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Orchestrating Circular Fashion in the Productive City: A Digital Platform Ecosystem Framework

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Abstract

The resurgence of urban manufacturing presents new opportunities for innovative governance and planning strategies, especially in fostering circular economy practices and localized resource flows. A key challenge, however, is how ecosystems of heterogeneous actors, including manufacturers, designers, waste managers, and residents, can effectively collaborate to advance circular production and consumption at the local level. Addressing this challenge requires a renewed approach to thinking about intermediation and ecosystem management in urban planning practice. This article proposes that new technology in the form of digital platforms offers a critical governance tool to facilitate and coordinate such complex ecosystems. Drawing on industrial management literature, particularly the concept of platform ecosystem orchestration, we develop a typology of orchestration strategies used by circular fashion platforms and analyze how each type coordinates participant interactions to support localized resource flows. Our focus is on the fashion and textile sectors, which present significant opportunities to keep clothes and textiles circulating at their highest value within the city's economy. Our analysis of circular fashion platforms identifies four main types of platform orchestration: marketplaces for residual textile exchange, supply chains for textile recycling, cross-sector networking, and supply chain data analytics. We examine the orchestration dimensions of platform orchestration, the varying degrees of localized interactions they generate, and opportunities to further enhance socio-spatial outcomes through platform orchestration. Overall, this exploratory study aims to foster future dialogues on the potential of digital platforms as governance tools for building sustainable and inclusive productive cities.

Keywords

circular economy; circular fashion; circular manufacturing; digital platform; ecosystem orchestration; productive city; urban manufacturing

1. Introduction

The pressing need to rethink the flow of resources in urban economies along more circular and regenerative lines has supported a renewed interest in the local manufacturing potential of cities (Acerbi & Taisch, 2020; Tsui et al., 2021). Following over half a century of hailing the birth of the post-industrial city, a more locally tailored manufacturing renaissance, spurred by technological advances and supported by mixed-use zoning, is now considered integral to urban planning and development that meet pressing sustainability and inclusion agendas (Ferm, 2023).

On an industrial management level, the implementation of the circular economy by manufacturing companies has taken shape in a variety of micro- and meso-level strategies (Lieder & Rashid, 2016). The former includes cleaner production, circular design practices, waste management, material and energy efficiency, and servitization; while the latter can be implemented through industrial symbiosis and closed-loop supply chains (Acerbi & Taisch, 2020). These strategies constitute what Acerbi and Taisch (2020, p. 11) term "circular manufacturing," defined as manufacturing strategies that aim to reduce resource consumption, extend resource lifecycle, and close resource loops. While the circular economy is an industrial system that operates at levels of micro (e.g., products, companies, and consumers), meso (eco-industrial parks), and macro (city, region, nation, and beyond; Kirchherr et al., 2017, p. 224), what we see is that circular manufacturing efforts tend to focus on company-level implementation, highlighting a greater potential for adoption at the meso or macro level (Acerbi & Taisch, 2020).

Yet a number of challenges remain when it comes to promoting circular manufacturing practices at the macro level, particularly in cities. For example, on a spatial level, research has evidenced growing "intra-industrial gentrification" that is driven by the limited supply of urban land and heightened demand for space, and results in emerging forms of competition and displacement that call into question the potential of cities to accommodate such a manufacturing renaissance altogether (Ferm, 2023, p. 266). This also presents specific challenges for locating "circular hubs" in urban settings (Tsui et al., 2024, p. 325), including access to resources, transportation networks, and labor availability.

In addressing these challenges and devising coordinated measures to support and strengthen local ecosystems towards sustainable and circular manufacturing, technologies are often considered central to efforts boosting the adoption of circular practices (Acerbi & Taisch, 2020). In particular, digital platforms and their ecosystem orchestration strategies are discussed in industrial management literature as fulfilling a crucial coordination and collective action role (Ritala, 2024; Sahamies & Welinder, 2025). Digital platforms offer a governance approach that facilitates information exchange, incentivizes participation, and ensures the efficient functioning of circular resource flows and network effects to create value (Blackburn et al., 2022; Ritala, 2024). Specifically, technologies can support information sharing and communication, which are often identified as barriers to the implementation of circular practices and the furthering of industrial symbiosis (Acerbi & Taisch, 2020; Halstenberg et al., 2017).

Although technologies such as digital platforms can help the adoption of circular practices and shape supportive ecosystems, their implications for urban planning and circular manufacturing governance remain underexplored. Building on Suwala et al. (2022), there is room to examine the role of space in industrial management. We propose that digital platforms can serve as a crucial governance tool for urban planning

practitioners, enabling them to orchestrate ecosystems of local producers and industry actors more effectively. By leveraging digital platforms, planners can facilitate collaboration among manufacturers, suppliers, and waste managers, ensuring that materials and products retain their highest value within the local economy.

The fashion and textile industry sectors offer a compelling case for studying how digital platform orchestration could facilitate local ecosystem development and localize resource flows in urban settings. Fashion production and consumption generate significant social and environmental impacts, including high waste levels, resource depletion, and carbon emissions (Kozlowski et al., 2012; Niinimäki et al., 2020). In response to these challenges, a growing movement is emerging to implement circular principles, reshore production, and develop short, local supply chains in fashion (Buchel et al., 2022). This study examines digital platforms designed to facilitate such a transition away from the dominant linear paradigm in the textile and fashion sectors. We ask: What typology of platform ecosystem orchestration best represents existing circular fashion platforms, and how does each type coordinate participant interactions to foster localized resource flows? With the start of this exploratory study, we aim to initiate both scholarly and practice-oriented dialogues on ways to integrate platform orchestration into urban planning for more productive cities and circular manufacturing practices.

