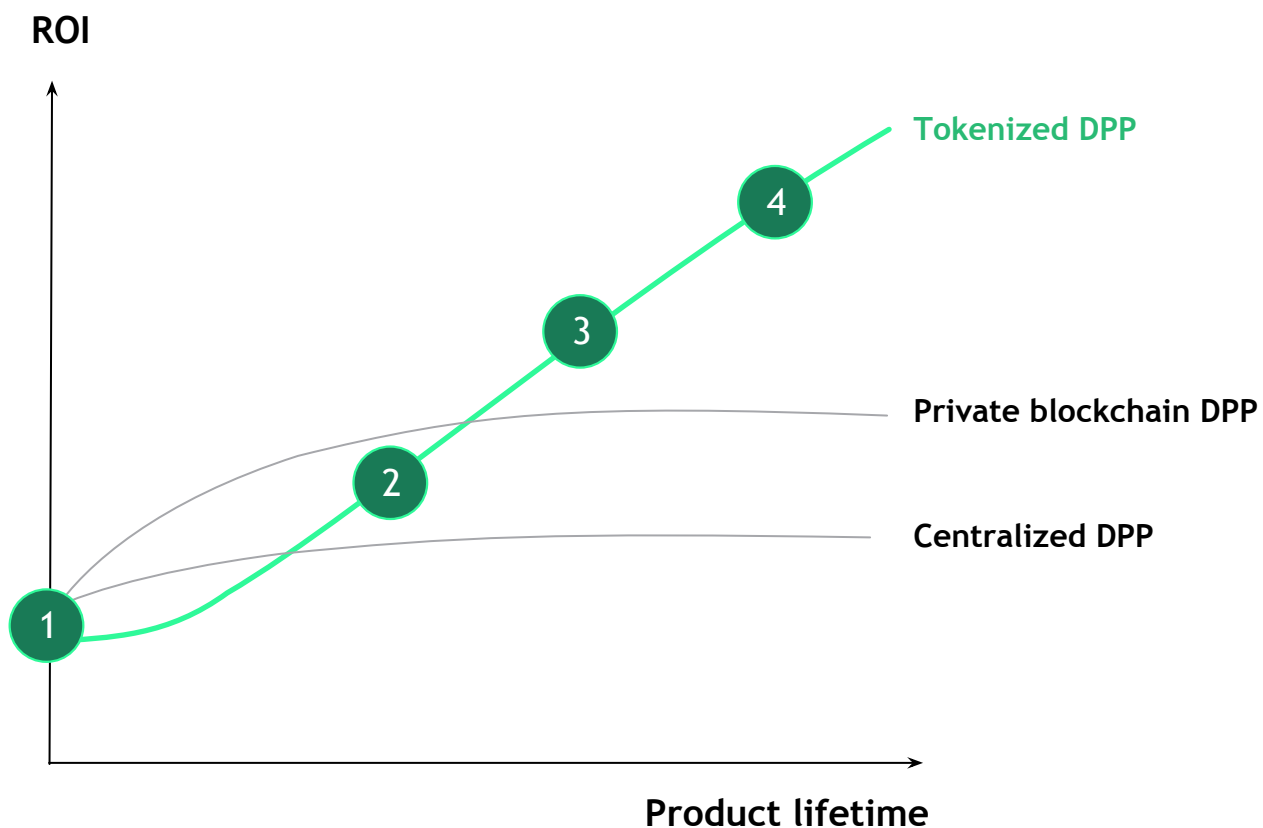
1 Reliable product information available to enhance trust in the product (and willingness to pay a price premium)

**2** Development of personalized services and recommendation to boost customer engagement (benchmark: cost of 1st party data)

3 Product sold on a 2H platform. Direct brand communication with the new owner (benchmark: customer acquisition costs)

4 Product lifecycle duration extended thanks to utilities (including warranty and repair services) creating additional revenue streams for brands

