Technology in Society 66 (2021) 101645

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Amazon's New Supra-Omnichannel: Realizing Growing Seamless Switching for Apparel During COVID-19

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ARTICLE INFO

Keywords:
Supra-omnichannel
Growing seamless switching
Luxury brands
On-demand manufacturing
Advanced digital fashions
Amazon

ABSTRACT

While COVID-19 has driven a significant drop in sales, the apparel industry has been undergoing a digital solution-oriented transformation.

Preempting its highly profitable potential, Amazon has been expanding its fashion-driven apparel business by developing a series of advanced digital fashions (*ADFs*). *ADFs* intensified Amazon's omnichannel dependence based on seamless switching by utilizing its innovative assets.

With this development, and in response to the increasing necessity for luxury brands to offer extra channels for a non-contact society, Amazon introduced Luxury Stores, a long-lasting digital platform for luxury fashion, in September 2020.

While luxury brands confront "the Internet dilemma," this conundrum can be solved by synchronizing *ADFs*, Luxury Stores, and on-demand manufacturing (ODM).

Taking Amazon's challenge to realize its long-lasting dreams of selling luxury brands and using ODM, this paper attempts to demonstrate the significance of this approach for exploring new frontiers in business models beyond the current omnichannel approach.

An empirical analysis was conducted focusing on the development trajectories of seven *ADFs* and 34 luxury brands that joined Luxury Stores by the end of the first half of 2021 by using a techno-economic analysis, analogical evidence approach, literature review, and subsequent SWOT analysis.

It was demonstrated that by means of timely synchronization of *ADFs*, Luxury Stores and patented ODM, co-evolution among them can be constructed leading to the emergence of a cloud-based fashion platform that enables on-demand personalization and customization. Consequently, big data on customers, vendors, manufactures, global influencers, and social trends can be collected, which grow and expand Amazon Web Service (AWS). This in turn further accelerates co-evolution among *ADFs*, Luxury Brands, and ODM. Activated co-evolution further advances cloud-based fashion platforms leading to a virtuous cycle between them. Thus, dual co-evolution of the co-evolution among *ADFs*, luxury brands, and ODM, and cloud-based fashion platform advancement emerged. This dual-co-evolution leads to a supra-omnichannel approach that enables apparel to grow seamless switching and explore new frontiers beyond current business models.

These findings give rise to suggestions for dynamic and resilient strategies toward a non-contact society.

1. Introduction

COVID-19 has significantly affected the apparel industry, leading to a decline in sales.

However, the apparel industry has been undergoing transformations even before COVID-19, initiated by (i) digital solutions to historical demand, (ii) the shift to a sharing economy, and (iii) the shift to a circular economy [1]. Apparel is now the most popular online shopping category worldwide [2].

Amazon anticipated the potential for large profits by expanding its fashion-driven apparel business with the development of a series of advanced digital fashions (*ADFs*), making substancial efforts for an omnichannel approach based on seamless switching. Here, *ADFs* can be defined as a new fast fashion business that leverages digital innovation

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https://doi.org/10.1016/j.techsoc.2021.101645
Received 12 April 2021; Received in revised form 15 June 2021; Accepted 16 June 2021
Available online 12 July 2021

assets and the learning effects of preceding development [3].

Amazon has been effectively utilizing learning effects during the process of research and development (R&D) in transforming "routine or periodic alterations" into "significant improvements" [4,5]. Provided that omnichannel thrives in the digitalized environment [6], Amazon's attempt to shift to an omnichannel approach can largely be attributed to learning orchestration externality [3].

In September 2020, Amazon introduced Luxury Stores, a long-lasting digital platform for luxury fashion. This was in response to Covid-19 bringing about an increasingly non-contact society, thereby necessitating the addition of extra channels for luxury brands.

Luxury brands confront "the Internet dilemma" [7,8], which is the reluctance to integrate online technologies into their business model. This makes them hesitant to collaborate with Amazon. However, considering the potential of Amazon's patented on-demand apparel manufacturing (ODM) that enables luxury brands to streamline their supply chain [9]; [10], this conundrum can be expected to be solved by synchronizing *ADFs*, Luxury Stores, and ODM [11].

Inspired by the possibilities created by Amazon's challenge to realize its long-lasting dreams of luxury brands and ODM, this paper attempts to demonstrate the significance of this challenge by examining the plausibility of this approach for exploring new frontiers in business models beyond the current omnichannel approach.

To date, a significant number of studies have analyzed the significance of the omnichannel approach for the advancement of the apparel industry, as well as the significant role of ODM in this advancement.

Brynjolfson et al. [12] suggested that digital technologies facilitate customers switching across various shopping channels, transforming from multichannel to omnichannel, therefore urging stakeholders to rethink their competitive strategies.

Various studies have developed this hypothesis regarding seamless switching ([13–16].

Piotrowicz et al. [15] argued that as the line between online and physical channels is blurred, a new approach to channel integration is emerging – the omnichannel, which aims to deliver a seamless customer experience regardless of the channel. This would be affected by information technology (IT), particularly by the mobile revolution and social networks. The significant role of digital innovation for this switching has been stressed by multiple authors [6,17–22]. Sun et al. [23] pointed out the significance of the digitalized social cognitive perspective of omnichannel service usage. According to Baker et al. [7]; contrary to such seamless switching, luxury brands confront the Internet dilemma, which makes them reluctant to collaborate with Amazon [24]. Kim [25] pointed out that quite a few luxury brands still do not employ the Internet as an active transaction channel. Against such reluctance, Sherburne [10]; Sharma et al. [26]; and Bijmolt et al. [11] argued the significance of the synergy between the advancement of digital fashion and ODM by stressing the integration between customer journey (demand) and product flow (supply) as omnichannel advances. Bijmolt et al. [11] pointed out that in an increasingly omnichannel world, many important interdependencies exist across the stages in the customer journey and product flow, creating significant challenges and opportunities for firms. Peretti et al. [27] pointed out the increasing significance of digitalization for luxury brands, both for firms and customers, and suggested the possible effects of synergy between Amazon's digital-driven fashion and luxury brands. Sherburne [10] expressed the expectation of Amazon's patenting of ODM in exploring an industrial textile ecosystem. Fashion United [9] expected that this embodiment would provide new ways to increase efficiency in apparel manufacturing and encourage brands to streamline their supply chains by internalizing production.

These studies suggest the possibilities of synergy between digital fashion and luxury brands, and also between these apparels and ODM. They also inspire the significant effects expected by these synergies.

However, they have remained conceptual ideas within partial systems and none have provided empirical convincing evidence derived from a system solution that may enable Amazon to realize its long-lasting dreams and subsequent exploration of new frontiers for business models beyond the current omnichannel approach.

In a recent study [3], the authors attempted an empirical co-evolutional analysis of the development trajectories of Amazon's recent *ADFs*, giving special attention to the role of AI advancement toward a non-contact society. They pointed out that Amazon's success in *ADFs* development can be attributed to its business culture as an R&D-based customer–centric company and its subsequent R&D strategy that inevitably utilized AI in unique ways, such as inducing multiple hierarchy-level functions for approaching human behavior and thoughts by learning from earlier innovations. They concluded that such institutional systems have enabled Amazon to enjoy the effects of learning orchestration externalities through the course of its successive development of seven *ADFs* businesses. In addition, they pointed out that challenges to luxury fashion brands led to the exploration of the multichannel approach that allows vendors freedom in managing their luxury brands on Amazon's marketplace, while paving the way for ODM, and suggested the significance of co-evolution among *ADFs*, luxury brands, and ODM.

In light of the increasing expectation for dynamic and resilient strategies toward a non-contact society expected to be realized by a system solution, this paper attempted to find this solution by following up the preceding analysis. This was undertaken using an empirical analysis using a techno-economic analysis centered on diffusion theory, analogical evidence approach,[1] literature review, and subsequent SWOT analysis, focusing on the development trajectories of 34 *ADFs* businesses and ten luxury brands that joined Luxury Stores in 2020.

It was demonstrated that (i) benefits of ODM increase as digital innovation advances, (ii) ODM contributes to transforming the resistance of luxury brands to collaborate with Amazon into a sustainable opportunity to contribute to a non-contact society, (iii) this in turn provides the manufacturing industry with a digital solution, advanced logistics and funding capability, (iv) thus, co-evolution among *ADFs*, luxury brands, and ODM can be constructed, (v) this emerges as a cloud-based fashion platform where *ADFs* and luxury brands are integrated. (vi) This enables on-demand basis personalization and customization, (vii) consequently, big data on customers, vendors, manufactures, global influencers, and social trends can be collected which grow and expand Amazon Web Service's (AWS) function. (viii) Advanced AWS in turn further accelerates co-evolution among *ADFs*, luxury brands, and ODM, (ix) activating co-evolution, further advancing cloud-based fashion platforms leading to a virtuous cycle between them, (x) thus, dual co-evolution between the co-evolution among *ADFs*, luxury brands, ODM, and cloud-based fashion platform advancement emerges. (xi) This dual-coevolution leads to a supra-omnichannel approach that enables apparel growing seamless switching, and (xii) this explores new frontiers beyond the current business model.

