

Findings Master's Thesis

Tailoring Tomorrow: Digital Twins for Circularity

How can Digital Twins support circular business models and practices within the fashion industry?

THREE KEY FINDINGS

DIGITAL TWINS (DTS) FOR CIRCULARITY IN FASHION

1

Digital Twin conceptualization for fashion

- Need for broadening the traditional DT definition for fashion
- Proposing of multi-perspective of DT concept
- DTs for internal use, DPP and future use cases

2

Support of circularity along the lifecycle of a garment

- DTs offer various opportunities to support circular business models and practices
- However we observe that circular practices are often added to linear core business models, leading to the question of what the true influence on circularity is

3

Policy recommendation Digital Product Passport (DPP):

Dynamic DPP on item level is required to support r-strategies for circularity most effectively

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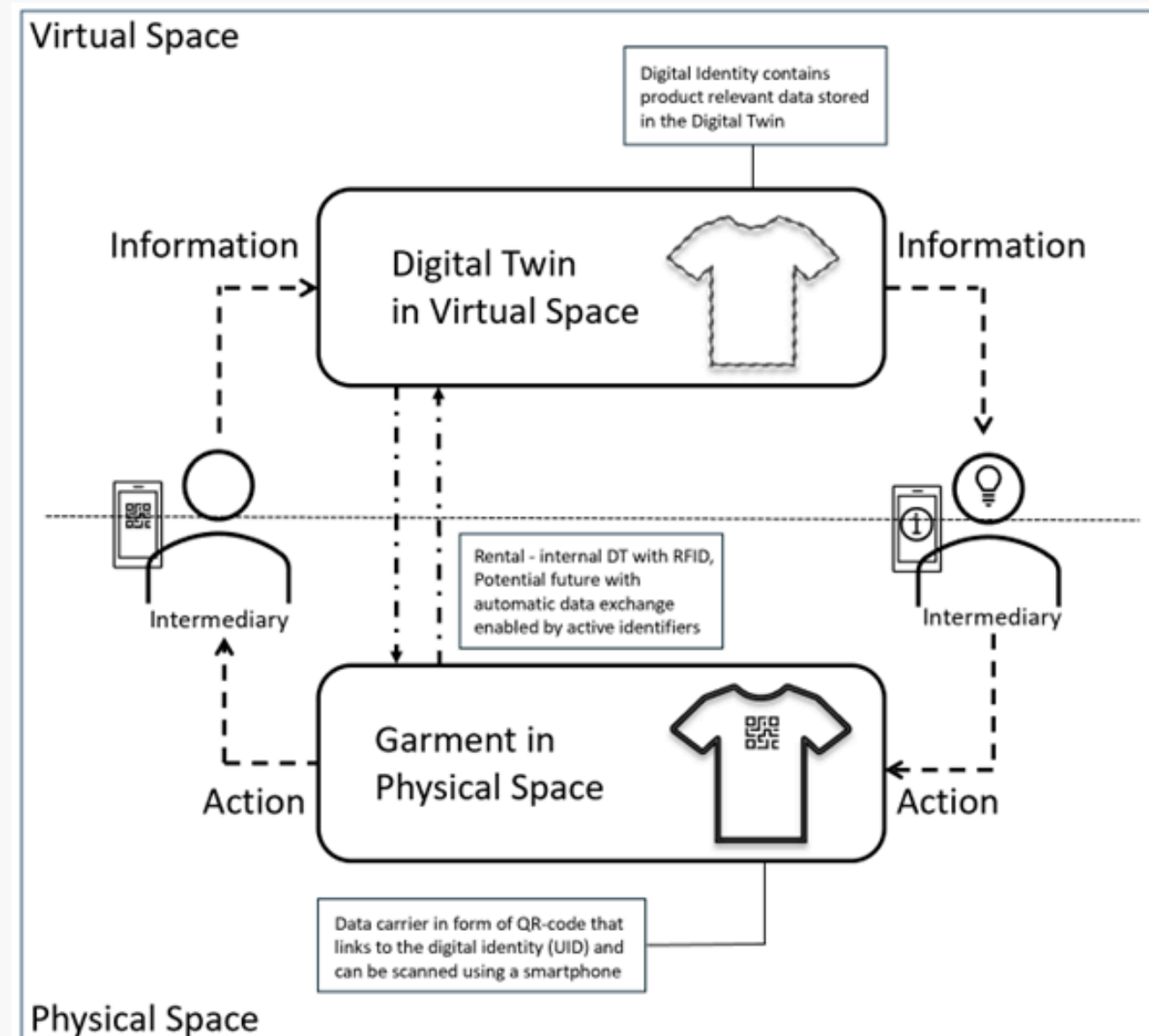


