

Shaping the future of fashion-tech - business models, roles and skills aiding digital transformations

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Abstract

Purpose: The purpose of the paper is to identify emerging revenue streams and business model opportunities offered within fashion-tech, and what transformational roles and skills are required in order to support fashion-tech business model transformation and value capture.

Design/methodology/approach: A focus group study is conducted digitally in three episodes with about ten invited industry practitioners representing fashion brands, technology firms, telecom operators and provider of circularity services. Ontologically, this adopts a four-step process on fashion-tech to explore current state, future directions, transitions required, and supporting roles and skills to assist transitions.

Findings: The top 3 revenue streams identified are subscriptions, digital platforms and data selling, while sustainable and circular business model was considered the most important for capturing value via these revenue streams. 7 meta-level skillset were resultant which revealed 11 future job roles essential for fashion-tech transformation.

Research limitations/implications: The paper highlights a list of prospective revenue streams, BM transformation requirements, skillsets and roles that are offered within, and required for, fashion-tech value chains, thus providing systematic understanding of digital transformation in the fashion industry. However, the results cannot be generalized.

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Practical implications (if applicable): The paper sheds some key takeaways for companies working with fashion-tech business models in terms of revenue streams, business models, roles and skillsets to consider.

Originality/value (mandatory): The novelty lies in its suggested approach of starting from revenue streams and then aligning it with transformations in business model elements, in order to understand how to capture value from fashion-tech business models.

Keywords: Fashion-tech, digital transformation, business model, value capture, COVID-19, focus group

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Introduction

According to BoF & McKinsey (2020) the global fashion industry is transforming rapidly owing to the impact of the current COVID-19 outbreak, with 80% of it expected to be under economic distress imposed by lockdown and recession, with a 27-30% contraction in global revenues. However this has simultaneously opened up new opportunities for driving a paradigm shift of the fashion industry powered by digital technologies and virtual connections with the promise of enhancing innovation and sustainability along the entire fashion value chain (Brydges et al. 2020; Gonzalo et al. 2020); believed to be resulting in more intelligent, resource efficient and customer-oriented processes, products, services, and business models (Bertola and Teunissen 2018; Kalbaska and Cantoni 2018).

Digital technologies are in the early phase of commercialization, and existing research primarily explores the technological advancements permitted by its adoption (Papachristou and Bilalis 2015, Arribas and Alfaro 2018). Even though digitalization is a 'silver lining' that offers opportunity to re-imagine the fashion industry, create operational and financial stability, and underpin focus on sustainability and circularity, it is crucial to explore in-depth how to capture the value of being 'digital' in fashion industry and what new fashion-tech business models and revenue streams can be created through it.

Previous literature have clearly acknowledged that virtual and digital technologies adoption across the different stages of design, sourcing, manufacturing, distribution, retail and reverse logistics leads to structural changes and transformation in the fashion industry in several ways by impacting its performance, in terms of time compression, lowering environmental impacts, improving process integration, visibility and customer orientation, amongst others (Berg et al. 2017; Brydges et al. 2020; Chaudhary et al. 2020; Gonzalo et al. 2020; Jain and Sundström 2021). However, there is a clear indication that this body of literature provides limited information on how digital technologies affect the business model innovation including the unleashing of new revenue streams in the fashion industry (see e.g. Arribas and Alfaro 2018; Bertola and Teunissen 2018; Noris et al. 2021). Without considering this interrelation, companies can find themselves facing the so-called 'digital paradox' where investments in digital transformation do not lead to the intended value capture. In particular, starting from revenue streams/revenue models and then aligning it with transformations in business model elements can help solving the 'digital paradox' and thus facilitate the digital transformation of the fashion industry. Parida et al. (2019, p. 18) suggests "*... aligning value capture to other business model components can reduce the likelihood of encountering digital paradox. Nevertheless, understanding how firms can manage the digital paradox and capture value in digitalization is an issue of considerable importance*".

Thus the purpose of the paper is *to identify emerging revenue streams and business model opportunities offered within fashion-tech, and what transformational roles and skills will be required in companies in order to support fashion-tech business model transformation and value capture.*

Literature background: digital transformation in the fashion industry

Adoption of digital and virtual technologies results in radical changes in the fashion industry (Arribas and Alfaro 2018). In particular, use of digital data combined with the use of advanced digital technologies such as machine learning, Artificial Intelligence, smart systems, etc. is improving productivity, reducing inefficiencies such as defects, waste and production lead time, and enabling greater agility and visibility through short runs and small lot sizes in the fashion industry (ETP 2020, Nasiri et al. 2020, Raab and Griffin-Cryan 2011). These structural changes in the back end of the supply chain and also complemented with changes in the front-end business operations including provision of new products, services and experiences to customers (Arribas and Alfaro 2018). As result, the very logic of doing business is transforming, novel business models are emerging that enable customer co-creation, predictive/remote monitoring and maintenance, virtual training, digital product twins, and 'production-as-a-service' concepts (ETP 2020). These industry disruptions characterised by structural changes in the entire value chain processes and business model innovations as result of digital and virtual technologies adoption are termed as digital industry transformation (Vial 2019).

According to Osterwalder and Pigneur (2010, p. 14), *"a business model describes the rationale of how an organisation creates, delivers and captures value"*. The architecture of value creation, delivery and capture and associated business model components are changing as part of digital industry transformation (Figure 1). At a systemic level, the shift towards a service-oriented, network-oriented, and user-driven approach in business model design becomes evident (Ibarra et al. 2018). Crucial in this context is delivery of innovative complementary product-service offerings that are co-created through higher degree of collaboration in extended supplier and customer networks (so-called business ecosystem), and are more oriented and responsive to user needs (Arnold et al. 2016; Ehret and Wirtz 2017). Multi-sided service-oriented platform models become popular where product/service value is increased due to network effects and value capture in form of platform revenues is enabled (Teece and Linden 2017, Bharadwaj 2013, Remane et al. 2017). Dynamic pricing, subscriptions, performance based contracting are examples of new pricing models (Ibarra et al. 2018).