2. Literature Review

2.1. From Urban Manufacturing to Circular Urban Manufacturing

Urban planning scholars have called for renewed attention to production within urban contexts, especially as manufacturing activities have been reshaped by technological advances. Industry 4.0 technologies, including cyber-physical systems, the Internet of Things, and smart factories powered by automation, 3D printing, and big data analytics, are driving the digitalization of manufacturing and blurring the line between production and knowledge-intensive services (Busch et al., 2021). At the same time, labor-intensive forms of "high-touch, low-tech" manufacturing, particularly in cultural sectors, still benefit from proximity to urban networks (Grodach & Martin, 2021; Lavanga, 2020). This resurgence of urban manufacturing supports diverse job opportunities and strengthens local economic resilience by reducing reliance on vulnerable global supply chains (Ferm, 2023). Aligned with the maker movement, it fosters flexible, market-responsive production that often integrates symbolic and aesthetic value, reinforcing the growth of cultural and creative industries (Grodach et al., 2017; Wolf-Powers et al., 2017). Urban manufacturing also supports knowledge-intensive and research and development (R&D) activities that thrive on spatial proximity to production (van Winden et al., 2010), while new spaces such as makerspaces and Fablabs promote inclusive, community-driven practices around making and consuming (Brandellero & Niutta, 2023).

In recent years, urban manufacturing has also been recognized as a promising strategy to support the circular economy transition agenda in cities, or circular cities (Lavanga & Drosner, 2020; Williams, 2019). In circular cities, localized resource and material flows are theorized to play a key role in preventing cities from remaining hotbeds of waste, virgin material consumption, and greenhouse gas emissions. For this, the implementation of circular manufacturing practices as highlighted by Acerbi and Taisch (2020) is crucial, including cleaner production, circular design practices, waste management, material and energy efficiency, servitization, and closed-loop supply chains. Tsui et al. (2021) identify that circular manufacturing in the urban setting can contribute to sourcing local waste or secondary raw materials for production and to

establishing localized supply chains for a local consumer base. In this way, circular urban manufacturing may not only minimize global supply chain risks but also reduce greenhouse gas emissions by shortening supply chains and time to product delivery (Tsui et al., 2021). Circular urban manufacturing is also posited to promote a culture of repair and upcycling, in which makerspaces play a role in enhancing urban citizens' participation in community activities in reuse, repair, and sharing (Coskun et al., 2022).

Supportive intermediaries play a crucial role in advancing circular manufacturing and localizing resource and material flows in cities (Tsui et al., 2021). While not grounded explicitly in the circular economy context, urban and regional scholars have examined how intermediaries more broadly help urban manufacturers connect with local stakeholders and navigate complex ecosystems. Clark (2014) identifies three types of regional intermediaries: supply chain, labor market, and innovation intermediaries. Supply chain intermediaries build networks among producers, designers, and innovators to embed manufacturing capacities locally. Labor market intermediaries coordinate among businesses, educational institutions, and governments to promote skill development through training and certification programs. Innovation intermediaries link firms with research centers, offering access to expertise and equipment to support collaborative R&D. Similarly, Wolf-Powers et al. (2017) highlight the role of maker-enabling entrepreneurs who provide services such as prototyping tools, affordable workspaces, business assistance, financing, and networking, often tailored to the specific challenges faced by urban manufacturers. Expanding these ideas, Lowe and Vinodrai (2020) introduce the concept of place-connecting intermediation, which links urban-based designers and makers with non-urban manufacturers. The Carolina Textile District, for instance, acts as a broker, trainer, and consultant to create localized, equitable, and sustainable value chains.

These studies collectively emphasize the importance of institutional intermediary actors in supporting manufacturing within place-based contexts, which is also crucial in supporting local circular manufacturing practices. Tsui et al. (2021) acknowledge that circular urban manufacturing faces challenges not only because of a lack of affordable industrial land and limited prioritization from investors, but also because of insufficient availability and accessibility of quality waste and secondary materials from local sources, as well as production networks to process these materials. In other words, despite the importance of circular manufacturing in supporting the transition towards circular cities, the challenge emphasized by Clark (2014, p. 437) still stands, which is that it is about "how to re-connect and re-create supply networks after decades of seemingly de-territorialized production systems." We propose that digital platforms represent a novel form of intermediation capable of addressing these challenges and advancing circular urban manufacturing. Bringing digital platforms into focus also expands the discussion of urban planning and intermediation in the context of circular transitions. Specifically, urban planners could use platform-based tools to intermediate, or orchestrate, circular manufacturing activities and ecosystems, drawing on insights from platform ecosystem orchestration developed in industrial management studies. To explore the core components of such digital platforms, we now turn to the concept of platform ecosystem orchestration.