These findings give rise to suggestions regarding dynamic and resilient strategies toward a non-contact society.

Organization of this paper is as follows: Section 2 provides an overview of the effects of the socio-economic transformation on the apparel industry. The driving force of the rapid jump of Amazon's apparel business is analyzed in Section 3. Section 4 analyzes the business' new stream leveraging supra-omnichannel. Section 5 summarizes noteworthy findings, policy suggestions, and future research.

[1] A plausible mechanism was certified comparing with known natural phenomena as a running principle of ecosystem (Section 3) and also the inferior mirage phenomenon (Section 4).

2. Socio-economic transformation affecting the apparel industry

2.1. Effects of COVID-19 on the apparel industry

COVID-19 has significantly affected the apparel industry. Non-essential sectors were hit the hardest in 2020 as consumer confidence fell, with apparel sales declining by 26% in 2020 in the US, as consumers had no events or holidays to purchase new clothes for. However, growth in the demand for loungewear did not follow this downward trend [28].

However, the apparel industry was already undergoing transformations even before the disruption of COVID-19, initiated by (i) digital solutions to historical demands, (ii) the shift to a sharing economy, and (iii) the shift to a circular economy [1]. As of 2018, 57% of global Internet users had purchased clothing online, making apparel the most popular online shopping category worldwide as demonstrated in Fig. 1.

In response to this a global trend, Amazon had already positioned itself well in clothing retail before the pandemic, with a strong third-party network of fashion brands in its marketplace, making full use of its position as a leader in online sales.

Amazon apparel sales consist of first-party sales (sold by Amazon itself) and third-party product sales. While the exact share between them is private, Coresight Research [29] revealed that, as far as number of products are concerned, Amazon depends heavily on the latter as it shared 86.3% of number of third-party products in 2018. Amazon appears to be focusing its first-party clothing inventory on higher value categories and most of the private labels tend to be clustered in specific clothing categories [29]. Shoppers feel greater reassurance on issues such as product authenticity, shipping returns charges, and returns policies when they buy direct from Amazon than when they buy from third-party sellers.

Therefore, greater first-party inventory would increase customer satisfaction and strengthen the relationships between Amazon and brands.

With this strategic policy, Amazon depends on a highly segmented approach to its first-party sales, which tend to be concentrated within specific high-value categories and focused on each of its own brands on a particular consumer type or product category. This policy demonstrates the long tail phenomenon in a huge amount of its apparel products both by first and third-party sales (see Fig. A1 in the **Appendix**). However, sales of high-value products are initiated by segmented category of business within first-party sellers. The development of *ADFs* from 2017 is a typical case. Therefore, contrasting the limited number of products, significant contribution to revenues (sales) has been initiated by first-party sellers depending on online sales.[2]

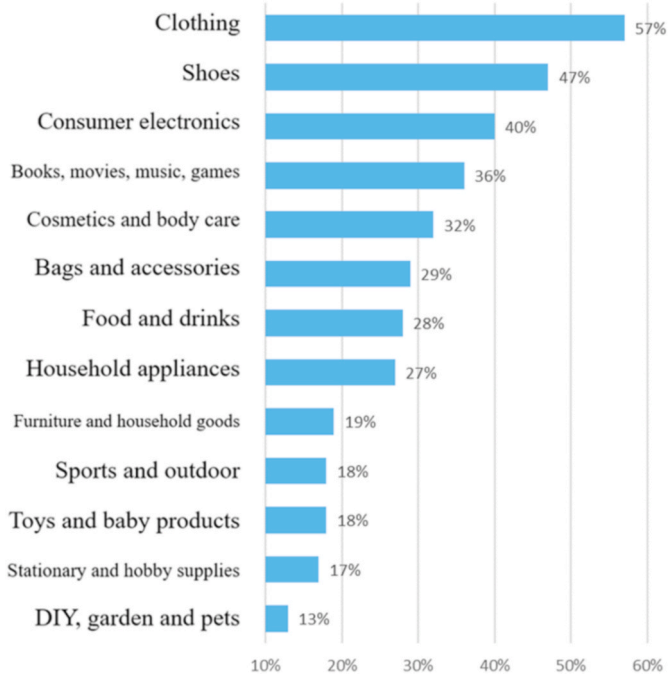


Fig. 1. Share of products purchased by global internet users in 2018. Share of Internet users who have purchased selected products online in the past 12 months as of 2018.
Source: Statista [2].

Under such circumstances, COVID-19 had a mixed effect on the apparel market worldwide with demand decreasing and online purchasing increasing [30]. The slowed down economic activity due to COVID-19 across the globe has resulted in a decline in the apparel market demand. The apparel manufacturing industry is experiencing cuts in spending and poor consumer confidence due to fear over coronavirus spread. Due to lockdowns and travel restrictions around the world, people have less desire or need to purchase or wear anything beyond casual clothing. As many companies encouraged remote working due to physical distancing restrictions, the market has witnessed a gradual increase in demand for work-from-home wear. Fashion retailers shifted their sales channels to online platforms, focusing on new trends based on the evolving consumer [30].

Consequently, COVID-19 has accelerated digital solutions in the fashion e-commerce industry. The companies operating in the market are adopting new technologies such as artificial intelligence (AI), barcode scanners, virtual reality outfits, and e-commerce automation tools that offer a highly personalized and relevant consumer experience. Moreover, many fashion companies are launching new apps to sell their products online in order to reach a large consumer base [31]. Amazon's attempt to develop a series of *ADFs* can be considered a pioneering approach to preempt this historical demand, as demonstrated in Fig. 2.

Fig. 2. Consumers prioritizing value in the US apparel market in 2021. Where shoppers plan to shift their spend in the next 12 months in 2021.
Source: Authors' elaboration based on thredUP [32].

[2] Amazon shares an extremely high level of online sales than its competitors (see Fig. 3), representing 50% of net sales in 2019. Its apparel sales share in 2019 was estimated at as 18% of net sales (Table A1 in the Appendix), the majority of which depended on online sales. Strong first-seller sales initiatives in developing *ADFs* from 2017 contributed to a significant increase in online store sales, as demonstrated in Fig. A2. While certain apparel sales (including those in Luxury Stores starting from 2020) were conducted in third-party seller services [117], these shares seemed to remain limited (around 2% of net sales) as the third-party seller services share was 19.2% of net sales in 2019 and the percentage of sellers in the clothing and shoes category (including jewelry) in third-party sellers services was 13% (11th out of 28 categories) (Fig. A3). Profitability of this category was 25th out of 28 categories [115].

Fig. 2 demonstrates that consumers prioritizing value in the US apparel market is shifting to correspond to a digital solution represented by Amazon fashion and the circular/sharing economy represented by secondhand toward a non-contact society after COVID-19.

2.2. Amazon's attempt to expand fashion-driven apparel

Amazon has been expanding its fashion-driven apparel business. Fig. 3 demonstrates Amazon's increasing share of apparel sales, as well as all online sales in the US market. Amazon has jumped to the second-largest seller of apparel in the US with 7.9% market share after Walmart (8.6%) in 2017. This increase continued, with Amazon jumping to the top with a 9.5% market share in 2019 exceeding Walmart (6.9%), as demonstrated in Fig. 4.[3] Apparel, including footwear, is now Amazon's most bought category in 2018–19, up from fourth place in 2017–18, surpassing books, beauty, and electronics.

Amazon quietly became the leading apparel retailer in the US in 2019 [33]. The unexpected drive to a non-contact society caused by COVID-19 has accelerated this trend.

3. Driving force of the rapid jump

3.1. Development of Amazon's fashion-driven apparel trajectory

Amazon's apparel sales share in the US jumped up from 3.7% in 2016 to 7.9% in 2017 and 9.5% in 2019 leveraged by the development of *ADFs* started from 2017 without which its share would remain 5% level in 2019 as illustrated in Fig. 5.

To demonstrate this hypothetical view, two development trajectories: sales share without *ADFs* (trajectory A) and sales share leveraged by *ADFs* (trajectory B) were examined using the logistic growth function both by simple logistic growth (*SLG*) and logistic growth function within a dynamic carrying capacity (*LGDCC*), as depicted in equations (1) and (2).[4]

$$\text{SLG} \quad S(t) = \frac{N}{1 + be^{-at}} \tag{1}$$

$$\text{LGDCC} \quad S(t) = \frac{N_k}{1 + be^{-at} + \frac{b_k}{1 - a_k/a} e^{-a_k t}} \tag{2}$$

where $S(t)$: apparel sales share at time t; N and N_k; carrying capacity; a, b, a_k, b_k; coefficients.

As far as the development trajectory depends on the *SLG* trajectory, its sales share $S(t)$ saturates with the fixed carrying capacity N. which inevitably results in the dilemma between advancement of time and productivity decline [43]. However, since *LGDCC* incorporates dynamic carrying capacity $N(t)$ that creates new carrying capacity during the diffusion process, it maintains sustainable growth depending on self-propagating development [44,45] (see the details of theoretical bases and logic behind this application in **Appendix 2**).