BUSINESS MODEL DESIGN/ VALUE ARCHITECTURE COMPONENTS	DIGITAL TRANSFORMATION OF BUSINESS MODEL COMPONENTS
VALUE DELIVERY	<input type="checkbox"/> ADDING NEW/DIGITAL PRODUCT AND SERVICE OFFERINGS (INCLUDING COMPLEMENTARITY AND LOCK-IN CONSIDERATIONS) <input type="checkbox"/> RE-SHAPING USER VALUE PROPOSITIONS (ENHANCING, EXTENDING, TRANSFORMING EXISTING USER VALUE) <input type="checkbox"/> CHANGING USER RELATIONSHIPS, E.G. COMMUNITIES AND CUSTOMER CO-CREATION <input type="checkbox"/> NEW DIGITAL CHANNELS <input type="checkbox"/> INTEGRATING USER TOUCHPOINTS/OMNICHANNEL EXPERIENCE <input type="checkbox"/> USER IMMERSIVE EXPERIENCE
VALUE CREATION	<input type="checkbox"/> DIGITALISING OPERATIONAL MODEL/BUSINESS FUNCTIONS <input type="checkbox"/> ADDING NOVEL ACTIVITIES (INTERNAL AND EXTERNAL) REQUIRED TO DELIVER RE-SHAPED VALUE PROPOSITIONS <input type="checkbox"/> DEVELOPING PARTNERSHIPS/COLLABORATIONS REQUIRED TO FULFILL THESE NOVEL ACTIVITIES <input type="checkbox"/> NEW BUSINESS ECOSYSTEMS <input type="checkbox"/> MULTI-SIDED PLATFORMS <input type="checkbox"/> OPPORTUNITIES FOR OPEN INNOVATION AND CROWDSOURCING
VALUE CAPTURE	<input type="checkbox"/> ENHANCING EXISTING REVENUE STREAMS (E.G. VIA COST SAVINGS DUE TO DIGITALISING OPERATIONAL MODEL/BUSINESS FUNCTIONS) <input type="checkbox"/> ENABLING NEW REVENUE STREAMS (SHIFT FROM SELLING THE OWNERSHIP OF PHYSICAL PRODUCTS TO PROVIDING NEW FORMS OF ACCESS TO INNOVATIVE DIGITAL PRODUCTS AND SERVICES (E.G. SUBSCRIPTION, PAY-PER-USE))

Figure 1. Business model design changes with regards to value delivery, creation and capture resulting from adoption of digital technologies.

Based on Dijkman et al. (2015), Bertola and Teunissen (2018), Teece and Linden (2017), Remane et. al. (2017), Colombi et al. (2018) and Ibarra et al. (2018).

Methodology

The study is conducted via three digital focus groups episodes with eminent invited experts from both fashion and digital industry sectors and academia. Specifically the industry practitioners represented fashion brands, technology firms, telecom operators and provider of circularity services. The focus group was designed to particularly ideate on future revenue streams enabled by fashion-tech (F-Tech) and then aligning the future revenue streams with required F-Tech business model (BM) transformations. Ontologically, an episodic focus group format was adopted in a four-step process to capture data on: 1) current state of fashion-tech 2) future directions of fashion-tech 3) transitions required to achieve future directions in fashion-tech and 4) supporting fashion-tech roles and skills to assist transitions. Application of this 4-step approach was also perceived as meaningful for establishing relevant and engaging context for discussion of Future F-Tech roles and skills with participating industry partners. In particular, it allowed to comprehend how corporate objectives behind

current and future engagement with Fashion Tech should be aligned with the development and investments into digital talents to support the F-Tech BM transformation for enhancing value capture opportunities.

The focus group named as “Shaping the future of Fashion” in communication with industry participants was carried out via three digital (zoom based) episodes that took place on June 2, June 4 and June 16, 2020. Each episode provided relevant insights for structuring the discussion in the consequent episode. Each episodes ran for about 3 hours. The structure and major areas of exploration of each episode are summarized below:

- Episode 1 “Current and future revenue streams in F-Tech business models”: focused on discussing the current state of revenue streams in fashion industry and envisioning future revenue streams enabled by Fashion-Tech, such as connected fashion and virtual products.
- Episode 2 “Essential business model transformations required for unleashing future revenue streams”: was devoted to identifying innovative business ideas and changes required to support business model transformations for capturing future revenue streams.
- Episode 3 “Fashion Tech roles and skills to aid business model transformations”: structured around discussing relevant fashion-tech professional skills to identify digital job roles that need to be developed in order to accomplish essential business model transformations and thus unleash untapped revenue streams offered by Fashion-Tech.

Within each episode, various set of methods for data collection and evaluation was used that included semi-structured multiple choice questionnaires, presentations of questionnaire results and joint discussions with participants, brainstorming sessions in smaller groups, sharing insights from the brainstorming session, and voting on shared ideas. Specific approaches for structuring and facilitating the brainstorming sessions included ‘*what if*’ scenarios for envisioning future revenue streams (in Episode 1) and *prompts* structured around key elements of F-Tech BM transformation (in Episode 2). The brainstorming sessions were assigned spokespersons to avoid the bias of misinterpreting the emerging ideas and themes. It also allowed for data reduction since participants were asked to decide and report on the most prominent and relevant insights for the future of F-Tech industry. Finally the *voting* on shared ideas from the brainstorming session further allowed data reduction in Episodes 1 and 2, and helped facilitating the group decision-making on the most prominent and relevant insights for the future of F-Tech industry.