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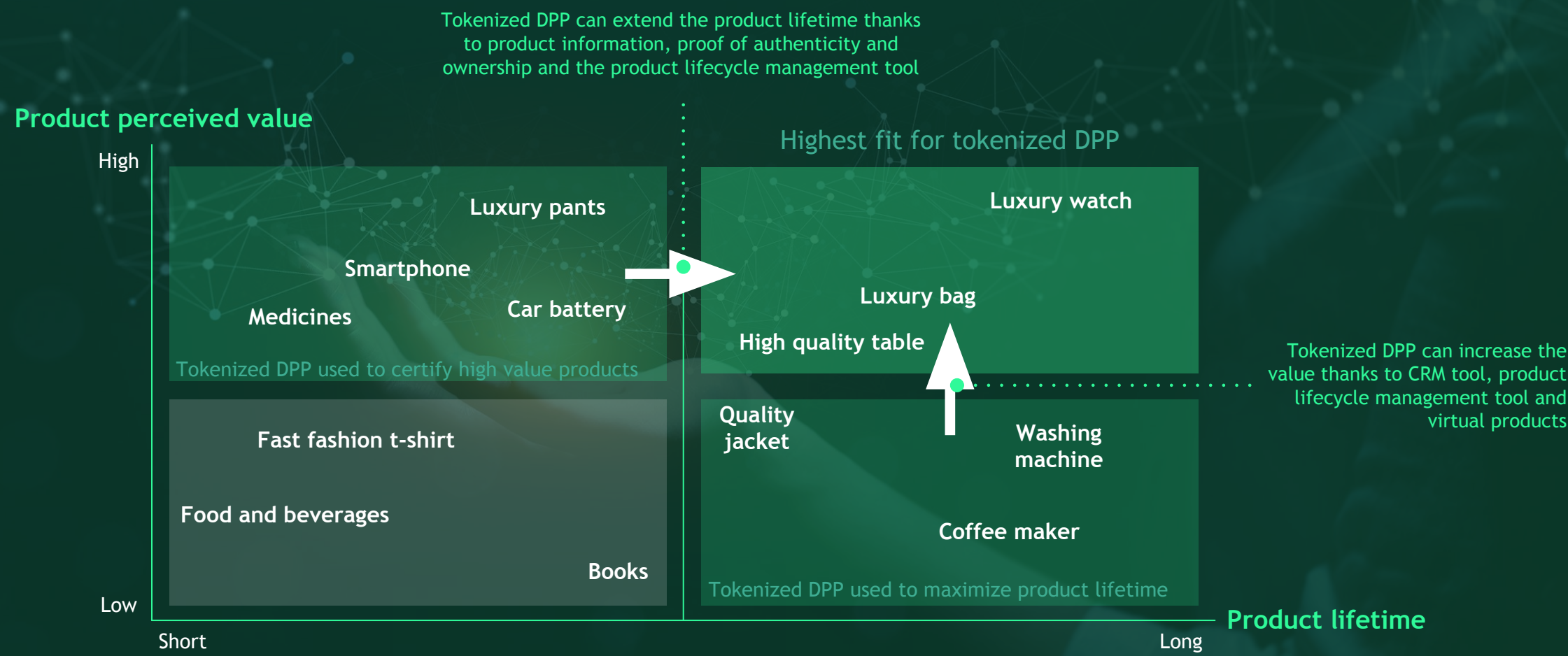
Road ahead:
Next steps to kick-start the journey

1

For the regulator:

- Decide on DPP granularity (unique item, SKU, product family)
- Define incentives to limit the number of available technology architectures and to promote technology interoperability

2

For brands:

- Decide the way the DPPs shall be made accessible to customers before they are bound by a sales contract, including in case of distance selling
- Evaluate the most relevant utilities for their business and choose the most appropriate architecture according to their objectives and the targeted customer journey

3

For technology providers:

- Improve the efficiency of the blockchain to be energy efficient and fast in the node's emissions
- Maximize wallet interoperability to develop the use of Digital Product Passports
- Improve the efficiency & scalability of the DLT (Distributed Ledger Technology)
- Develop user-friendly tools to access the blockchain technology

4

For all stakeholders:

Boost technology acceptance:
- Educate key stakeholders on the daily use of the blockchain
- Incentivize buy-in from key industry members through some form of monetary means or flagship project build-out

Source: Expert interviews; BCG and Arianee analyses

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