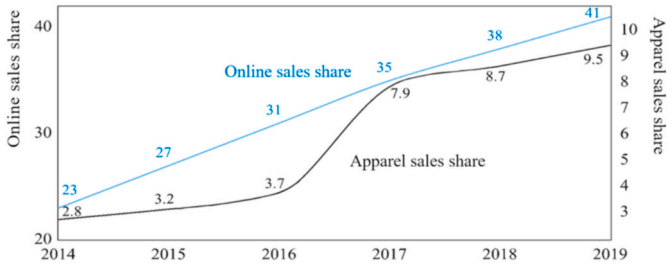


Fig. 3. Trends in Amazon's apparel sales share 2014–19 (%).
Sources: Lieber [34]; Statista [35]; Keyes [36]; Richter [37]; Wichser et al. [38]; PYMNTS [39]. Sabanoglu [40]; eMarketer [41].

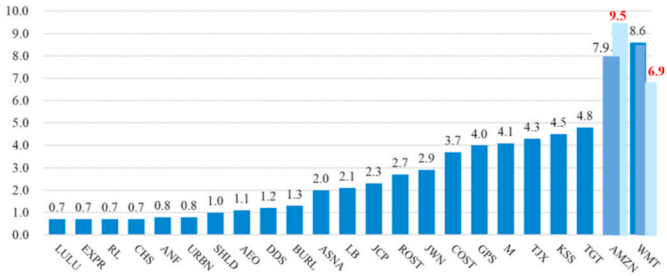


Fig. 4. Apparel sales share in the US in 2017 (%).Brown figures on the light blue bars indicate sales share in 2019. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)
Source: Authors' elaboration based on Segura [42] and PYMNTS [39].

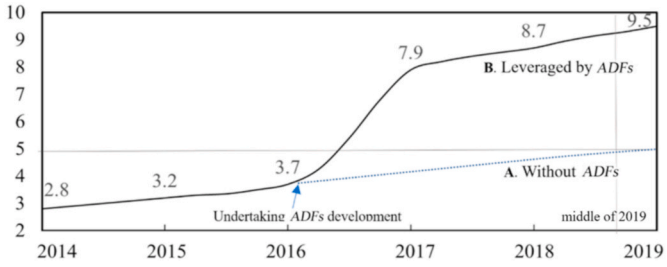


Fig. 5. Trends in Amazon's apparel sales share in the US 2014–19(%).
Sources: Lieber [34]; Statista [35]; Keyes [36]; PYMNTS [39]; Sabanoglu [40].

The result of the analysis is summarized in Table 1. Trajectory A (without *ADFs*) was analyzed by taking the period between January 2014 and August 2016, a period before undertaking *ADFs* development, while trajectory B (leveraged by *ADFs*) took a period between January 2014 and December 2019 that reflects the effects of the development of *ADFs*.

Looking at Table 1, we note that while trajectory B demonstrates *LGDCC*-driven development with sustainable growth depending on self-propagating development leading to a 9.5% share level in 2019, trajectory A demonstrates *SLG*-driven development remaining at a 5%

Table 1
Development trajectory of Amazon's sales share in the US.

	N	a	b	a_k	b_k	adj. R^2
Trajectory A (2014.1–2016.8)	9.32 (2.04) *	0.016 (4.36)	2.81 (1.52) **			0.994
Trajectory B (2014.1–2019.12)	12.20 (7.01)	0.053 (3.76)	10.37 (2.49)	0.15 (1.82) *	14.81 (1.27) **	0.951

The figures in parentheses indicate the t-statistics: all are significant at the 1% level except * 5% and ** 10%.

[3] CNBC estimated that this share increased to 11–12% in 2020 [118].

[4] Monthly trend was used by disaggregating annual data to monthly data by using the Denton-Cholette temporal disaggregation method. See Table A2 in Appendix 1 for monthly data used.

share level in 2019.[5]

Provided that *LGDCC*-driven sustainable growth can be attributed to self-propagating development [44,45], the above analysis prompts a hypothetical view that a rapid jump in Amazon's apparel sales share in the US leveraged by *ADFs* can be attributed to its self-propagating dynamism.

3.2. Inertia of transformation from multichannel to omnichannel

3.2.1. Transformation to omnichannel approach

Business dynamics are changing, and manufacturers must keep up with the increasing customer demand for personalized shopping experiences. From anticipating pre-purchase experiences to tracking post-purchase activities, the quest for improving the customer experience is almost endless [46,47].

Customers expect a seamless, personalized experience everywhere they shop which blurs the line between the internet and reality and accelerates the transformation from solo-channel customer experience to multichannel and omnichannel as illustrated in Fig. 6.

While multilateral channels such as physical stores, e-commerce, mobile applications and social media channels are used for a multi-channel approach, these channels have stayed co-existing and no switching between these channels functions for a multichannel approach.

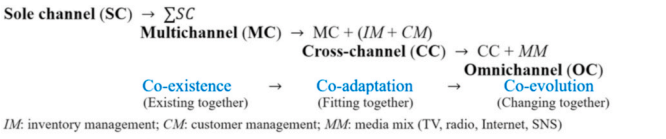
Contrary to such an approach, the omnichannel approach depends on seamless switching across all available channels and these channels co-evolve each other (mutually inspiring one another, leading to a virtuous cycle). Advancement of the digital economy has enabled this co-evolution. Brynjolfson et al. [12] postulated that digital technologies facilitate customers to switch across various shopping channels, evaluate the quality of products or services, and make purchase decisions. Omnichannel thrives in the digitalized environment [6]. Foregoing analysis on the development trajectory of ADF cultivated in the digitalized environment suggests that their omnichannel function grows with the increase in seamless switching, as the trajectory depends on self-propagating development.

In light of the increasing significance of the omnichannel approach corresponding to the advance of the digital economy, a significant number of studies have been undertaken to identify the unique nature of the omnichannel approach.

Brynjolfsson et al. [12] identified strategies for omnichannel retail and claimed that omnichannel retailing can be defined as a business model in which different channels are fully integrated to provide a seamless experience throughout a customer's journey. Verhoef et al. [16] have critically analyzed multichannel retail studies and demonstrated that the synergetic management of the numerous available channels and customer touch points can be expected in such a way that the customer experience across channels and the performance over channels is optimized. Cummins et al. [14] suggested that omnichannel retailing refers to retailing that involves a synergetic integration of channels to create a unified brand experience for customers, regardless of the channel or stage they are in during the purchasing process. Bernon et al. [13] mentioned a synchronized operating model in which a firm can align all channels with not only the presentation of a single face to customers but also a consistent way of doing business. Hubner et al. [48] studied the multichannel transformation to an omnichannel fulfillment and identified channel integration and expansion strategies. They suggested that channel integration creates synergies, whereas expansion improves the service options for customers. Luo et al. [19] stressed that digital technologies are a major force driving the retail industry's transformation toward omnichannel retail. Saghiri et al. [6] and Shen et al. [21] supported this view. Kranzbühler et al. [18] identified that customer experience encompassing customers' cognitive, emotional, social, sensory and value responses to the organization's offerings over time, including pre-and post-consumption. Von-Briel et al. [22] defined omnichannel retail as referring to the integration of retail channels like stores, online, and mobile into a single, seamless customer experience. Similarly, Shen et al. [21] claimed that omnichannel aims to coordinate the fragmented service processes and technologies in various channels to deliver a consistent and integrated cross-channel experience for customers.

Weiner et al. [49] have addressed the online-offline business model synergies and co-existence of multichannel in an omnichannel environment. They have recommended further research and clarification on the complex interplay between online and offline business models that co-exist within an organization. Sun et al. [23] pointed out the significance of the digitalized social cognitive perspective of omnichannel service usage.

On the basis of this pioneering research, the core function governing the omnichannel approach can be identified as seamless switching that is an integration of all available channels (multi-channels) seamlessly (consistent availability seeking) for sustainable performance optimization in co-evolutionary, rather than a simple co-existence of multilateral channels.



	Multichannel	Omnichannel
Channel scope	Phys. store, e-com., mobile app.,	Phys. store, e-com., mobile app., social media
Channel integration	No switching between channels	Seamless switching among all channels
Channel characteristics	Co-existence resulting in diminish	Co-evolution leading to self-propagation
Channel goals	Sales per channel, experience per channel	All channels work together to offer a holistic customer experience

Fig. 6. Scheme of transformation from multichannel to omnichannel approach.

3.2.2. Running principle of ecosystem

This identification corresponds to a running principle of ecosystem.

With an understanding that (i) ecology is the science of the relationships between living organisms and their environment, (ii) human ecology is about the relationships between people and their environment, and (iii) in human ecology, the environment is perceived as an ecosystem, masterpiece of the system, Marten [50] classified the state of ecosystem into co-existence, co-adaptation and co-evolution. While co-existence is existing together, co-adaptation and co-evolution are fitting and changing.