Both qualitative and quantitative data were generated from the focus group. Qualitative data in the form of expressed ideas and insights contributed to identification of the thematic framework via *deductive approaches in Step 1 and partially in Step 4*, and via *inductive approach in Steps 2, 3 and 4* (see more details explaining the

logic behind employed analytical approaches in Table 1). Quantitative data in the form of descriptive statistics from questionnaires (how many participants provided particular insight) and voting results complemented qualitative data, providing indication of what ideas and insights were viewed more prominent/relevant by majority of participants.

Some focus group results were generated from questionnaire (in episodes 1 and 3) and from application of the inductive approach during the focus group itself (in all the episodes). In particular, emerging ideas and insights were plotted on the whiteboard or shared Zoom slides and followed by voting during episodes 1 and 2, allowing identification of insights considered by majority of participants as important and relevant for the future of F-Tech industry. Furthermore, episodes 1 and 2 can be viewed as preparatory activities which laid the foundation for the contextual and in-depth discussion of the future F-Tech skills and roles demanded by the industry to realize the F-Tech BM transformation. Finally, episode 3 can be viewed as the cumulating point of the whole focus group where some characteristics of the future F-Tech professional profiles (roles and skills) started to emerge. Therefore, in addition to applying inductive approach to data evaluation during the episode 3, the detailed transcript was produced and analyzed inductively to identify a thematic framework. Line by line coding was performed to identify similar ideas, group similar ideas together and aggregate them under different themes.

Table 1. Activity to generate FG results, including detailed insights into tools and questions employed

	Activities and tools for data collection	Specific purpose of activity: what set of results is to be generated based on collected data	Step in ontological framework	Logic/tools behind identifying themes within each step of the framework
Episode 1	<ul style="list-style-type: none"> - Preparatory activity: questionnaire (semi-structured multiple-choice questions) - Presentation of questionnaire results 	Collecting qualitative and quantitative data on: <ul style="list-style-type: none"> - Current state of revenue streams 	Step 1	<i>Deductive approach before and during the FG: the collected data were structured and analysed/discussed along the major themes/areas explored in the questionnaire.</i>

	and feedback from participants	in F-Tech Business Models		
Episode 2	-‘What if’ brainstorming session -Sharing results of the brainstorming session -Voting	Collecting qualitative and quantitative data on: -Future state of revenue streams in F-Tech BMs	Step 2	<i>Inductive approach during the FG:</i> Emerging ideas on future revenue streams (as reported by groups spokesperson) were summarized on the whiteboard and followed by voting on the emerged ideas to facilitate group decision-making
Episode 2	-Semi-structured brainstorming session -Sharing results from the brainstorming session -Voting	Collecting qualitative and quantitative data on: -Essential F-Tech BM transformations, with specific purpose to ideate future F-Tech BM preferred by the industry	Step 3	<i>Inductive approach during the FG:</i> Emerging ideas were summarized on the whiteboard and followed by voting on the emerged ideas to facilitate group decision-making <i>Inductive approach after the FG:</i> -Grouping emerged ideas and aggregating them under various categories of capabilities required to support F-Tech BM transformation for capturing future revenue streams; -Relating identified capabilities to ‘Skills radar’ tool to ideas skills required to support F-Tech business model transformation
Episode 3	-Preparatory activity: questionnaire	Collecting qualitative and quantitative data on:	Step 4	<i>Deductive approach before and during the FG:</i> the collected data were structured and analyzed/discussed along the major

	<p>(semi-structured multiple-choice questions)</p> <p>-Presentation of questionnaire results and joint discussion</p> <p>-Brainstorming session</p> <p>-Sharing results from the brainstorming session</p> <p>-Joint discussion of shared result between industry and academia</p>	<p>-Future F-Tech skills and roles, and</p>	<p>skills and roles explored in the questionnaire.</p> <p><i>Inductive approach during the FG:</i></p> <p>The relative importance of discussed roles and skills which form the characteristics of the future professional F-Tech profile were rated by participants on the scale 1 (non-essential) to 5 (indispensable).</p> <p><i>Inductive approach after the FG:</i></p> <p>Identifying emerging themes with regards to future F-Tech roles and skills that form characteristics of future F-Tech professional profiles. Detailed transcript was produced and line by line coding of expressed ideas were performed, followed by grouping and aggregation them into set of different thematic categories/insights.</p>
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Results and Analysis

Results from the episodic focus group shed light on diverse critical aspects of F-Tech BM transformation and value capture.

- *Disposition and stability of current revenue streams*

Although collected results (Figure 2) indicate that major share of profits are generated from selling digital products and services online, it should be acknowledged that companies who took part in the survey based on which results are compiled are rather digitally advanced, built their business model via offering digitally

enabled fashion (e.g. customized garments, platforms for re-use) or represent providers of F-Tech services, e.g. traceability, digital solutions for powering circularity.

The focus group highlighted that while revenue streams related to subscription and provision of digital products/services online could potentially be less affected in times of high risk and uncertainty, e.g. COVID-19, the demand for some digital services, e.g. traceability, has even increased since the start of pandemic. At the same time revenues generated from provision of digital products and services in the physical environment (e.g. consulting fees) are in decline as confirmed by participants, while revenues generated from offline sales of physical assets could suffer the most. As a reflection on presented results, it was acknowledged by the participants that traditional fashion brands generate majority of their profits from selling analog fashion (i.e. physical products and services in the physical stores), which is reported to be the most negatively affected in the times of high risks and uncertainty.