2.2. Platform Ecosystem Orchestration for the Circular Economy

The transition to a circular economy in cities requires an ecosystem perspective, which brings to the forefront the importance of loosely coupled interdependencies among actors, technologies, and institutions, coordinated through shared goals, values, and affiliation (Aarikka-Stenroos et al., 2021; Jacobides et al., 2018). However, ecosystems do not emerge in a vacuum; they often require an orchestrator to establish the

conditions under which collaboration can take place. Increasingly, digital platforms have gained attention as tools for such orchestration, enabling connections among diverse actors and supporting the transition toward a circular economy. In particular, in business-to-business applications, platforms move away from having hierarchical control toward enabling participant engagement and managing relationships, which requires balancing control with the encouragement of contributions (Grabher & van Tuijl, 2020). In this role, platforms help establish what Ritala (2024, p. 169) describes as platform ecosystems or "communities and groups of actors in different markets orchestrated via a digital platform" and that are an effective organizing form in addressing complex societal and ecological challenges.

In relation to circular economy, scholars have studied digital platforms through various lenses, such as circular business models for start-ups (Henry et al., 2020), business-to-business applications that facilitate industrial symbiosis and material exchange (Krom et al., 2022; Ritala & Jovanovic, 2024), and even as tools that enable non-commercial exchange of goods among local residents in everyday life (Korsunova et al., 2025). In particular, industrial management research has explored the specific mechanisms through which digital platforms orchestrate ecosystems to promote circular resource flows and waste recovery (Blackburn et al., 2022; Ciulli et al., 2020; Sahamies & Welinder, 2025). In this framework, digital platforms contribute by shaping three key organizing dimensions to address grand challenges effectively (Ritala, 2024).

The first organizing dimension is coordinating structures. As Ritala (2024) explains, the first organizing dimension of platform ecosystem orchestration involves establishing coordinating structures. These structures provide shared principles, rules, and technologies that define the platform's participatory architecture. This architecture facilitates the matching and brokering of inputs, such as resources and activities contributed by participants. Through the platform's coordinating structures, orchestrators must ensure that participants' contributions align with the platform's overall value proposition.

In the context of digital platforms in a circular economy, as Blackburn et al. (2022) argue, these platforms promote circular value creation by structuring interactions among actors, their resources, and their activities. Circular value creation is defined as "an effort to simultaneously address economic and circularity objectives for a firm" (Blackburn et al., 2022, p. 254). Platform ecosystem orchestrators develop a user-friendly platform architecture capable of automating the exchange of circular resources such as residual materials, waste, or unused assets (Blackburn et al., 2022; Ciulli et al., 2020; Sahamies & Welinder, 2025). This structure enables transactions for resources that have limited or no supply and demand in traditional linear markets, fostering new value flows through platform participation. To further realize circular value creation, orchestrators also establish platform-specific rules and identities that encourage participants to engage in making connections with other platform participants (Blackburn et al., 2022).

Collective action, the second key aspect of platform ecosystem orchestration, involves fostering collective action to support circular value creation (Ritala, 2024). Orchestrators establish platform-specific rules and shared identities that encourage participants to connect, align around common goals, and engage in joint activities (Blackburn et al., 2022; Ritala, 2024). To enable network effects, orchestrators attract new participants by presenting compelling business cases (e.g., improved resource efficiency) and lowering entry barriers through marketing, training, and support initiatives (Blackburn et al., 2022). Growing participation in the platform increases the availability and diversity of circular resources, enhancing value for all users (Cennamo, 2021; Ritala, 2024). With more users joining, the utility of the platform for each participant

increases, as both supply and demand for circular resources grow, reinforcing the platform's capacity to generate circular value (Ciulli et al., 2020; Sahamies & Welinder, 2025), thus driving a virtuous cycle of network effects (Rochet & Tirole, 2003).

Generativity, the third organizing dimension of platform ecosystem orchestration, refers to the platform's potential to inspire creativity and new contributions of participants, without direct intervention (Ritala, 2024). By encouraging participants to experiment, collaborate, and share knowledge, orchestrators are able to build a repository of shared solutions and experimental practices. In the context of digital platforms in a circular economy, generating actionable insights on resource traceability or environmental performance metrics can empower participants to assess and enhance their circularity efforts independently (Blackburn et al., 2022; Ciulli et al., 2020; Sahamies & Welinder, 2025). This accumulated data in the platform ecosystem fosters a self-sustaining cycle of learning, experimentation, and improvement, further advancing the platform's circular value creation.

As advanced in industrial management literature, digital platform ecosystem orchestration focuses on establishing the platform coordinating structures, collective action and network effects, and generativity potential for continuous experimentation and innovation among platform participants. However, for these organizing dimensions to have relevance to urban planning practices, there is room to further explore the potential for digital platforms to serve as effective orchestrators of localized circular practices, thereby supporting diverse actors, including urban manufacturers, and promoting the transition toward circular cities. As Barns (2019) observes, digital platforms shape the socio-spatial experiences of everyday life through intentional design strategies that foster highly interactive and participatory ecosystems. At the same time, Ricart et al. (2020) caution that digital platforms in cities must adopt governance approaches that engage diverse stakeholders and present an inclusive value proposition to minimize resistance. This inclusivity, which emphasizes joint creation and continual updating of value, is essential for platforms to generate positive impacts in urban settings (Carrasco-Farré et al., 2022). In planning circular activities within the textile and fashion sectors, it is particularly important to consider the socio-spatial relationships that platforms could help foster.