Given the positive feedback between people and the environment against indispensable obsoleting features, Watanabe [51,52] and Watanabe et al. [53] postulated a contrasting consequence between co-existence and co-evolution suggestive to the consequence of multi-channel (simple combination of multilateral channels) and omnichannel approaches (synergetic management of all channels) as illustrated in Fig. 7.

While an omnichannel approach leads to self-propagating development based on synergetic management of all channels that activates co-evolution among multiple channels, a multichannel approach based on the simple combination of multilateral channels that keeps the co-existence of these channels results in diminishing future.

3.2.3. Emergence of service-oriented manufacturing

By means of seamless switching, the omnichannel approach enables a firm to increase its number of services and attractive assortment (N)

[5] *SLG* demonstrates decline of the growth rate after termination period t_0 when its value is $N/2.t_0$ can be depicted as $t_0 = \ln b/a$. In this case, $t_0 = 64.6$ (middle of 2019) and $N/2 = 4.7$ (see Fig. 5).

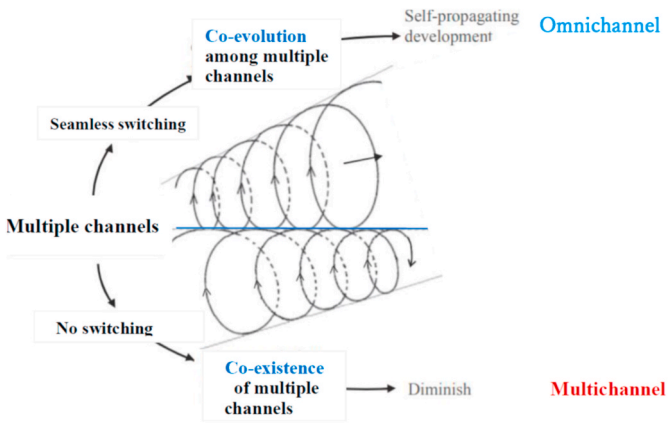


Fig. 7. Contrasting the consequences between multichannel and omnichannel.

[11,47], leading to an increase in its profits (P) and productivity (S/L) [6,16]). This can be attributed to the self-propagating function (S^n) as demonstrated earlier by Amazon's development trajectory. Here, S, L, and n denote sales, number of employees and the multiplier of network elasticity, respectively.

In their preceding analysis on the performance of Japan's top five leading electric and electronic mega retail firms (EEMRs), authors demonstrated that a virtuous cycle exists between S/L, N and P based on the success in customer's involvement, depending on self-propagating development. They also explored the prospect of service-oriented manufacturing in which retails firms play a similar function to ODM [54]. In service-oriented manufacturing, tangible products and intangible services are integrated into one product service system to provide comprehensive solutions for customers where each firm focuses on core businesses, outsources non-core businesses, and provides producer services for one another to achieve rapid innovation and improve efficiency [55,56]. This corresponds with Amazon's R&D-driven customer-centric business model that transforms routine or periodic alterations into significant improvements during the R&D process [4,43].

Transformation to the omnichannel approach leverages this dynamism, as illustrated in Fig. 8, and paves the way for ODM [9].

3.3. Amazon's initiatives

Amazon's initiatives both in developing a series of *ADFs* and going deeper into the luxury market can be considered as efforts to increase the effects of an omnichannel approach.

3.3.1. Series of ADFs development

3.3.1.1. Cultivation of the digital environment. Co-evolution in the digital economy can be leveraged by a self-propagating function indigenous to ICT [52]. The rapid jump in Amazon's apparel share in the US market based on the *LGDCC* trajectory corresponding to undertaking the series of *ADFs* from 2017 demonstrates the shift from a multichannel approach to an omnichannel approach. While a certain extent of omnichannel approaches have been deployed prior to ADF development, including "Fashion website" (2007), "Smart Lockers" (2011), "Amazon Flow app" (2012), "Amazon Physical Popup Stores" (2014), "University/college pickup points (2015) and "Amazon, Kohl, and Best Buy collaboration" (2017), they are hardly satisfactory in shedding Amazon's perception as an uncool brand seller that will not satisfy customers' desire to try before purchase.

Thus, Amazon made substantial efforts to employ an omnichannel approach to improve their reputation as selling uncool brands seller have been undertaken together with developing *ADFs*.

While Amazon has been effectively utilizing learning effects during the process of transformation of routine or periodic alterations into significant improvement [4], provided that omnichannel thrives in the digitalized environment [6], Amazon's attempt to the shift to an omnichannel approach has been enabled by its intensive R&D investment centered on digitalization. Fig. 9 and Table 2 analyze the contribution of learning effects and R&D investment to Amazon's apparel sales share in the US market over the period 2014 to 2019 by utilizing quarterly data. Looking at Table 2, we note that while Amazon's increase in this share depends on learning effects for the whole period examined (dummy periods D_1, D_2, and D_3), its rapid jump in 2017 (similarly, D_2) largely depends on R&D investment centered on AWS (Amazon Web Service), BD (big data), AI (artificial intelligence) encompassing ML (machine learning), DL (deep learning), CV (computer vision) and IR (image recognition), as well as AR (augmented reality), BR (blended reality), DM (data mining), GAN (generative adversarial networks) and QR (quick response).

This suggests that Amazon undertook intensive R&D for cultivating the digitalized environment for undertaking *ADFs* starting from Prime Wardrobe, which emerged in 2017, and AI Algo (2017), Echo Look (2017), and AR Mirror (2018), Amazon then utilized learning orchestration effects thereon for the development of succeeding *ADFs* as Personal Shopper (2019), Style Snap (2019), and The Drop (2019) [3].

Business-model innovation is essential for the omnichannel shopper. Omnichannel customers are hungry for innovation and are more likely to experiment with new technologies and engagement models. As the number of omnichannel shoppers grow, the degree and pace of innovation and experimentation will need to grow to serve them [57]. This corresponds to $N \rightarrow S^n$ (self-propagating function increases as services increase) in Fig. 8. Innovative direct-to-consumer apparel firms are gaining real-time insights into what customers want and responding to trends faster than ever [57]. Since omnichannel service can satisfy customers' demands for smooth and convenient experiences, they naturally expect satisfactory outcomes from omnichannel service usage. At the same time, omnichannel urges customers to develop certain abilities [23].

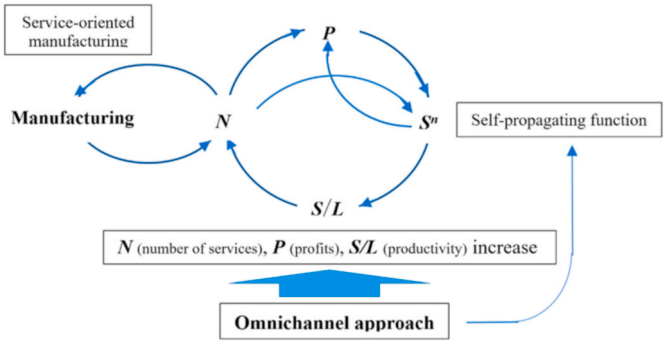


Fig. 8. Prospect of service-oriented manufacturing.

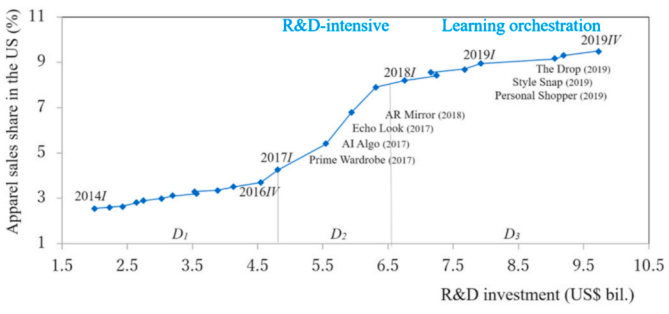


Fig. 9. Correlation between Amazon's R&D investment and apparel share in the US market (2014–19 quarterly).

Table 2
R&D Contribution to Shift to Omnichannel Approach in Amazon (2014-2019).

$$S(t) = Ae^{\lambda t}R(t)^{\alpha}$$

$$\ln S(t) = \ln A + \lambda\, t + \alpha \ln R(t)$$

$$\ln S(t) = 1.75 + 0.03\, D_1\, t + 0.13\, D_2\, t + 0.02\, D_3\, t + 0.85\, D_2 \ln R(t) - 0.85\, D_1 - 3.38\, D_2$$

$S(t)$: apparel sales share in the US, A: scale factor, λ: learning coefficient, t: time trend, $R(t)$: R&D investment, α : R&D elasticity to $S(t)$, D: dummy variables; D_1: 2014*I*-2016*IV* = 1, others = 0; D_2: 2017*I*-2017*IV* = 1, others = 0; D_3: 2018*I*-2019*IV*= 1, others = 0 (*I*: 1st quarter, *IV*: 4th quarter).
Backward elimination method with 5% criteria was+ used.
The figures in parentheses indicate the t-statistics: all are significant at the 1% level.