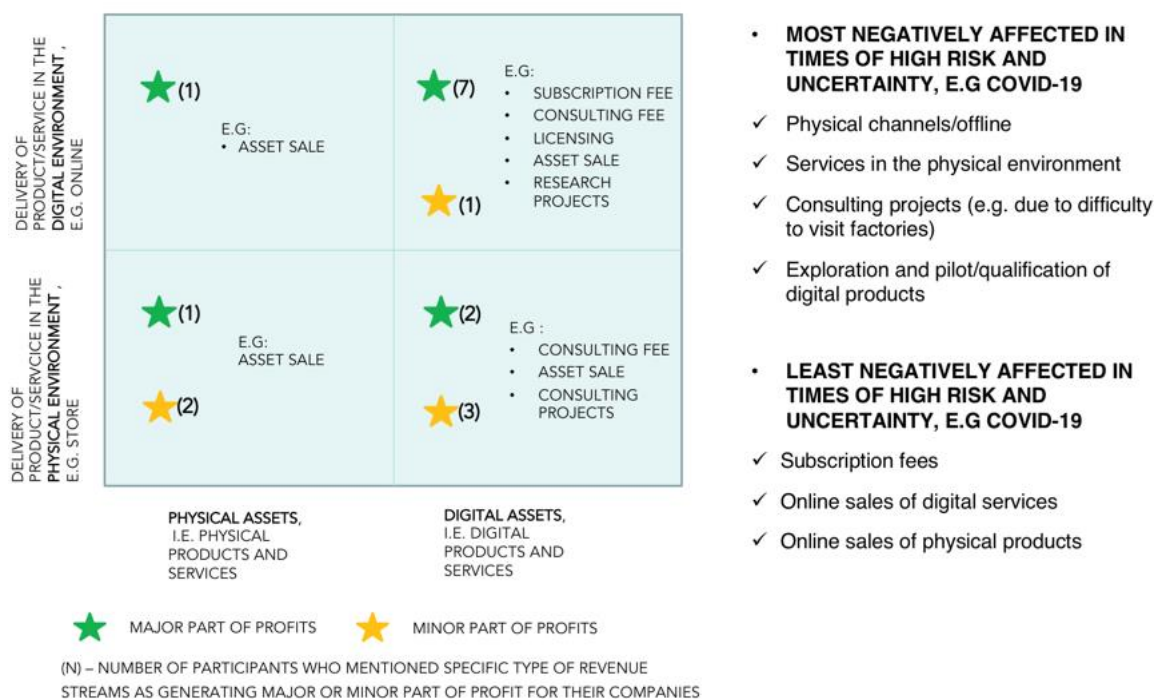


Figure 2. Disposition and stability of revenue streams as reported by the industry participants

Additionally, when discussing the effects of digitalization on BM outputs (Table 2) it was emphasized by the focus group participants that fashion-tech industry should put emphasis not only on enabling operational excellence by integrating digital technologies in the supply chain operations, but focus on digital front end initiatives (customer facing elements) that lead to improved customer value propositions, better customer experience management and engagement. According to collected results, enrolled industry participants take

a holistic approach to their business, where digital technologies improve both efficiency/productivity and customer value/experience.

To better understand where industry currently invests or looking to invest when it comes to fashion-tech business transformation, participating companies were asked to list top digital initiatives and technologies in their organizations. The collected results revealed a plethora of digital technologies that can lead to such end-to-end transformation, amongst which digital twins, digital product development and design tools, and artificial intelligence and machine learning are the most crucial ones to consider.

Table 2. Digitalization and its effect on BM outputs

Effects of digitalization on revenue streams	Monetization practices resulted from digitalization and key in driving revenues	Digital initiatives
Digitalization enhances efficient operations/productivity and operational excellence (N = 7)	Improved efficiency and productivity (N = 7)	Digital twins (N = 4)
Digitalization allows improving customer value propositions, delivering better customer experience and engagement (N = 6)	Improved customer value proposition (N = 6)	Digital product development (N = 3)
Digitalization allows launching new types of digital products and services in new markets/adjacent industries (N = 6)	Better customer experience management and Better customer engagement (N = 5)	Digital design tools (N = 2)

- *Business alignment of digital transformation*

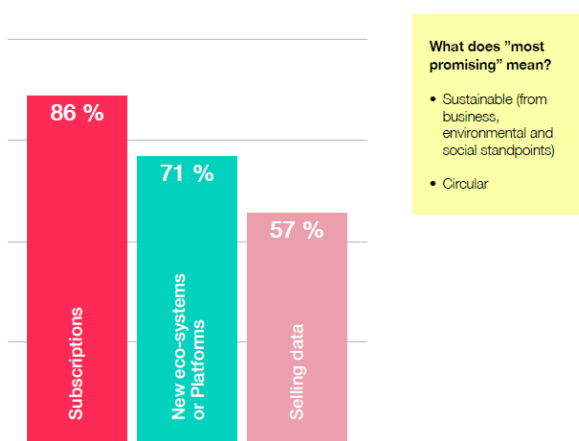
Previous findings from research and practice indicate that companies often face a ‘digital paradox’, i.e. inability to capture value from investments into digital initiatives and technologies. In order to gain insights into whether participating companies are aware of aligning digital business transformation with value capture opportunities, the question was asked if their organizations set KPIs (Key Performance Indicators) to measure effects of digitalization on profitability. Only 3 participants acknowledged the presence of KPIs, whereas

majority of collected responses (N = 7) indicated that companies don't currently measure effects of digital transformation.

- *“Revenue Stream Ideation” for the future of Fashion-tech*

The top 3 ‘most promising’ revenue streams (Figure 3) identified based on majority of votes are subscriptions (N = 7), new eco-system/platform enabled (N = 5) and selling data (N = 4). The characteristics of the ‘most promising’ included association with capturing value from sustainable and circular business practices. It was acknowledged that business value generation and capture should contribute to simultaneous creation of economic, environmental and social benefits, and enable more circular material flows.

