Extended Abstract: Limits to Success of the Individualization Business Model in Digital Textile Micro Factories

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The textile and clothing industries face challenges such as severe competition from low-cost nations, rising demand for sustainable and ethical production, automation, and a skilled labor shortage (Lee, 2019). Furthermore, the sector must continually adjust to changing fashions, designs, and client preferences, which adds to the difficulty.

The need for customized items is a notable trend in customer preferences, leading to increased demand for personalized clothes (Tilebein, 2019). Historically, small manufacturers and artisans met this demand. With the rise of Industry 4.0 technologies, DTMFs have gained significant attention as they enable a fully digital end-to-end development and production process for textile and clothing products. This digital infrastructure enables speed, customization (including tiny batch sizes and single-piece production), efficiency, sustainability, and excellent quality. Furthermore, DTMFs have a high potential for innovation and improved customer engagement (Kiel et al., 2017; Winands et al., 2022).

Despite these potential advantages, the industry has hesitated to adopt technologies of Industry 4.0 together with new business models due to various challenges (Saebi et al., 2017). These challenges are well known also from other industries and include a lack of time, the cost of changing current processes, and resistance to change (Chesbrough, 2010). With no previous experience in this field, decision-makers require more information to assess the financial feasibility and customer acceptance of the individualization business model,
urging concerns about its viability and slowing the adoption of new technologies and new business models (von den Eichen et al., 2015).

This paper aims to develop a System Dynamics-based model analyzing Digital Textile Micro Factories (DTMFs) with the individualization business model. A medium-term perspective enables the detecting of unintended effects and comprehending complex business strategy relationships. The individualization model faces challenges, such as "limits-to-success" scenarios involving design service assistance for customers lacking design skills. Adequate design service capacity leads to satisfied customers and facilitates company growth. The research provides valuable insights for decision-makers to identify critical system drivers and understand their impact, which is vital for developing viable and flexible business models.

Our results have two main contributions. On the one hand, in the industry, it could help firms considering implementing the individualization business model, based on DTMF processes, make informed decisions that increase the firm's benefits while mitigating any possible negative consequences. On the other hand, our paper adds to the literature on System Dynamics with a specific case of limits to growth in the field of business models.

In this paper, we developed an SD-based model to analyze the complex relationships underlying adopting the individualization business model on a DTMF. We tested two possible scenarios. The first scenario limits customers to ordering only if they have received the design support service, while the second scenario relaxes this limitation. Both scenarios show a decline in the customer base reaching the maximum. In both cases, we can distinguish the limits to the success archetype. In this archetype, there is an endogenous resource that limits the growth of the system. In our case, the decision-makers on DTMFs have to balance sustainable growth with the expansion of the design support capacity.

The findings of this research may provide helpful insights for decision-makers in identifying key system drivers and understanding how changes in these drivers impact the overall system, which is critical in creating viable and flexible business models. DTMFs that want to offer fully customized garments to their customers need to understand the importance of balancing their key processes and sales that attract new customers and increase customer loyalty.

Our results should be seen as an exploratory experiment and thus should be seen as a tool for organizational learning. For this, the DTMF technology is new and companies aiming to start urban production business for individual clothing need decision support for their investment decision. Our model can provide insights into limits to growth mechanisms that have to be considered upfront. This model could be adapted to study the financial feasibility or the environmental impact of the individualization business model for the textile industry.
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