3.3.1.2. Increased density of omnichannel dependence. With an identical notion of the omnichannel approach, Amazon has attempted to fully perform its comparative advantage through learning orchestration based on its innovative technology assets as AWS, AI, and big data and used a variety of omnichannels as illustrated in Fig. 10. Through this attempt, Amazon has improved the curation system for developing customers' abilities.

In line with this strategy, Amazon has been securing a digital solution by developing *ADFs* successively based on learning orchestration externality [3] and increased density of omnichannel dependence as *ADFs* proceeds as demonstrated in Table 3. For example, The Drop, which emerged in 2019, taps global influencers to co-design street-inspired collections sold over a 30-h window. The collections are manufactured in line with demand, leading to developing a testbed function for on-demand manufacturing. This has been enabled by accomplishing seamless switching among physical stores, the website, mobile channels, social media, and an extensive media mix. With AI advancements and the omnichannel experience, apparel can be manufactured to order without mass producing a product and holding it in inventory. This paves the way for ODM and further reinforces seamless switching among an increasing variety of channels [9].

Table 4 summarizes seamless switching in seven- *ADFs* businesses.

Since omnichannel service can satisfy customers' demands for smooth and convenient experiences, they naturally expect satisfactory outcomes from omnichannel service usage. At the same time, omnichannel urges customers to develop their abilities for searching, learning, and absorbing trends in the global fashion community [23].

Table 4 demonstrates Amazon's successive *ADFs* developments in line with:

(i) effective utilization of innovative assets as AWS, AI, big data, and a variety of omni-channels thereon [59,60]),
(ii) maximizing learning orchestration externality [3,61–63];
(iii) improving the curation system function for developing customers' abilities [64,65] as initiated by Echo Look in training Amazon's machine learning algorithms through customers' photos and short videos captured by its smart camera device [66];
(iv) intensifying the density of omnichannel dependence by enriching functions as *ADFs* advances, as demonstrated in Table 5 [67,68], and
(v) developing a testbed function for ODM [67,69]; Amazon.com, 2021). Here, testbed incorporates systems functions such as as predictability, observability, and trialability [70].

3.3.1.3. Contribution of ADFs development. Consequently, the development of a series of *ADFs* has contributed to intensifying the density of qualified omnichannel dependence based on high-level curation systems equipped with learning orchestration of innovative technologies as AWS, AI, and big data. This development has led to increasing in Amazon's sales share of apparel and high prospecting business, and contributed to its sales increase, as demonstrated earlier (Fig. 5 and Table 1, as well as Fig. 9 and Table 2). It has also paved a realistic way for ODM. In addition, it cannot be overlooked that the development of a series of *ADFs* has leveraged Amazon to advance deeper into the luxury market.

3.3.2. Advancing further into the luxury market

3.3.2.1. New digital platform for luxury fashion. Advancing further into the luxury market is Amazon's long-lasting dream. However, Amazon's previous attempts to court luxury brands have been met with resistance [71]. These brands want to avoid being associated with discount and counterfeit products [72,73]. Brands have been reluctant to collaborate with Amazon due to its solo-channel approach of selling basic apparel using its own control over branding, pricing, and discounts [3,74]. Amazon introduced a new digital platform for luxury fashion, Luxury Stores in September 2020 by collaborating with renowned luxury fashion designers and brands in attempting to overcome these structural impediments, in line with its development of successive *ADFs* businesses, and also in response to the increasing requirement from brands to look for extra channels that address a non-contact society. Taking into account the structural impediments that make brands reluctant to collaborate with Amazon, Amazon allowed brands to make decisions about their inventory, selection, timing, and pricing, which in turn

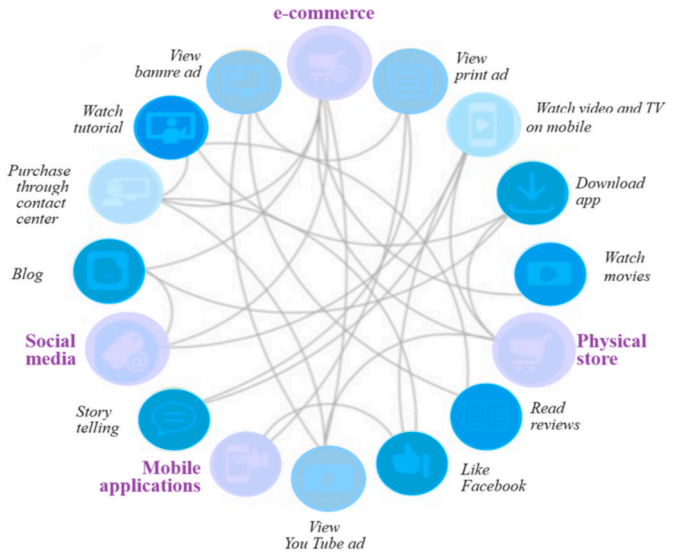


Fig. 10. Scheme of digital customer journey- Physical store, e-commerce, mobile app., social media, and media mix.
Source: Authors' elaboration based on Coelewij [58].

Table 3
Trend in omnichannel density in *ADFs*.

	Physical store (PS)	e-commerce (e-com.)	Mobile application (m-app.)	Social media (SM)	Media mix (MM)
Prime Wardrobe	Not depending (*ND*) (mimics PS by bringing sensory experience and flexible returns at homes)	Subscription-based online clothing service, access to premium brands, try at home before purchase.	m-app. is designed to collect and store data, real time info, and purchase any time anywhere, customized messages.	Branded content campaign, product tagging on SM, experience sharing, brand awareness, product reviews, partnership with content creators.	m-TV, SMS, YouTube ad, video, m-video, blog, purchase through contact center, reviews, tutorial, print ad
AI Algo	*ND*	Algorithmic fashion design solution.	*ND*	Learning from trends on SM.	YouTube ad, m-video, blog, purchase through contact center, reviews, tutorial, print ad
Echo Look	*ND*	Online fashion recommendation service through photos and short videos.	Companion apps that recommend styles collect and store data, sharing photos with others, real time info and purchase any time anywhere, customized messages.	Branded content campaign, experience sharing with other consumers, brand awareness, product reviews, and partnerships with digital content creators.	YouTube ad, m-video, blog, purchase through contact center, reviews, tutorials, print ad
AR Mirror	*ND* (mimics PS through AR/VR experience at homes)	Device based on AR/VR for Prime members.	*ND*	Promotions, experience sharing with other consumers, brand awareness, product reviews, partnerships with content creators.	YouTube ad, m-video, blog, purchase through contact center, reviews, tutorials, print ad
Style Snap	*ND*	Image based style inspiration search for prime members.	m-app. sharing with others, real time info and purchase any time anywhere, customized messages.	Promotions, brand awareness, reviews, experience sharing with other consumers, partnerships with digital content creators.	YouTube ad, m-video, blog, purchase through contact center, reviews, tutorial, Facebook
The Drop	*ND*	Fashion influencers designed clothes for Prime members.	Mobile app, real time info and purchase any time anywhere, customized messages.	Influencers designs, collaboration with influencers on social media, promotions, experience sharing with other consumers, brand awareness, reviews.	YouTube ad, m-video, blog, purchase through contact center, reviews, tutorial, banner, Facebook

Media mix encompasses TV, radio, e-mail, phones, call centers, and short messages service (SMS).

abled broader luxury brand participation with close integration with manufacturers [71,73,75].

However, this is a trade-off between multichannel and omnichannel approaches as this challenge incorporates trade-offs between exclusive and wide availability, as well as owning and ease. Luxury brands have to figure out how to maintain their high-class reputation while being available to many around the world. This requires Amazon to provide an answer to a previously impossible conundrum [75]. Luxury Stores is expected to make this answer viable; therefore, luxury brands are expected to have their own exclusive interactive experiences while having the availability of Amazon's non-contact-oriented channels. Once accomplished, both luxury brands and Amazon enjoy seamless switching.

Starting with Oscar De La Renta (September 2020), followed by Roland Mouret (September), Altuzarra (October), Clé de Peau (October), Car Shoe (October), Révive Skin Care (October), La Perla (November), Elie Saab (December), Mark Cross (December), and The Conservatory (December) Amazon has endeavored to expand Luxury Stores by inviting ten pioneering brands by the end of 2020. Success of this challenge depended on the construction of the co-evolution between traditional business models in luxury brands and Amazon's successive efforts for a more sophisticated omnichannel approach [75]. Table 6 reviews the current state and prospect of the omnichannel approach in ten pioneering luxury brands that joined Amazon's Luxury Stores in 2020.

Table 6 demonstrates the pioneering state and future prospects of Amazon's Luxury Stores with ten brands as follows:

(i) Currently, Amazon and ten brands continue co-existing regarding their respective functions and hardly perform seamless switching by integrating both functions [24,25,71].
(ii) However, all incorporate the potential to transform co-existence to co-evolution that activates multi-channels with seamless switching by maximizing co-evolutionary effects [77,78].
(iii) This transformation contributes to paving the way to Amazon's ODM [46,79].