Top 3 most promising revenue streams



Means to create these revenue streams

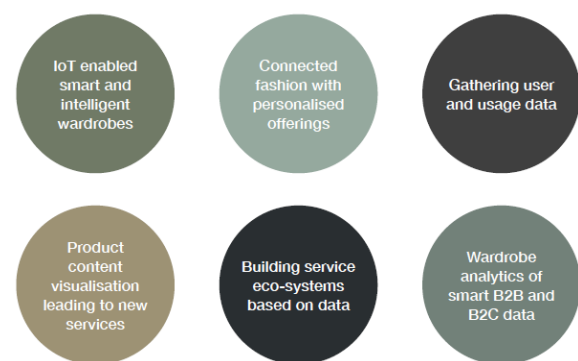


Figure 3. Revenue streams for the future of F-Tech industry

- *F-Tech business model transformation*

During episode 3 participants were asked to ideate F-Tech BM for capturing the 3 most promising revenue streams identified from Episode 2. Although participants were guided via offered prompts to identify the changes with regards to key business model elements (e.g. product/service idea including the customer value propositions, characteristics of customer experience and required capabilities and technologies), it became evident during the focus group session that it was challenging for participants to come up with concrete ideas. The brainstormed ideas were reported by participants and summarized by moderator (Figure 4).

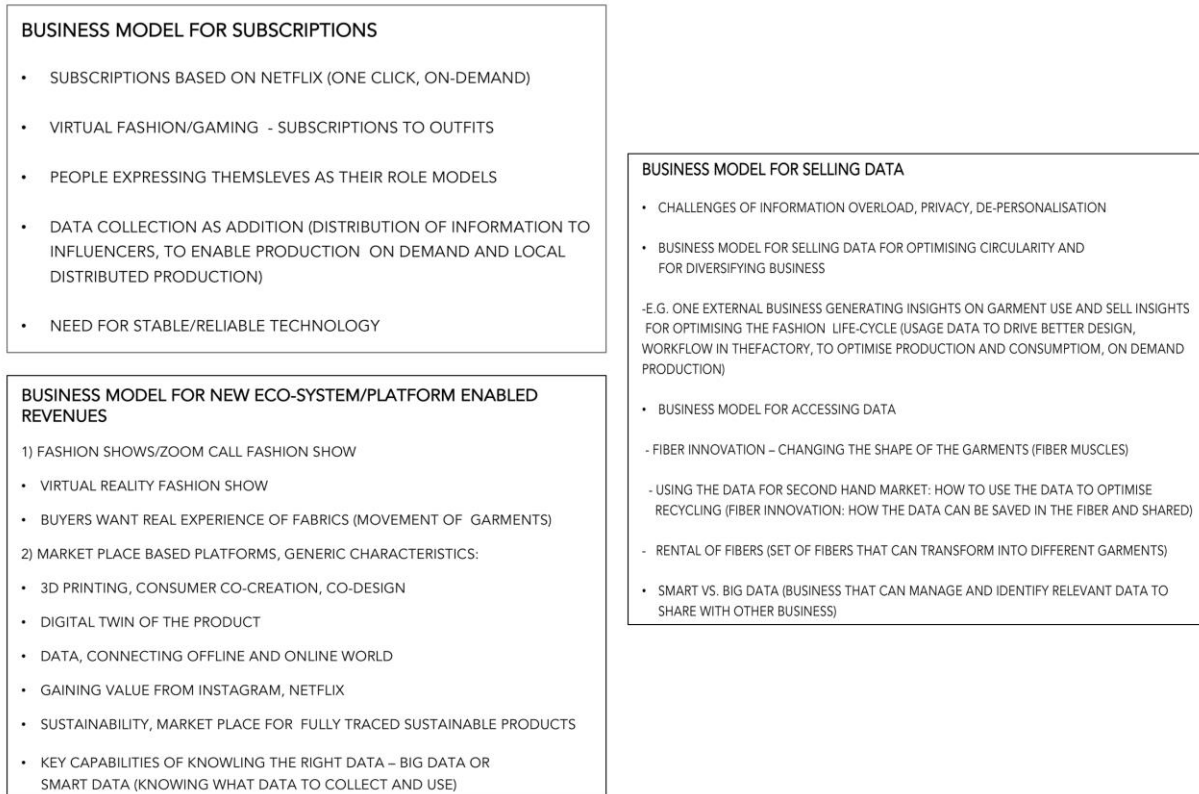


Figure 4. Ideation of F-Tech business models for capture future revenue streams

After presenting ideas on F-Tech BMs for capturing future revenue streams, participants have voted for the business model that they perceive as preferred for the industry. Based on results of single choice voting, F-Tech BM for new ecosystem/platform enabled revenues have been identified as the most preferred choice for the industry (50%, 5 out of 10 votes)¹. It was acknowledged by participants that this business model can be largely associated with ‘mega-revenue’ streams, including value capture based on selling data and subscriptions. The selected new eco-system/platform based F-Tech BM thus allows creation of new and diversified revenue streams, combining complementary business models within and between organizations across different industries (e.g. fashion, tech, gaming, movie, telecommunication). This business model is characterized by:

- servicification and customization/personalization enabled by smart B2B and B2C data,
- virtualization of products (e.g. digital clothing) and customers experience (e.g. digital fashion shows),
- improved sustainability and circularity performance where user and usage data can be accessed and used to inform better product/service concept, design and more efficient supply chain operations.

¹ Business models for subscriptions and selling data have gained 20% (2 out of 10) and 30% (3 out of 10) of votes respectively.