2.3. Circular Urban Manufacturing for the Fashion Industry

Today's fashion industry provides valuable insights into sustainability challenges, largely driven by the fast fashion paradigm, which has normalized a linear take-make-waste model that encourages both overproduction and overconsumption of textiles and garments (Bhardwaj & Fairhurst, 2010; de Koning et al., 2024). As supply chains have globalized and grown more complex to minimize production costs, the ecological and social burdens of fashion supply chain activities disproportionately affect countries in the Global South, where production has been outsourced (Niinimäki et al., 2020; Pugh et al., 2024). Meanwhile, cities in the Global North, once vibrant centers of garment production in the 19th century, have experienced deindustrialization and become hubs of fashion consumption (Wubs et al., 2020), lacking the infrastructure and skills needed to reuse, repair, or recycle clothing (Vladimirova et al., 2024).

Against this backdrop, current discourse on circular fashion seeks to replace the linear industrial model with a circular one, where "clothes, textiles, and fibers are kept at their highest value during use and re-enter the economy afterwards, never ending up as waste" (Ellen MacArthur Foundation, 2017, p. 22). Aligned with this

effort, there is a growing push to shorten fashion supply chains and localize resource flows, emphasizing the need for supportive intermediation to connect makers and producers operating near cities and regions (Kim, 2024). Intermediaries in the fashion and textile industry have a key role in strengthening the connections among different actors in the value chain (Lavanga, 2018), and their role in accelerating the sustainability transition is increasing. Studies by Norris (2019) and Real et al. (2020) highlight cases in Bristol, UK, and the Nouvelle-Aquitaine region in France, where local makers, designers, fiber producers, and educators collaborate in shared workspaces to create localized textile flows. Scholars such as Smith et al. (2017) discuss the role of local production and makerspaces in experimenting and developing new design strategies on material recovery, repair, and reuse. Similarly, industrial districts or eco-industrial parks promote recycling innovation by connecting collectors, suppliers, and recyclers (Bressanelli et al., 2022; Huang et al., 2021).

Despite these growing efforts, short, localized supply chains and resource flows in fashion remain as niches (Buchel et al., 2022). Echoing the broader challenges faced by circular urban manufacturers (Tsui et al., 2021), establishments in fashion production, upcycling, and recycling need accessible urban space to facilitate sourcing, production, storage, and other logistics matters (Kim, 2024; Williams, 2020). Studies also point to the absence of a systematized information network for tracking secondary textile materials by location, quantity, and composition (Han et al., 2017; Singh et al., 2019). Furthermore, effective circular supply chains in fashion depend on trust-building, shared commitments, and cross-sector collaboration, including between seemingly unrelated fields such as fashion design and secondhand sorting (Karell & Niinimäki, 2019; Kazancoglu et al., 2020).

In the following analysis, we examine digital platforms that support circular fashion practices in production and identify a typology of platform ecosystem orchestration that best represents these platforms. We then explore how each type coordinates participant interactions through the dimensions of platform ecosystem orchestration, as summarized in Table 1. Additionally, we assess whether these orchestration strategies integrate socio-spatial considerations to facilitate localized resource flows and networking among local producers and related actors. By analyzing how orchestration is implemented across existing platforms along these organizing dimensions, we suggest that urban planning practitioners can gain insights into the types of digital tools and mechanisms they could employ when planning circular fashion initiatives in urban contexts.

Table 1. Analytical framework on platform ecosystem orchestration mechanisms with socio-spatial considerations.

Platform dimension	Orchestration mechanisms
Coordinating structure	Design a platform with participatory architecture and features that enable platform users to contribute and interact
	Facilitate and, where possible, automate matching and brokering of inputs such as resources, skills, and activities
Circular value creation	Articulate the platform's value proposition around circular economy objectives
Collective action	Frame a shared objective or goal around circular value creation that motivates participant contribution
	Enable network effects by attracting new participants and incentivizing engagement
Generativity potential	Foster continuous experimentation and knowledge sharing among platform participants
	Provide environmental performance metrics, resource traceability tools, and a repository of circular practices

Table 1. (Cont.) Analytical framework on platform ecosystem orchestration mechanisms with socio-spatial considerations.

Platform dimension	Orchestration mechanisms
Socio-spatial consideration	Design a platform participatory architecture that specifies the geographic distribution of participants
	Enable matching and brokering of inputs within geographic boundaries
	Promote value creation with positive socio-spatial impact
	Support tailored skill development and capacity-building initiatives

Note: This table is adapted and extended from Ritala (2024).

3. Method

To develop a typology of platform ecosystem orchestration that best represents circular fashion platforms, we first compiled a list of existing platforms operating with the goal of advancing circular and sustainable practices in the fashion and textile sectors. Our initial dataset was built upon a list developed during a platform benchmarking exercise conducted by platform experts in the EU-funded project FABRIX, in which the authors participate. This list was assembled through desktop research conducted between July and August 2024 and supplemented by recommendations from experts and practitioners in the field. To expand our dataset, we incorporated additional platforms identified through participation in a circular textile fair in the Netherlands (September 2024) and an examination of ECOSYSTEX network members, a European community of practice for sustainable textile ecosystems. These efforts resulted in an initial list of 34 platforms.