3.3.2.2. Acceleration of innovative technology solutions. While seamless switching expects the consistent availability of products and services on all available channels, luxury brands confront the Internet dilemma [7]. They seek to maintain brand image, sustain personal links with customers, and retain an exclusive aura while providing products and services to online customers [24]. Kim [25] pointed out that quite a few luxury brands still do not employ the Internet as an active transaction channel. The untransferable in-store experience and luxurious atmospherics of physical stores are considered the main reason that makes luxury brands hesitant to go online as retailers. In addition, the uncertainty of product authenticity is a critical issue that prevents customers from purchasing luxury goods online [80]. With these hesitations, luxury brands may overlook opportunities that the digital platform can bring such as financial strength and brand awareness [25]. Parisi [71] argued out that Amazon has to strike a delicate balance between being exclusive enough to court luxury brands but not so exclusive and small-scale that the brands see no value in joining.

However, by selling luxury goods on their own e-commerce sites, luxury stores can help luxury customers reduce perceived risks of online shopping and thus increase sales [25]. Kluge et al. [81] stressed that online accessibility of luxury goods does not negatively affect brand desirability for customers. Instead, online accessibility positively affect customer perceptions of convenience and willingness to buy. According to Gendre [77] "If Amazon can continue to develop innovative technology solutions, it has a real opportunity to increase online revenue share in the luxury sector." Dalpiaz [78] pointed out that "Now, it's important to do what it takes to reach customers where they are and offer what they need. It's possible for luxury brands, via Amazon, without losing their luster."

Taking this invaluable opportunity during COVID-19 when apparel demand confronts stagnation, by making full use of learning orchestration externality accumulated through *ADFs* development, Amazon's Luxury Stores attempts to solve the structural impediment of the Internet dilemma by providing an answer to a previously impossible challenge through a "store within a store" that gives brands the power to manage their inventory and customer relationships by themselves [82].

Consequently, Amazon has succeeded to invite additional 24 luxury brands, in addition to the ten pioneering brands, to join Luxury Stores by the end of the first half of 2021 [83].

Germany based Mytheresa is a major competitor of Amazon's Luxury Stores and considers Amazon as threat. Its curated offerings come from a network of over 200 luxury brands. However, It doesn't have as flexible services and advanced technological infrastructure as Amazon has. It is in fact Amazon's customers that use AWS for cloud computing, online sales management and other innovative technologies [82,84]. While it took 15 years for Mythersea to attract 200 brands, Amazon attracted 34 brands in less than one year. This demonstrates the system efficiency of Amazon's Luxury Stores. It is estimated that Amazon could bring 180 luxury brands to Luxury Stores in less than three years [73].

Table 6–2 summarizes the additional 24 luxury brands that joined Luxury Stores by the end of the first half of 2021. This demonstrates that all can be attributed to effects of learning orchestration externalities from *ADFs* in overcoming the Internet dilemma. In addition, they suggest the possibility of co-evolution among *ADFs*, luxury brands, and ODM.

3.3.2.3. Synchronization of Amazon's assets. Amazon's success in advancing into the luxury market depends on maximizing substantial seamless switching effects [79] in the triggering scheme of co-evolution among *ADFs*, luxury brands, and ODM under the increasing dependence on ODM in a non-contact society by finding the right hybrid set of skills, technologies, and the right partner [46]. As manufacturers begin to see the business benefits, they will start to adopt a more comprehensive approach to their omnichannel strategy [46].

The newly appointed president of Amazon fashion, Muge Edirik[6] Dogan has been using her skills and experience in retail, technology, and innovation to attract luxury brands to compete with rival platforms [85].

She is expected to solve the above concerns by synchronizing Amazon's assets, *ADFs*, Luxury Stores, and ODM system, which was patented in 2017.

Table 7 demonstrates the significance of this synchronization through SWOT analyses of ADF and Luxury Stores.

Table 7 demonstrates the significance of the synchronization of *ADFs*, luxury brands, and ODM by supporting findings obtained in Tables 4 and 6 and also suggesting the opportunity of ODM for the apparel industry.

4. New stream leveraging supra-omnichannel in Amazon's apparel business

4.1. Three-dimensional approach for a fashion-driven apparel leader

The ambitious goal to be a fashion-driven apparel leader has led Amazon to focus on the following a three-dimensional approach consisting of: (i) satisfaction of customers' dream to have their own

[6] In this chasing game, while a inferior mirages in the distance ahead move together with the same size, given the certain obsolescence rate ρ indispensable to new innovation, moving with the same size implies growing by this rate. $S[(1+g)^t](1-\rho)^t = S \quad (1+g)^t = 1/(1-\rho)^t$ *then* $g \approx \rho$ where S: size of the inferior mirage, g: growth rate, ρ: rate of obsolescence of innovation, and t: time trend.

Table 4
Way of seamless switching in *ADFs*.

	Way of Seamless Switching
Prime Wardrobe	**Subscription clothing box with a try at home before purchase:** See online try offline service→ subscription-clothing box→ try at home before purchase experience →personalization (online product matches) enabled by **BD** analytics i.e., **BD** collection through website visits, past histories and profiles→ **AWS**→ **BD** processing and experimentation→ **ML** algorithms development→ customer taste, buying patterns and preference identified and structured → seamless fashion catalogue browsing and ordering → enables customers to renew their fashion collection with free trials at home → order via m-app. or e-com. free shipping/return →24/7 (seven days trial period) customer service (cs) →multi- channel presence, i.e., Amazon contact center, blogs, email, YouTube and MM.
AI Algo	**AI fashion designer: ML** algorithmic approach→ **GAN** to understand human tasks → Amazon trained **GAN** to fashion designer→ spots, reacts and redesign fashion trends by learning from images on web → data set of trendy images on SM and MM (input data) → similar images produced by generative model (output) → real-time process→ **DM**→ style identification→ demand prediction of trends before manufacturing → produced on demand → based on context predict why the customer is seeking support, speeding the response. **Recommendations provision:** Provide recommendations for problem-solving, both from the perspective of recommending a particular journey, but also providing recommendations to the customer and support staff on how to address the problem, improving support effectiveness → through continuous learning, refine these journeys and recommendations leading to optimizing the experience.
Echo Look	**Virtual try-on service:** Integrated with companion recommendations and rating apps (Style Check, outfit Compare) → virtual fashion wardrobe creation (look book app) at home as in PS. → enable fashion image sharing on social networks →**ML** curates photos into categories → human designers provide final recommendations. **AWS computing platform for profiles mapping:** Smart speaker with depth-sensing camera for profiles mapping → powered by **AI**-based interactive voice service (Alexa) → lives in Amazon cloud →**ML** enables continuous skills learning → virtual advisor to virtual fashion advisor supported by **AWS** computing platform. **Omnichannel data integration and management:** Outfit images contain customers' behavioral data (lifestyle, fashion sense, and buying behavior), → personalized recommendation→ algorithm training→ order via m-app., e-com. or Alexa delivered at home with free shipping and returns, 24/7cs. → multichannel presence i.e., Amazon contact center, blogs, SMS, email notifications, YouTube tutorials, and MM→ fully integrated retail experience → device stopped functioning in 2020 → corresponding apps are in operation for recommendations.
AR Mirror	**AR based virtual try on service:** Echo Look extension→ **BR** view → removes the hassle of changing rooms in PS → create seamless PS experience online along with fun, enjoyment, and time spent in PS. Customers envision virtual outfits at physical locations→ new outfits emerge based on touch screen, voice and body movements→ closes the gap between online and offline (show rooming and web rooming concepts) → Mass customization and personalization→ could be integrated with other ADF and fashion catalogue. **Smart mirror with depth-sensing camera for profiles mapping: CV** to create human avatars with realistic movements → used for outfit modeling → **ML** provides self-learning and self-adapting features to the mirror → updates and more responsive in delivering experiential consumption, more certain product evaluation and decision making → a sophisticated data collection tool. → Integrated retail experience enables seamless switching between channels. **Context-relevant information: AR** brings inventory directly to the customer home and can help boost customer confidence, reduce shopping cart abandonment, and limit returns → link to the Amazon's Web page → order via AR Mirror device (IoT), to be delivered to the home with free shipping and returns, 24/7cs. → Amazon patent → commercially unavailable.
Personal Shopper	**Multi channels exploitation:** Styles are selected by humans (customers and designers) and **AI** by means of e-com., m-app. and SM as key sales channels → enables a customer to renew their fashion collection with free trials at home→ order via m-app. or e-com. With free shipping and return → 24/7cs. → multichannel presence i.e., Amazon contact center, blogs, SMS, email notifications, YouTube tutorials, and MM. **Mass customization and personalization:** Prime Wardrobe extension with curation function learning through data analytics, AI, customer input, and human designers supported by AWS→ closes the gap between offline and online channels with a try at home before purchase → **ML** carries learning assets, **BD** both structured data (preference, size, fit, color) and unstructured data (images, videos, special requests, SM) as well as Amazon fashion inventory → data analytics for interpretation and structuring of structured data → human expertise for interpretation of unstructured data→ data sets assist human designers for final curation, and delivery→ **BD** continuously trains **ML** for determining personalization and latest trends that support curation function and service improvement. **Highly engaging clothing box service:** Created by customers, **AI**, and human designers on monthly basis → highly engaging service (customers are always curious in finding what they have created) → curation function satisfy customers increasing desire of individuality.
Style Snap	**Curation with lifestyle influencers learning from SM:** Photo-based fashion shopping service by landing page via selecting camera icon → upload a photo →**AI** photo analysis → **IR** to retrieve similar items from a fashion catalogue supported by **AWS** → **DL** and **CV** initiated voice and text free fashion search → faster and easier online shopping experiences in real-time → recommendations based on brands, price, and reviews → continuous curation thereon. **Inducing advanced influencer program:** Fashion influencers tag their SM fashion images or add to their storefronts→ notifications to followers→ they upload screenshots on Style Snap→ AI analyzes the photo and match it with influencer's shared images for similar recommendations and matching → induce influencers to further develop their followers by receiving a commission on SM. **Photo-based matching recommendations:** Customers use typical filters for Prime eligibility, size, fit, etc. → within the catalog, the branded **QR** codes drive customers directly to the Amazon website → customers scan fashion items **QR** → gain more product information, its availability on other channels or other recommendations from Amazon catalogue → recommended items are consistently available at Amazon catalogue customer can order via Prime Wardrobe, e-com, and m-app. → delivered to home with free shipping and return 24/7cs. → seamless switching among multi-channels i.e., Amazon contact center, blogs, SMS, email notifications, YouTube tutorials, and MM.
The Drop	**Curation with international fashion influencers:** International fashion influencers learning from SM fashion influencers → minimal and exclusive editions → new capsule collections in every few weeks →production starts as soon as collection ends →available for 30 h → limited inventory→ produced in small batches → enables on-demand manufacturing→ delivery in 2–3 weeks. **Direct relations between influencers and customers:** Most of the influencers are SM active → fashion customers explore multiple channels, particularly by SM to seek fashion information→ SM enables influencers to create direct relationships → share their contents by MM (blogs, reviews, banner, videos, YouTube) and inspire customers in decision making→ their credibility, design expertise, specific channel contents, and direct relations allow customers to trust and follow them. **Global fashion data acquisition through worldwide collaboration and co-creation with renowned influencers:** Shed uncool image → deeper into Luxury fashion as well as towards on-demand manufacturing → expertise and knowledge of influencers enable Amazon and its **AI** system to learn evolving global fashion cultures →global fashion data acquisition → every influencer representing "The Drop" has significant number (millions) of SM and MM followers. **Testbed for on-demand manufacturing: ML** algorithms training→ designing personalized and dynamic services → accurate recommendations → testbed for future on-demand manufacturing factory → order via m-app., e-com. or phone call → deliverer to home with free shipping and return 24/7cs. → seamless switching among multi-channels i.e., Amazon contact center, blogs, email notifications, YouTube, influencers SM and MM.