A number of challenges was mentioned by participants for realizing the future F-Tech BM for new eco-system/platform enabled revenues, including:

- “challenge of coordination and collaboration between different parties and industries”,
- “challenge of collecting and sharing ‘right’ data”, and
- “challenge of having tools that analyze data and integrate model predictions into the business”.

The collected insights pointed towards the need for establishment of various types of capabilities for realizing F-Tech business model transformations towards capturing new eco-system/platform enabled revenue streams. These capabilities via method of analytical induction were grouped into eight thematic categories as presented in Figure 5.

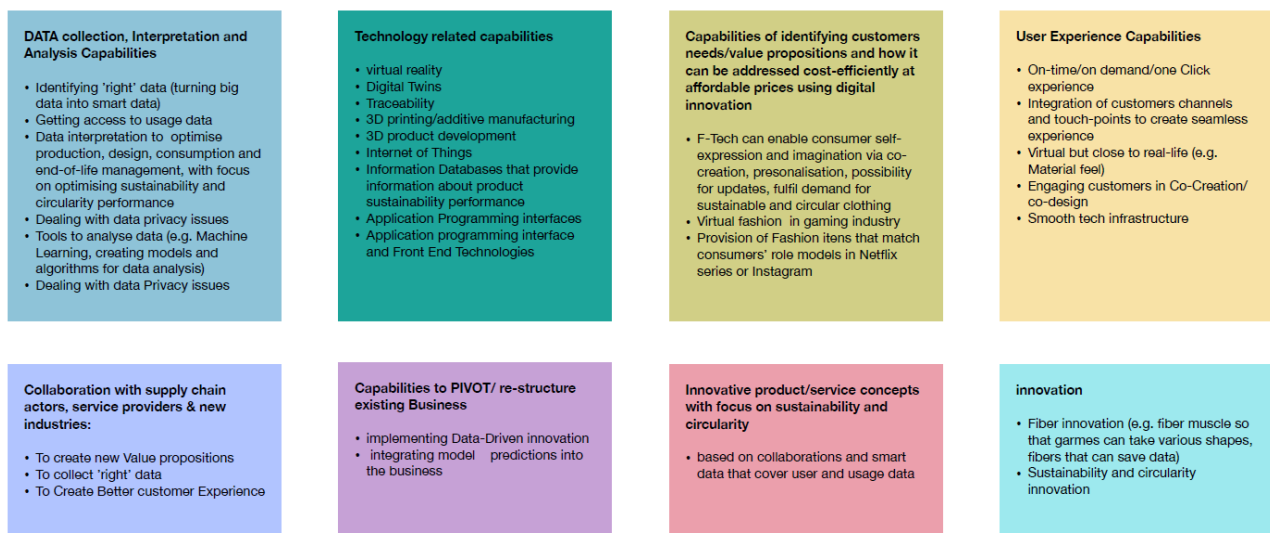


Figure 5. Capabilities identified as relevant for realizing F-Tech business models

- *Future F-Tech skills and roles for supporting F-Tech business model transformation*

Set of capabilities for realizing F-Tech BM transformation (Figure 5) formed the basis for ideating F-Tech skills (Figure 6) that were discussed in the final third episode. Provided ratings of relative importance of F-Tech skills in Figure 6 are derived from questionnaire results, based on input from 3 industry respondents before the start of the third digital episode. The structure of joint discussion of ideated F-Tech skills during episode itself allowed to open up for the input/feedback from more participants. The major insights and emerging themes from analysis of data collected during episode 3 activities are presented below.



Figure 6. Skills required to support F-Tech BM transformation²

A joint discussion on the ideated F-Tech skills was generated in order to receive in-depth feedback on the 15 “F-Tech business model transformation” skillset. The joint discussion resulted in further refining this skillset into 7 meta-level skillset. These are:

- **User experience testing:** was acknowledged by participants as very important competency that still need to be developed for designing wearables and garments made of smart materials. One of the participants (Owner of a Dutch start-up specialized in smart textiles and smart clothing) indicated, *“...in fashion we developed in the direction where we don’t take the user experience into account sufficiently, the risk indeed of the digital orientation that we will forget/miss this part even more”*, while another participant (IT lecturer at a French institute) added, *“But for most of the industries, they lost touch with the user. Human centered design should not be lost in the digital era”*.
- **Data collection, interpretation and analysis:** According to participants, such a meta skill is required for understanding what you are analyzing/interpreting from data. One participant (Co-Founder & CMO at a German blockchain start-up) mentioned *“... I still see lots of software development skills missing.. I mean collecting these data, if we don’t have software developers who can build systems with it, ...; “You need front and back end developers, and general software developers to build systems ...”* As the discussion unfolded, it became clear that while software development skills are important for supporting F-Tech BM transformation, these skills do not necessarily have to be specific for the fashion industry. Nevertheless, there is a need for professionals at the top level (e.g. Product Manager and/or Chief technology officer) who can interpret specific fashion industry needs and explain to software

² Numbers against each ideated skill refer to the relative importance of this skills for supporting F-Tech BM transformation as rated by participants. The rating scale was 1 (non-essential) to 5 (indispensable).

*Asterisks indicate which skills were mentioned as currently insufficiently developed or lacking in participants’ organisations

developers what need to be built. The participant continued, *“I think they (software developers) can definitely be general, as long as they have the right attitude and work with brands to understand what need to be build... but you need somebody at the top level interpreting the needs and creating the work maps for the developers... That’s generally the role of the product manager as the bridge between the business and the tech side. And the CTO (Chief Technology officer) who will usually break it down for his/her team of developers to build the software platform”*.