To refine the list, each platform was systematically reviewed to assess its relevance and scope. Platforms were excluded if they lacked a specific focus on fashion, or more precisely on clothes and textiles, which are central to waste generation in the industry's linear take-make-waste paradigm (Ellen MacArthur Foundation, 2017), or if they operated broadly across multiple sectors. Another key criterion was the presence of multi-sided interactions, as these are essential for understanding how digital platforms orchestrate participant engagement and generate network effects. Following this refinement process, we identified 19 platforms, listed in Table 2. Our analytical framework, summarized in Table 1, allowed us to identify four main orchestration strategies used by circular fashion platforms and evaluate their role in shaping local circular economies and fostering sustainable production networks. For each platform, we conducted an in-depth analysis of its coordinating structures by examining types of participants involved, forms of circular value creation facilitated, network effects generated, generativity potential, assessing how platforms enable new interactions and collaborations within the circular fashion sector, and socio-spatial considerations, evaluating whether localized networking and resource flows were explicitly incorporated into platform orchestration strategies. We also examined how these dimensions are operationalized through specific platform features, such as stakeholder directories, product lifecycle management (PLM), project collaboration dashboards, resource catalogues, business management tools, spatial relation visualizations, or sustainability assessment tools. We organized this data in a spreadsheet and grouped platforms according to recurring patterns across these dimensions. This thematic grouping formed the basis for identifying four distinct types of orchestration, each reflecting the platform feature that serves as its primary component. Accordingly, this study employs an exploratory research approach, focusing on aggregating, categorizing, and analyzing the structural and functional characteristics of existing digital platforms in this domain.

Table 2. List of selected circular fashion platforms.

Type	Platform name	Governing body	Link
Marketplace	The Fabric Connector	Private organization	https://fabric-connector.com
Marketplace	Aloquia	Private organization	https://www.aloqia.com
Supply chain for recycling	Cibutex Exchange	Nonprofit organization (by Cibutex cooperative)	https://cibutexchange.com
Supply chain for recycling	Refashion	Nonprofit organization (producer responsibility organization)	http://refashion.fr
Networking	Common Objective	Private organization (under Ethical Fashion Group Ltd.)	https://www.commonobjective.co
Networking	Ellie Connect	Private organization (under Ariadne Innovation)	https://ellieconnect.com
Networking	Maker's Row	Private organization	https://makersrow.com
Networking	Manufy	Private organization	http://manufy.com
Networking	RegioGreenTex	EU-funded project	https://www.regiogreentex.eu/dashboards/home
Networking (PLM)	Circular.fashion	Private organization	https://circular.fashion
Networking (PLM)	Delogue	Private organization	https://www.delogue.com
Networking (PLM)	Foursource	Private organization	https://foursource.com
Networking (PLM)	Sqetch	Private organization	https://sqetch.co
Networking (PLM)	Supply Compass	Private organization	https://supplycompass.com
Data analytics	Circulareconomy.earth	Part of a project of an independent policy institute (British think tank Royal Institute of International Affairs, also known as Chatham House)	https://circulareconomy.earth/trade
Data analytics	Import Yeti	Private organization	https://www.importyeti.com
Data analytics	Open Supply Hub	Non-profit organization	https://opensupplyhub.org
Data analytics	Supply Trace	Research project at Northeastern University (multi-stakeholder advisory board)	https://supplytrace.org
Data analytics	Tex.tracer	Private organization	https://www.tex-tracer.com/solutions/brands-retailers

4. Findings

4.1. Market Orchestration Enabling Deadstock Material Transactions

Our exploratory analysis of circular fashion platforms highlights four main types of platform ecosystem orchestration. The first is market orchestration, which focuses on establishing a coordinating structure that enables platforms to function as marketplaces for the exchange of surplus or deadstock textile material. Digital platforms that enable transactions of excess resources are common in circular economy business

models (Blackburn et al., 2022; Ciulli et al., 2020). Through its coordinating structure, platforms support the matchmaking process between suppliers such as manufacturers with surplus textile inventory, and buyers such as designers and brands seeking materials for reuse. These platforms design features around material directories with customizable search filters on price, dimensions, material type, fiber type, color, and patterns, and standardized order submission pages. By defining the rules of engagement and material transaction processes, these platforms help overcome common frictions in textile reuse, such as heterogeneous material quality, lack of standardized inventory data, and fragmented market access (Kazancoglu et al., 2020).

As a result, market orchestration platforms that facilitate excess textile transactions contribute to circular value creation by enhancing resource reuse and reducing reliance on virgin material production. In this context, collective action involves instigating and sustaining transactional engagement among participants to realize these circular outcomes. For example, Aloquia emphasizes that both suppliers seeking to offload their surplus inventory and buyers searching for excess materials derive mutual benefit by participating on the platform. The effectiveness of these platforms is amplified by network effects. As more suppliers list surplus materials, the marketplace becomes increasingly attractive to buyers, and vice versa, creating a self-reinforcing cycle of participation.

To further incentivize the generativity potential of platform participants, market orchestrators offer additional features and tools. For instance, Aloquia provides impact reports that quantify and communicate the environmental benefits of inventory utilization for platform participants, reinforcing value creation beyond simple transactions. Similarly, Fabric Connector curates web pages to educate participants on circular economy practices and provides assessment questions for marketplace participants to evaluate the circularity of their material sourcing practices.

In terms of socio-spatial aspects, market orchestrating platforms facilitate textile transactions across multiple spatial scales, maximizing the reach of supply and demand. The global scale of transactions enables deadstock material valorization, which would be difficult for local sourcing alone to achieve. However, some platforms strategically promote regional exchanges of materials to align with sustainability objectives such as reducing transport-related emissions and supporting local suppliers. For instance, Fabric Connector collaborates with Manufy, a platform dedicated to sustainable textile and fashion manufacturing in Europe (categorized under networking orchestration), to encourage deadstock circulation within the EU. This illustrates how collaborations between digital platforms can enhance both market creation and circular economy outcomes at different spatial scales.