Figure 1: Illustration of DT and physical garment – Information Flow Present and Future (own illustration based on Jones et al. (2020))

Concept	DT concept in the fashion industry		
	Current DT usage	DPP (from 2027)	Potential future DT
Current literature	Predominant (Donmezer et al., 2023; Kuzmichev & Yan, 2022; Wagner & Kabalska, 2023)	Seen as a distinct concept from the DT (Jansen et al., 2023; S. F. Jensen et al., 2023; Psarommatis & May, 2024)	Rather scarce (Stacchio et al., 2022; Wagner & Kabalska, 2023)
Use case	DT of prototypes DT for simulation DT for stock tracking DT for store efficiency	Digital Product Passports	DTs for smart fashion DTs in metaverse
Lifecycle phase	Predominantly pre-sale phase	Predominantly post-sale phase	Entire lifecycle Virtual space
Database & storage	Internal data storage solutions	1. Internal data storage solutions (ERP/ PIM) 2. Decentralized data repository (DDR)	?
Data access	Internal	1. Internal (data storage solutions ERP/ PIM or DDR) 2. External users and third parties (DDR) 3. Authorities (EU registry)	1. Internal 2. External 3. Authorities 4. Beyond (AI)

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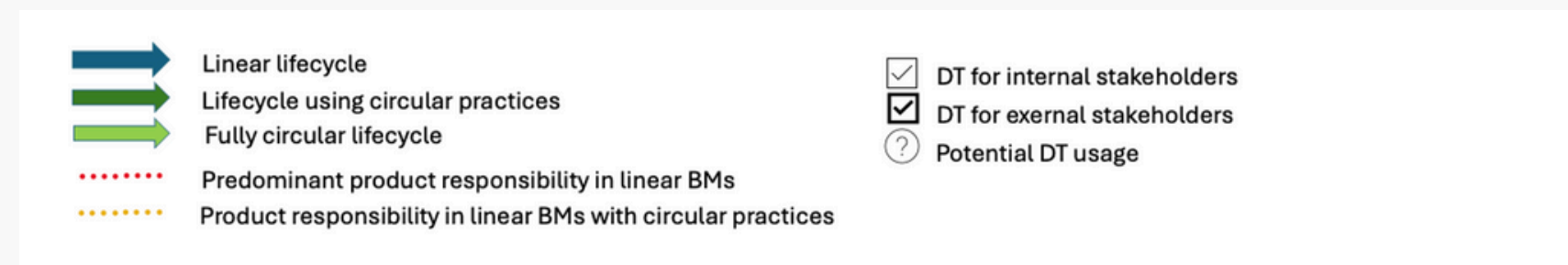
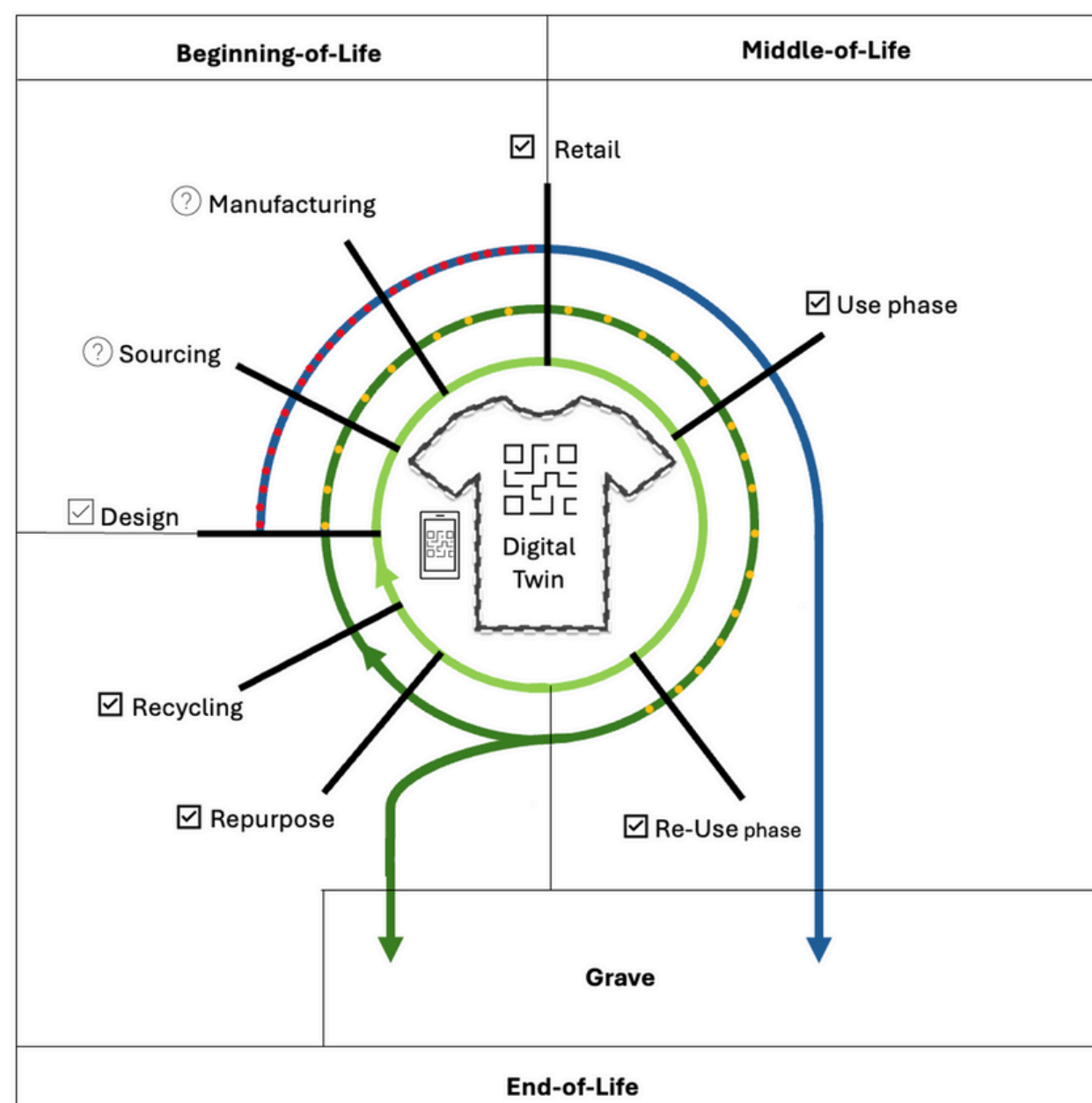