Thus, *fashion related insights* were acknowledged as important for professionals dealing with data science and analytics. Yet, the area of data collection, management and interpretation was characterized as challenging for the F-Tech industry, with relevant competences and skills currently being lacking/underdeveloped. Another participant from an Italian Research and Innovation Institute indicated that such way of operating is a big transformation for a traditional manufacturing company in the fashion sector, so training and competency building are crucial.

- Policy-making: The role of policies and policy-making skills both at the governmental/national and corporate levels was mentioned as important for facilitating F-Tech BM model innovations. The issue of transformation in roles and skills related to digital law, e.g. data security and privacy, has been raised in this context as foundational for facilitating industry collaboration, data sharing and innovation. For the integration between analog and digital, the need to have *knowledge of digital laws and digital data protection* (e.g. legal aspects regarding what data are used and how the data are captured from users) has been acknowledged by two academic representatives and two industry participants as important.

A participant from leading multi-national IT firm said, *“There have to be some degree of understanding of the (fashion) domain, and this is also going down to the responsibility of policies to approach the practices of the teams that they have”*. She continues with referring to example of some teams having metrics, and elaborating on the importance of having similar understanding and assumptions regarding fashion system to work together so as to facilitate new F-Tech BMs.

- Combination of digital and classical fashion skills across the board of different roles: Understanding the fashion domain for tech practitioners and tech domain for fashion practitioners was highlighted by two industry participants as particularly important. It was argued that different roles need to have basic understanding and assumptions of fashion business and practices, what in turn will facilitated collaboration between different roles required to find and leverage emerging opportunities for realizing future F-Tech BMs. The representative from multinational IT firm highlighted, *“So there is a technical journey that have to happen, i.e. more understanding of the fashion domain, and focus on*

human centered design, as well as the journey for traditional fashion participants on how to approach the tech.... because if you don't understand the domain, than it is very difficult to see the opportunities and leverage the tech to build partnerships to build these new businesses we are talking about. There is a level of understanding of differences, whether you are a developer, fashion designer, CTO... and all of these have to be coordinated together... and especially because this is new, no one is really understanding what they are doing, so there is a way of figuring it out on the way as it goes..."

- Competence renewal, collaboration and serendipity as soft skills: In the joint discussion of presented ideated skills that are required to support F-Tech BM transformation, the themes of competence renewal to understand the fashion and tech together, collaboration, and serendipity (also associated with open and innovative mindset) started to emerge. This largely referred to building important soft skills for all F-Tech professional profiles. One of the participants stated, *"I would leverage the existing advocates for using policy, ethics, brand designers, user experience and then build competencies, because I don't believe it really exist and we know what to do; there is some creating, building and co-creating that we have to do. And that is exciting"*.
- Ethics in addition to focus on sustainability and circularity: In addition to sustainability and circularity, ethics (specifically AI ethics and how philosophy of technology fits with ethics) was mentioned as important competency to add to data analysis, research and meta-design skills. The academic representative (an Educator in Sustainable Fashion and Interdisciplinary Textile Design) briefed *"Ethics is quite a big word, and it depends what type of data we talk about, in terms of biases in analysis and data, to make sure it is not skewed, inclusive ... I think it is an interesting area in terms of sustainability. I personally see that it should be part of every single role. It depends on what it means to you and how it is communicated across the business. So that is the area that should be inherent in each role. Ethics take important part in design decisions..."*
- Meta-design: Meta-design skills were referred to by participants as important part of future F-Tech skills. Meta-design was discussed as part of research and product development skills (rated as 5/indispensable skill by two participants from the industry and one participant from academia during joint discussion). However, according to some participants, meta-design also extends beyond the traditional product development and design, and becomes a system design skill. One academician stated, *"...meta-design can be applied to designing a BM, a campaign, a digital storytelling; it is continuous and iterative process"*, which was seconded by another participant (Circular Design Strategy Lead from a Circular Fashion digital platform service provider), *"what we are doing when we*

working with design teams, it not about designing a circular product, it is more about designing a product that can circulate. And that requires the role of designers to expand well beyond the product designer, it is a system designer". Another participant reflected that nowadays digital marketing and storytelling have become important meta-design skills adding that knowledge of digital marketing includes lot of legal repercussions, as there are issues related to GDPR, what data to use and how to capture data from users when it comes to brand communication and storytelling.

- *Future F-Tech roles*

As the joint discussion on various F-Tech skills unfolded, several key roles were mentioned as either encapsulating these above ideated skillsets and relevant for catalyzing the F-Tech BM transformation. These discussed future F-Tech roles form the foundation on characteristics of future F-Tech professional profiles, which in particular emphasized on the new ways of working and organizing in F-Tech companies, and F-Tech roles and skills that will be in demand in the industry in the next 1-3 years. In particular, discussed roles were assigned to three major categories:

- Bridge between the design and the tech teams ('translator'/'inbetweener'/'linking' roles)
- Updated traditional fashion roles or roles that require upskilling/transitioning to incorporate more digital aspects
- Predominantly online focused roles

All discussed roles were acknowledged as important, with particular appreciation of the 'bridge' roles between design and tech teams that were commonly agreed to be indispensable for supporting F-Tech BM transformation. Some of the findings are presented in Table 3.

In the group discussion, it was mentioned by the participants that many fashion brands in Europe, and Sweden in particular, are SMEs that don't have departmental structure. Hence, locating F-Tech roles within departmental silos in an organization was not deemed relevant by participants. Instead, more agile and 'fluid' way of working and organizing were discussed with regards to F-Tech BMs, especially in SMEs, such as forming a cross-disciplinary team for solving a specific task. In particular, one of the participants referred to professional 'circles' as a common way of organizing in their company. Some professional 'circles'/teams are put together for a limited period of time to solve a specific task, whereas other 'circles' are permanently existing. One person can belong to many different circles and have different role(s) within each circles, as well as having a responsibility of acting as a link between certain circles.