4.2. Supply Chain Orchestration Enabling Textile-To-Textile Recycling

The second type of platform ecosystem orchestration in a circular fashion enables textile-to-textile recycling. Similar to platforms that enable deadstock material transactions, the coordinating structure of platforms that facilitate recycling establishes an intermediary marketplace that connects the supply and demand for feedstock used in textile recycling. However, these platforms operate within a more complex material flow structure, as recycling involves multiple stages, including collection, sorting, preprocessing, and recycling, each requiring specialized industrial actors and technological infrastructure. By coordinating these interactions, platform orchestration focuses on connecting and establishing supply chains that involve

participation of diverse actors such as brands, material suppliers, recycling solution providers, sorting centers, and industrial users of recycled materials. Cibutex Exchange, for instance, aims to bring together the supply, demand, and logistics of textile recycling by automating the process of aggregating textile volumes and directing them to recycling facilities. The matching of material types to suitable recycling technologies is particularly critical, as different fibers require different treatment methods (e.g., mechanical vs. chemical recycling; Sandvik & Stubbs, 2019).

Collective action in supply chain orchestration is actively promoted by launching collaborative projects and continuous innovation and experimentation among platform participants. Platforms such as Refashion actively support R&D by issuing calls for expressions of interest from sorting centers, preprocessing facilities, and recyclers to collaborate on pilot projects. Similarly, Cibutex Exchange organizes pilot projects to strengthen recycling supply chains and create markets for recycled products, such as its kitchen towel made from recycled textiles. The economic viability of these markets ensures network effects to take place, where the more recyclers, sorting facilities, and industrial buyers that participate in these platforms, the greater the economic viability of recycled material markets. This is especially important, yet challenging, given that many textile recycling markets remain underdeveloped or economically unattractive compared to conventional linear production models (Sandvik & Stubbs, 2019). As discarded textiles turn into feedstocks of value in markets, this in turn creates opportunities for generative potential in the form of continuous contribution and innovative adaptation of platform participants to experiment with new sorting techniques, fiber processing, and closed-loop recycling models.

In orchestrating supply chains for recycling, platforms also re-territorialize supply chain formation. For example, Refashion integrates mapping visualizations into its platform interface, encouraging the development of European-level recycling value chains. These visual tools help platform participants identify nearby sources of recyclable feedstocks and available processing infrastructure, promoting regionalized recycling loops that minimize carbon footprints. Given that recycling involves the shipment of materials at various processing stages, localized and shorter supply chains enhance overall sustainability and economic feasibility. Moreover, textile recycling initiatives align with extended producer responsibility policies, making a regional orchestration strategy more practical and legally relevant, particularly in the European context.

4.3. Network Orchestration Enabling Cross-Sector Collaboration

The third type of platform orchestration in a circular fashion focuses on facilitating networking and collaboration. If the focus of the previous orchestration types, that is, in textile reuse market and recycling supply chain orchestration, was primarily on facilitating market transactions and matching of supply and demand among textile industrial actors, networking-enabling platforms foster collaborations by connecting diverse stakeholders across and beyond the textile and fashion value chain. These platforms bring together actors from multiple sectors, including fashion, manufacturers, governments, research institutes, social enterprises, and circular economy solution providers. By expanding participation beyond traditional supply chain actors, these platforms help cultivate cross-sectoral partnerships, enabling systemic solutions that address the complexities of circular fashion transitions.

A subset of networking-enabling platforms includes PLM platforms, which primarily facilitate collaboration between brands and suppliers for production management, traceability, and compliance. Unlike platforms

that orchestrate broader cross-sectoral networking, PLM platforms typically focus on structured communication between brands and suppliers, which enables seamless coordination of production orders, design modifications, and material specifications. PLM platforms such as Delogue also integrate circular design guidelines and regulatory compliance tools, ensuring that supply chain interactions align specifically with sustainability mandates. Hence, while PLM platforms streamline supply chain management for fashion industry actors, broader networking platforms enable open-ended, cross-sector collaborations.

From a platform orchestration perspective, networking-enabling platforms structure interactions through customizable directories and matchmaking tools that facilitate strategic collaborations. The coordinating structure of these platforms prioritizes ease of navigation and visibility, for instance, by allowing participants to search for potential partners based on specific criteria such as sector and geographical location. Coordination can also help participants find solution providers for specific challenges. For example, on the Ellie Connect platform, participants can post challenges that specify the partners they are seeking. This approach fosters tailored project formation and collaboration among participants. Therefore, the coordinating structure of network orchestrating platforms is tightly linked to fostering collective action, as circular value creation centers around supporting collaboration opportunities and community making. Furthermore, as more participants join the platform, the network effects intensify, increasing the diversity of expertise and collaboration opportunities.

To amplify generativity potential, networking-enabling platform orchestrators provide curated content streams, including newsletters, reports, podcasts, and research briefings. These insights keep participants informed about emerging trends, new technologies, regulatory updates, and best practices, so that platform participants are able to continuously seek partnerships and collaboration opportunities in circular practices. Furthermore, by offering trend monitoring and regulatory intelligence, platforms help participants navigate the shifting landscape of circular economy regulations and market demands, increasing the strategic value of platform participation.

In terms of socio-spatial considerations, some network orchestrating platforms also strengthen local collaborations by encouraging geographic concentration of interconnected actors. For example, RegioGreenTex, in collaboration with Ellie Connect, promotes the development of textile recycling hubs where industry, research institutes, and governments collaborate. These orchestration strategies extend beyond digital matchmaking to active community-building, reinforcing place-based network effects.