R&D - BD: Big data, AWS: Amazon web service, ML: Machine learning, AI: Artificial intelligence, GAN: Generative adversarial networks, AR: Augmented reality, CV: Computer vision, IR: Image recognition (subset of CV), DL: Deep learning, QR: Quick response, DM: datamining, BR: Blended reality.
Channels - PS: Physical store, e-com.: e-commerce, m-app.: Mobile application, SM: social media, MM: media mix.

Table 5
Development of key functions in *ADFs*.

Prime Wardrob	Subscription clothing box with try at home before purchase
AI Algo	AI fashion designer
	Recommendations provision
Echo Look	Virtual try on service
	AWS computing platform for profiles mapping
	Omnichannel data integration and management
AR Mirror	AR-based virtual try-on service
	Smart mirror with depth-sensing camera for profiles mapping
	Context-relevant information
Personal Shopper	Multi channels exploitation
	Mass customization and personalization
	Highly engaging clothing box service
Style Snap	Curation with lifestyle influencers learning from SM
	Inducing advanced influencer program
	Photo-based matching recommendations
The Drop	Curation with international fashion influencers
	Direct relations between influencers and customers
	Global fashion data acquisition and co-creation with renowned influencers
	Testbed for on-demand manufacturing

initiatives, (ii) shedding uncool label and increasing curation function, and (iii) deepening into the luxury market.

(1) Satisfaction of customers' dream by accelerating SNBN program

Amazon has accelerated the SNBN (see now buy now) program to let shoppers create by themselves [5]. This corresponds with the increasing trend of prosumers (consumers as producers) in response to the increasing anger of consumers to have been retained non-producers [86,87] against their dream to enjoy an exciting story with their own initiatives as heroes/heroines of a drama [52].

(2) Shedding uncool label and increasing curation function

Amazon has attempted to shed its uncool label and increase the curation function to improve customers' abilities by developing a series of *ADFs* leading to tapping global influencers to co-design most fashionable collections sold and manufactured in line with demand.

This development of a series of *ADFs* corresponds to the shift from multichannel and cross-channel to omnichannel.

(3) Advancing into the luxury market

Amazon has attempted to advance into the luxury market through opening to a multichannel approach by allowing luxury brands to make decisions about their inventory, selection, timing, and pricing.

While this attempt started from the co-existence of luxury brands' traditional channels and Amazon's own channels, the ultimate goal is to transform this co-existence into co-evolution.

4.2. Synchronization of three-dimensional streams

Synchronization of these three-dimensional streams is expected to pave the way to long-lasting ODM for the apparel business together with shedding Amazon's uncool label and advancing further into the luxury market, as illustrated in Fig. 11. The first stream, satisfaction of customers' dream to have their own initiatives, encourages ODM from the motivation-side. The second stream, shedding the uncool label and increasing the curation function, encourages ODM from demand-side. The third stream, advancing into the luxury market, encourages ODM from the supply-side.

4.3. Breakthrough to on-demand manufacturing for the apparel business

(1) Features of ODM

Less uncertainty, shorter lead-time, higher flexibility, minimum investment and inventory [88,89].

(2) Merits of ODM

Customization, individuality, exclusivity, sustainability, less wastage, reduced energy and pollution, faster supply chains, and reduced inventory [90,91].

(3) Necessary requirements for ODM

(i) Ability to comprehend variations in volume, variety, and processes [90,92].

(ii) Capital and technology for an automated system, investments in AI, standardization and rapid supply of materials for manufacturing, real-time supply chain visibility, a platform for customer-supplier interaction, talented workforce, collaborations, intelligent decision support system, and high-speed Internet such as 5G technology to handle intelligent machines and robotics [88].

(iii) 5G will further accelerate automated processes and allow machines to update themselves, transfer big data, and initiate a new process based on customers' demand [93].

(4) Structural impediments to realize ODM

Design and technological requirements for every order, access to materials as every order is unique, uncertain lead times, irregular supply of customer orders, uncertain production planning and control, setting delivery priorities, cost of customization, and multiple orders from multiple customers can lead to production errors [94].

(5) Effects on broad stakeholders

Satisfy customers' dream to be heroes/heroines of a drama (corresponding to an increase in prosumers).

(6) Contribution to the apparel industry

ODM contributes the following benefits to the apparel industry:

(i) Enables brands to focus more on finding new customers and their data instead of dictating fashion trends to the world [95].
(ii) Eliminates intermediaries such as dealers, wholesalers, and marketing firms [96],
(iii) Enables apparel producers to make products close to the customer, without inventories, long lead times, and forecasts.
(iv) Customers and suppliers can communicate in real time for customized products [97],
(v) Virtuous circle of agile production and rapid response to quickly evolving customers' demands can be constructed [98].

(7) Amazon's aim to develop ODM for apparel

Amazon is taking steps to develop the tools that deliver real-time consumer insights and can be leveraged for just-in-time delivery. In light of the significance of ODM for this attempt, with its comparative advantage in data and automation technology, Amazon applied a patent for an on-demand apparel manufacturing system based on data and automation in December 2015 and was granted this patent in April 2017 [99].

In this patented system, orders are received through multiple channels used by customers, based on data and automation. Computers then collect orders and arrange them for production. The manufacturing system is based on textile printers, cutters and computers. The computing environment increases production efficiency and real time customization, allowing new manufactures with advanced technologies to enter the market with very low minimum order quantities [100].

The acquisition of this patent steps up Amazon's fashion game (CB

Table 6
Development of luxury stores.

