Extended Abstract: Digital Textile Microfactories in Urban Manufacturing: A Quantitative Analysis on Market Diffusion and Dominance

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The fashion industry is experiencing a major transformation driven by the demand for sustainability, personalization, and resilience in global supply chains (Shen, Zhang and Liu, 2021). One promising innovation addressing these shifts is the Digital Textile Microfactory (DTMF)—a digitally integrated, localized manufacturing concept that enables mass customization while minimizing waste (Arfaiee, Winkler and Tilebein, 2023). DTMFs utilize advanced technologies such as body scanning, 3D CAD, digital textile printing, and automated assembly to support urban production models that reduce lead times and environmental impact (Tilebein, 2022; Sayem, Kennon and Clarke, 2010).

This paper presents a System Dynamics simulation model designed to analyze the competitive behavior of two DTMF platforms within a local market. The model comprises five key modules: diffusion dynamics (based on the Bass model), customer adoption and churn, pricing strategies, learning curves, and indirect network effects via complementors (Arzoglou, Holweg and Pil, 2019). The model structure follows the "Success to the Successful" system archetype, highlighting reinforcing feedback loops such as customer lock-in, complementor engagement, and compatibility-driven platform attractiveness (Wolstenholme, 2003).

In the baseline scenario, both DTMFs achieve equal market share. However, introducing a 20% reduction in avatar creation cost for one platform triggers a tipping point—leading to accelerated adoption, reinforced network effects, and eventual full market dominance. Similarly, doubling design compensation for third-party designers results in substantial platform growth, though at a slower pace. These results indicate that direct network effects (e.g., through strategic pricing) generate a more rapid and impactful influence on market share than indirect effects driven by ecosystem expansion (Panico and Cennamo, 2022). Once a platform reaches a critical installed base, it benefits from compatibility

standards and switching cost barriers, locking users into the ecosystem and suppressing competition (Brynjolfsson, Hu and Smith, 2003).

The simulation further reveals the strategic importance of early intervention in platform competition. Lowering entrance barriers can lead to self-reinforcing feedback loops and long-term dominance (Dou and Wu, 2021). The findings align with two-sided platform economics, which advocates subsidizing the more price-sensitive user group (e.g., consumers) while extracting value from complementors (Frishammar et al., 2018). In addition, the model demonstrates the potential for path dependence, where small early advantages become magnified through feedback mechanisms and result in entrenched market positions. Proprietary standards, in particular, enhance ecosystem cohesion and raise entry barriers for competitors (Arzoglou, Holweg and Pil, 2019; Tilebein, 2022).

Finally, this work contributes to the literature on urban manufacturing, platform strategy, and system dynamics, offering a model for assessing the market behavior of emerging digital production platforms. The findings are relevant for platform designers, policy-makers, and innovators seeking to foster sustainable, inclusive, and resilient urban manufacturing ecosystems.

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