4.4. Supply Chain Data Analytics Orchestration

The fourth type of digital platform orchestration in a circular fashion focuses on supply chain analytics and data management. These platforms play a crucial role in enhancing transparency, monitoring environmental and social impacts, and supporting evidence-based decision-making for circular economy transitions. By leveraging data analytics, life cycle assessments, and supply chain risk assessments, they provide actionable insights that help businesses, researchers, and policymakers address inefficiencies, risks, and sustainability challenges within textile and fashion supply chains.

From a platform orchestration perspective, the coordinating structure of data analytics platforms promotes collective data stewardship, allowing a broader range of participants, including researchers, civil society

organizations, and regulatory bodies, to contribute to and access supply chain datasets. These platforms improve accessibility of information on trade flows, labor conditions, and environmental footprints. A key objective is to enhance the completeness and reliability of global supply chain data, addressing the long-standing issue of opaque and fragmented supply chain visibility in the fashion industry, which is a key challenge in promoting circular and sustainable fashion practices (Kazancoglu et al., 2020). By fostering collective action on data-sharing practices, these platforms enable supply chain transparency and policy-oriented research, expanding their role beyond corporate sustainability reporting to public accountability and monitoring. As more platform participants share data, the network effects of these platforms grow, leading to more comprehensive, real-time, and granular insights into the global textile supply chains.

The generativity potential of these data analytics platforms is also amplified by supporting research and training initiatives to input and utilize platform data. To help a diverse range of participants use these data sets and insights to monitor and shape sustainable supply chains, platforms such as Open Supply Hub offer information sessions and knowledge-sharing tools tailored to their varied needs. Further refinement, precision, and verifiability of supply chain data strengthen trust among stakeholders and reduce information asymmetries. From a socio-spatial perspective, however, supply chain data analytics orchestration focuses on global datasets to enhance transparency across complex, transnational supply chains. What remains largely underdeveloped is the application of micro-level, bottom-up analytics that capture city—or even neighborhood-level resource flows and supply chain actors involved.

5. Discussion

Foregrounding the potential role of digital platforms in supporting circular manufacturing in cities and local regions, this study asked what typology of platform ecosystem orchestration best represents existing circular fashion platforms and how each type coordinates participant interactions to foster localized resource flows. As summarized in Table 3, our exploratory analysis identified four main types of digital platform orchestration: orchestration of residual material marketplaces, recycling supply chains, cross-sectoral networking, and supply chain data analytics. Each type establishes coordinating structures for platform participants to collectively contribute to circular value creation in a continuous and collaborative manner.

Our analysis also expands the platform ecosystem orchestration literature by emphasizing the spatial relationships that can be facilitated by the four types of circular fashion platform orchestration. This also responds to the call for more exploration of the role of space in management studies (Suwala et al., 2022). For platforms focused on circular textile market creation, coordinating structures can encourage participants to prioritize localized transactions. To support this, platform interfaces often feature customizable filtering tools and visual maps to help users identify potential partners by location. Additionally, these platforms collaborate with local-facing networking platforms to expand access for participants seeking localized partnerships. In turn, networking platforms aim to strengthen localized collaboration by fostering the development of local hubs and clusters for circular textile and fashion activities. For supply chain data analytics platforms, while global datasets enhance transparency in complex textile and fashion supply chains, incorporating micro-level, bottom-up analytics could strengthen the orchestration of localized resource management.

Table 3. Summary of findings on the typology of circular fashion platforms and their orchestration strategies.

	Market orchestration for textile reuse	Supply chain orchestration for textile recycling	Networks orchestration	Data analytics orchestration
Coordinating structure	Create a marketplace that enables the exchange of surplus textile materials between suppliers and buyers	Coordinate supply chain actors for the delivery of textile-to-textile recycling	Foster matchmaking across and beyond textile and fashion industry actors	Collective data stewardship by standardizing supply chain data and automated aggregation
Circular value creation	Enhance resource efficiency and reduce reliance on virgin material production	Create recycling supply chains and markets	Support collaborations and community making	Enhance transparency, completeness, and reliability of the global textile and garment supply chain data
Collective action	Instigate collective action by enrolling more suppliers and buyers to engage in excess resource exchange	Organize collaborative projects for recycling supply chain actors	Develop platform features to facilitate collaboration and project formation among participants and solution providers	Promote collective data stewardship by facilitating participant data contribution to generate more comprehensive and accurate insights into global textile and garment supply chains
Generativity potential	Develop tailored features and tools for participant engagement	Demonstrate and enhance the economic viability of recycled textile products for continuous contribution and innovation	Provide curated content streams on best practices, regulations, market trends, and challenge sharing to incentivize collaborations	Support research and training initiatives that utilize platform data
Socio-spatial considerations	Support localized transactions of materials by collaborating with local-facing platforms or network facilitators	Support localized supply chain formation by enhancing visibility of local recyclers, sorters, and processors	Promote matchmaking to strengthen local collaborations or the formation of local hubs	More granular insights and local-scale data collection are needed
Examples	Fabric Connector and Aloquia	Cibutex Exchange and Refashion	Ellie Connect, RegioGreenTex, Manufy, and PLM providers	Open Supply Hub and data analytics service providers

Therefore, while platform ecosystem orchestration literature has not explicitly addressed the socio-spatial relations that orchestration can incentivize, platform features and strategies can be designed to enhance the participation of local producers in circular practices, fostering ecosystems of localized circular fashion. More

importantly, as scholars such as Pauli et al. (2021) note, digital industrial platforms often struggle to develop effective strategies for attracting both supply and demand and generating network effects. In this context, fostering relational ties at the local scale may serve as a crucial starting point for collective action, with network effects gradually emerging as the platform's geographical reach expands.