Table 3. Future F-Tech roles

<p>Bridge between designer and tech team <i>(All ranked as indispensable i.e. 5 on a likert scale of 1-5)</i></p>	<p>Updated traditional fashion roles/roles that require upskilling/transitioning to include tech/digital competences <i>(Ranked as important to indispensable i.e. 3-5 on a likert scale of 1-5)</i></p>	<p>Predominantly online focused, digital fashion roles <i>(Ranked as important to indispensable i.e. 3-5 on a likert scale of 1-5)</i></p>
<p>- (Digital) Product Manager: Understanding the designer as well as the tech sides of things. Concept development/meta design skills</p> <p>- Creative Technologist: Very hands on, translator between the design, materials and tech. Hybrid skill-set; operates between coding, materials and electrical engineering. Not trained in fashion per se, but have understanding of the fashion areas like smart clothing and able to work closely with people trained in fashion to come up with prototype or mock-up</p> <p>- Digital Knowledge Manager: In comparison to traditional responsibility of documentation and information management, new skills and knowledge need to be added, e.g. related to certifications and standards, legal and ethical issues related to data management. They also a link</p>	<p>- Material researcher: Developing and researching new types of (smart) materials.</p> <p>- Recycling/End-of-life/Circularity Researcher: Understanding of the know-how of the recycling processes and fully circular systems*.</p> <p>- User researcher/User experience expert - Researching and understanding consumer feedback, possibility to on the regular basis to invite pilot users to test garments.</p> <p>- Manufacturer: New assembling methods, manufacturing processes, optimization of processes, designing transformative systems.</p>	<p>- Industrial designer - modeling in 3D, creating samples and digital designs</p> <p>- Chief Technology Officer - for developing the software platforms, apps, etc.</p> <p>- UX designer - for ensuring that users understand the flow and enjoy using digital products</p>

<p>between all the departments to make sure there is a good knowledge floating</p> <p>- Change manager/Transformation manager: pushes for company-wide shifts to catalyze tech advancements and helps fostering required collaborations/pairing different professionals to work together</p>		
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While in this context, the need of the ‘translator’/‘bridge’ roles that help different professionals to converse were already expressed, in addition, the need for interdisciplinary skills were acknowledged, in order to pair and augment competences, and for various professionals to have insights into fashion business, design and tech/digital domains. While inter-disciplinarity and need to develop ‘hybrid’ skill set was brought up as relevant, the issues of retaining specialization in specific subjects was still stressed as very important by academic representatives. Thus both directions of specialization and generalization/developing ‘hybrid’ competences across various subject disciplines was mentioned as relevant for the future of F-Tech education, by bringing specialists from various domains to work together for developing new ‘hybrid’ competences via the process of working together on a particular project.

Whereas the idea of ‘circles’ was mentioned to facilitate the flow of knowledge and collaboration between different professionals, the idea of rotations in different departments was brought up as an interesting approach to facilitate inter-disciplinarity. Finally, the role of soft skills (applied across the board of different F-Tech roles) was emphasized as *‘interdisciplinary facilitator’* defined “*as a basic soft skills to cooperate and co-design with different professionals and disciplines*” (F-tech design lecturer). Such soft skills include: (i) building sustainability/circularity built into every role, (ii) creating own roles by entering into a traditional role and then expanding into a more technologically advanced position, (iii) being ‘hands-on’ by being more open to user experiences in the real world, when testing designs; and being more ‘hands on’ in terms of understanding the human context but also ‘fashion’ domain; (iv) serendipity - leave it open to opportunities in the market/consumer/user feedback ; be agile in your approach, and (v) have innovative mindset - less fixed, more fluid positions. Fashion designers need someone who can make them aware of the tech opportunities.

Additional insights emerged, highlighting the need for more comprehensive and holistic 'fashion tech' education including not *"just fashion design, but everything from circularity, marketing, to coding to help the next generation of fashion designers to have a bit of the overview of possibilities around"* (Co-Founder & CMO at a German blockchain start-up). As part of F-Tech education, the collaboration between students from different specializations (e.g. from fashion, business, engineering, coding, re-/upcycling, e-commerce, sustainability) was mentioned as important part of educational process. In particular, the new educational approach that brings students with various skills together to figure out new F-Tech products/services, entrepreneur start-up and business strategies was highlighted as desirable. Such approach would allow augmenting and pairing various competences to face associated challenges, as well as help figuring out what roles and skills are required for future F-Tech industry via collaborative co-creation process.

Concluding discussion

This paper provides a systematic understanding of digital transformation in the fashion industry by identifying: (i) emerging revenue streams and business model opportunities offered within fashion-tech, (ii) essential BM transformations required for unleashing these revenue streams, and (iii) transformational roles and skills that will be required in companies in order to support fashion-tech BM transformation and value capture. While the results of the study derived through a series of focus group discussions with selective experts from both fashion and IT industries and academia, may not provide a representative/generalizable result, it definitely highlights a list of prospective revenue streams, BM transformation requirements, skillsets and roles, amongst other explored topics. However, beyond that, the main novelty of the paper lies in its suggested approach of starting from revenue streams/revenue models and then aligning it with transformations in business model elements. Such an alternative approach is essential to shift the view on how to capture value from digital transformation in the fashion industry, i.e. with a *"BM transformation for new revenue stream"* approach instead of a *"new revenue streams from BM transformation"* approach, thus might help to solve the so-called "digital paradox" faced by firms i.e. inability to capture value from investments in digital initiatives. It is suggested that aligning value capture to other business model components can reduce the likelihood of encountering digital paradox (Parida et al. 2019), thus make organizational design and its underlying assets, technologies, processes, and people to make strategy more full-proof.

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