Figure 2: Circular Practices and DTs along the Lifecycle (own illustration based on Payne, A. (2015) and Mügge et al. (2024))

Lifecycle stage	DT/ DPP	enables...	Specific activity	Circular practice (Reike et al., 2018)	Effect on CE (Geissdoerfer et al., 2020)
Design	DT	Digital prototyping and sampling	Creating a garment in virtual space first	Reduce	Dematerializing
	DPP	Collection & accessing of post-sale data	Use of post-sale data to inform design process	*Design for durability (technical & emotional)	Extending
Retail	DPP	Transparency & consumer awareness	Consumer accesses relevant product and sustainability data for purchase decision	Refuse	Intensifying Extending
Use phase	DPP	Consumer awareness, education & engagement	Access & make use of care instructions	*Care	Extending
	DPP	Consumer awareness	Visibility through digital wardrobes	Refuse	Intensifying Extending

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R-strategy (Reike et al., 2018)	Model level	Batch level	Item level
Refuse		X	
Rental*			X
Resale	(x)		X
Repair	(x)		X
Repurpose			X
Recycling	(x)		X

Table 9: R-Strategies and required DPP Integration Levels (own illustration)

() Limited impact on circularity

*Rental is not identified as individual r-strategy by Reike et al. (2018)

CONSIDERATIONS

DIGITAL TWINS (DTS) FOR CIRCULARITY IN FASHION

- What implications does the passing of the ESPR and the introduction of an EU-wide DPP have for your business?
- How do you evaluate the potential of DTs and the DPP to support your CE efforts?
- Does your brand want to learn more about the post-sale phase of your garments?
- How can you leverage the DPP as an additional customer touchpoint to increase trust and loyalty?
- Should your brand make DPP data accessible to support resale platforms and digital wardrobe apps?
- Are you employing selected r-strategies or are you on your way towards a fully circular business model?

THANK YOU FOR YOUR ATTENTION

In case you have any questions you can reach out to us here:

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