Urban planning practitioners can contribute to locally grounded processes and advance their initiatives through the collective action these efforts enable. While planning and regional studies have emphasized the role of institutional intermediaries in supporting urban manufacturing and maker businesses, planners could also adopt platform-based tools to foster local ecosystems centered on circular value creation. This involves considering how different forms of platform orchestration structure participation, generate collective action, and support innovation in circular manufacturing. Planners might partner with platforms, often private organizations, as our analysis shows, and explore how such collaborations can help build the ecosystems local industries need for a circular transition. In doing so, planning's role could evolve from intermediation to orchestration of productive urban ecosystems through platform technologies.

Moreover, planning practitioners could enable platforms to address spatial inequalities or identify geographic areas where participation and visibility are low. In other words, the spatial relations orchestrated by digital platforms could lead to place-connecting strategies, as discussed by Lowe and Vinodrai (2020). Additionally, collective action and network effects could be fostered to create place-specific identity, transforming "sources of shared vulnerability into collective cross-regional identity" (Lowe & Vinodrai, 2020, p. 7). Furthermore, while platforms, particularly cross-sectoral networking platforms, provide industrial updates and learning materials for participants, an orchestration model akin to labor market intermediation, as identified by Clark (2014), has yet to emerge. As Lüthje (2019) observed in his study of platform-driven manufacturing in China's Taobao villages, the distribution-oriented platform model led by e-commerce giants, unlike more production-driven approaches, can contribute to greater fragmentation, informalization, and less innovative working conditions for supply chain actors. Planning practitioners could encourage platforms to integrate skill development and capacity-building features tailored to specific roles in a circular fashion. They could also include social enterprises as platform participants to offer training programs and develop curricula on circular fashion practices. Additionally, platforms could facilitate the matching of interns, trainees, or employees with circular fashion businesses.

Future research could further explore platform ecosystem orchestration strategies that promote local industrial activities and facilitate their transition to a circular economy. While our study focused on circular fashion platforms, other resource flows, such as food, construction materials, and plastics, also require the integration of circular economy principles in urban contexts. Platforms that enable localized and shortened supply chains in these sectors would deepen the socio-spatial implications of platform ecosystem orchestration.

Additionally, there is a need to examine the challenges platform orchestrators face in coordinating localized collective action. For instance, while network effects can drive platform growth, they may also require expanding participation beyond local contexts. Future research should investigate how orchestration strategies balance the benefits of scaling network effects against the risk of losing local focus. Beyond platform orchestrators, future studies could also explore challenges faced by platform participants, particularly urban manufacturers and other local producers such as makers. Understanding their experiences

with platform enrollment could reveal the need for capacity-building programs or training initiatives that support their participation.

Finally, while our study highlights the potential of digital platforms to create productive city ecosystems and generate positive socio-spatial effects, we acknowledge that negative consequences may also arise. Future research could examine potential exclusionary practices, unequal power dynamics in platform ecosystem orchestration, or the potential negative effects of algorithmic orchestration, and explore strategies to mitigate these risks.

6. Conclusion

This study examined how digital platforms orchestrate ecosystems in a circular fashion, identifying key typologies and their implications for urban planning and localized circular resource flows. By analyzing the key dimensions of platform ecosystem orchestration strategies, we highlighted the role of platforms in facilitating marketplaces, recycling supply chains, cross-sectoral networking, and data-driven supply chain monitoring. In doing so, we emphasized the spatial dynamics that accompany platform orchestration, suggesting that platforms not only streamline resource exchanges and production processes but also shape socio-spatial relations that influence localized dynamics in circular fashion.

For circular manufacturing to thrive in cities and contribute to their circular transitions, the varying degrees of localized interactions generated by platform orchestration can be leveraged. However, there is still room for improvement. As noted, micro-level, place-based supply chain data captured through supply chain data analytics platforms could provide urban planners with insights into where and how circular industrial activities are taking place, as well as spatial inequalities in participation in circular transitions. Furthermore, while some platforms facilitating marketplaces, recycling supply chains, and networking have developed features and partnerships to encourage localized interactions, these efforts often operate at the broader regional scale (e.g., the EU). Hence, further research and development can be made to explore how these types of platform orchestration might also activate more spatially proximate connections, potentially within cities or even neighborhoods. Additionally, our study identified the underdeveloped role of platforms in workforce development and skill-building. Expanding platform functions to include digital training programs, workforce matching, and capacity-building initiatives tailored for local manufacturers and makers would enhance the inclusivity and accessibility of platform ecosystems.

Overall, this study underscores the new opportunities that platform-based coordination presents for urban planners to actively orchestrate productive city ecosystems that support circular manufacturing. However, more importantly, we stress the need for intentional governance, equity-driven strategies for local industrial participants, and spatially nuanced orchestration. We hope that this exploratory study encourages further interdisciplinary research bridging urban planning, digital platform studies, and industrial management to ensure that these tools foster truly inclusive and sustainable circular transitions in cities and regions.

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Conflict of Interests

The authors declare no conflict of interests.

Data Availability

All data generated or analyzed during this study are included in this published article.

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