Brands	Time of launch	Label	Prospect of omnichannel
Oscar De La Renta	Sep. 2020	USA	1. With ready-to-wear and on-demand fashion from 2013, it offers personalized shopping with fitting solutions by using True Fit technology. First official partner on Luxury Stores. 2. Integration with Amazon is expected to increase visibility, digital-merchandising solutions to personalize the brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. Provides customization and remodeling services. In addition, customers and brand's designers curate bridal dresses. These services correspond to on-demand apparel manufacturing.
Roland Mouret	Sep. 2020	UK	1. With ready-to-wear and on-demand fashion with online and PS, e-com. Collaboration with Shopify. SEO (search engine optimization) strategies for increased sales were initiated. 2. Both co-created "Utopia" for virtual try-on with virtual backgrounds, "No Show" movie, enabling integration of digital content with e-com. Such storytelling strategies would enhance customer's luxury experience. Amazon provides digital-merchandising solutions to personalize the brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. It also offers customized dresses, and the "Utopia" strategy enables mass customization and personalization, leading to on-demand manufacturing.
Altuzarra	Oct. 2020	USA	1. While ready-to-wear both PS and online, collaboration with a multi-brand department store is a significant sales channel at present. 2. In collaboration with Amazon, storytelling strategies via movies will be used for an enhanced luxury experience that combines digital content with e-com. Fashion collections are presented to Luxury Stores with three short films and curated product vignettes. Amazon provides digital-merchandising solutions to personalize the brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. These strategies and curation function in creating product vignettes represent personalization pave the way to on-demand manufacturing.
Cle de Peau	Oct. 2020	Japan	1. Since cosmetics are major products with luxury brands of Japan's Shiseido group, Cle de Peau doesn't sell outfits. With online and PS presence, major sales channels are outlets, boutiques, departmental stores, and several e-com. Channels. 2. Integration with Amazon is expected to increase visibility, digital-merchandising solutions to personalize brands' content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. Digital-merchandising solutions contribute to Amazon's on-demand apparel manufacturing.
Car Shoe	Oct. 2020	Italy	1. With both online and PS presence, it sells leather shoes, not outfits. Major sales channels are outlets, boutiques, departmental stores, and e-com. Collaborated with Adobe to analyze customers' preference data in designing digital marketing campaigns, personalization, and customization. 2. Collaboration with Amazon's Luxury Stores provides access to customers across the world with SM, MM, and email campaigns, Storytelling through a short movie on Amazon fashion social media channels with a tag line "City or Country." Amazon also provides digital-merchandising solutions to personalize brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. It belongs to the leading luxury brand Prada that uses "Made to Measure" technology that enables customers to curate outfits with the brand's designers. This personalization and customization approach leads to on-demand apparel manufacturing.
Revive Skin Care	Oct. 2020	USA	1. Since cosmetics constitute a significant product, revive skincare doesn't sell outfits. Sales channels include web, several e-com., mobile, SM, own stores including revive skincare and boutique, and departmental stores. It also provides AI-enabled selfie-based customized skincare recommendations to individual customers representing an omnichannel approach in cosmetics. 2. Its founder won a Nobel prize for inventing medicine for burn victims, which became the foundation for the company. Integration with Amazon is expected to increase visibility, digital-merchandising solutions to personalize brands' content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching in broader apparel businesses. 3. AI-based customized recommendations contribute to Amazon's on-demand apparel manufacturing.
La Perla	Nov. 2020	Italy	1. With both online and PS presence, major sales channels are outlets, boutiques, departmental stores, and several e-com. channels. Collaborates with SM influencers and bloggers, meet and greet events with brand's own designers, and Candid videos that capture in natural, spontaneous, or unposed manner. 2. Collaboration with Amazon's Luxury Stores provides access to customers across the world with SM, MM, and email campaigns, storytelling through short movie at Netflix series. Amazon also offers digital-merchandising solutions for personalizing the brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. Better solution for La Perla problems, the satisfaction of individual customers' needs, urges Amazon's on-demand apparel manufacturing.
Elie Saab	Dec. 2020	Lebanon	1. With both online and PS presence, major sales channels are departmental stores and outlets. Collaboration with e-com. platforms, Net a Porter and Ounass. 2. Collaboration with Amazon's Luxury Stores provides access to customers across the world with SM, MM, and email campaigns, storytelling through auto play imagery, and in motion graphics. Amazon also offers digital-merchandising solutions to personalize the brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. Its customized dresses and digital-merchandising solutions urge Amazon's on-demand apparel manufacturing.
Mark Cross	Dec. 2020	USA	1. Since luxury leather accessories i.e., handbags and wallets are major products, it does not sell outfits. With both online and PS presence, major sales channels are outlets, boutiques, departmental stores, and e-com. 2. Collaboration with Amazon's Luxury Stores provides access to customers across the world with SM, MM, and email campaigns. Joined Luxury Stores with new gifting suits in time for holidays strategy, leveraging storytelling elements and curated offerings. Amazon also provides digital-merchandising solutions to personalize the brand's content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3. Curated offerings urge Amazon's on-demand apparel manufacturing.
The Conservatory	Dec. 2020	USA	1. Multi-brand store representing fashion, wellbeing, and lifestyle products. Both PS and online presence, for e-com. collaborated with Farfetch. Allow customers to try items on but not make any purchases. Uses universal cart technology for cash less payments. Some of its stores act as showrooms to boost online sales.

(*continued on next page*)

Table 6 (*continued*)

Brands	Time of launch	Label	Prospect of omnichannel
			2. Collaboration with Amazon's Luxury Stores provides access to customers across the world with SM, MM, and email campaigns. Amazon also provides digital-merchandising solutions to personalize the brand's content, international presence, virtual store-fronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching. 3 It's eco-friendly approach and creativity representing ageless outfits urges Amazon's on-demand apparel manufacturing.
2 Development of Luxury Stores (2) – 24 Luxury Brands joined by June 2021			
Brands	Time of launch	Label	Prospect of omnichannel
Aquazzura	2021	Italy	1. Women's footwear brand with timeless classic styling. Acquazzuras' "Wild Thing" shoe designs led to international success. With PS, online, and e-com. presence. Collaboration with Shoe Spa that provides repair, restoration, and revitalizing services. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Digital merchandising solutions and customized offerings lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Charlotte Chesnais	Apr. 2021	France	1. Luxury jewelry designer brand that specializes in crafting handmade and timeless designs. With PS, online and e-com. presence. Its creativity represents both jewelry and sculpture i.e., wearable art. It also collaborates with other leading designers. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Digital merchandising solutions and customized offerings lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Christopher Kane	May 2021	UK	1. Luxury apparel brand offers ready-to-wear, customized, and on-demand apparel. With online, PS, and e-com. presence, its patent leather embroidered dresses lead to international success. Collaborated with Far fetch white label e-com. platform. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Its customized services, and rush order features lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Costa Brazil	Dec. 2020	USA	1. Eco-friendly beauty and skincare products inspired by Brazilian nature and Amazon rain forests where beauty is viewed and felt. With online, PS, and e-com. presence, it also collaborates with multi-brand retailers. Acquired by biotech company Amyris provided Costa Brazil resources for global business expansion. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Digital merchandising solutions lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
CVC Stones	2021	USA	1. Since jewelry is a major product, CVC Stones doesn't sell apparel. With online, PS, and e-com. presence, it specializes in hand-crafted diamond and gold jewelry. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Digital merchandising solutions lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Deveaux New York	2021	USA	1. Ready-to-wear luxury apparel brand. With online, PS, and e-com. presence, it also collaborates with multi-brand retailers. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Digital merchandising solutions lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Dundas	2021	UK	1 Luxury apparel, jewelry, and accessories brand famous for celebrity designer. With online, PS, and e-com. presence, its major sales channels are outlets, boutiques, and different e-com. platforms. It follows the non-season structure of timeless capsule collections. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Virtual try-on, and digital merchandising solutions lead to Amazon's ODM, thereby co-evolution among *s,* luxury brands, and ODM can be expected.
Epara	Dec. 2020	UK	1. Based on skincare products, Epara does not sell apparel. With online, PS, and e-com. presence, its major sales channels are outlets, boutiques, and several e-com. platforms such as, The Conservatory. Epara finds its roots in Nigerian dialect, the very first luxury skincare brand specifically created for women of color. Its online presence is limited.

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[101] leading to accelerating the above three streams and enhancing the feasibility of ODM for apparel through synchronizing of these streams.

4.4. Co-evolution among ADF businesses, luxury brands and ODM

Benefits of ODM increase as digital innovation advances, leading to providing a sustainability base, particularly to luxury brands working toward a non-contact society where customers are moving from physical channels to digital channels.

Thus, advanced ODM steadily contributes to transforming the resistance of luxury brands to collaborate with Amazon into a sustainable opportunity against a non-contact society. This, in turn, provides manufacturing industry digital solutions, advanced logistics and funding capabilities initiated by Amazon. Thus, co-evolution among *ADFs*,

Table 6 (*continued*)

2 Development of Luxury Stores (2) – 24 Luxury Brands joined by June 2021			
Brands	Time of launch	Label	Prospect of omnichannel
			2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Fabrizio Viti	May. 2021	UK	1. Specializes in creating timeless women's footwear and handbags with the ambition of classical elegance with a real attitude. With online, PS, and e-com. presence, it does not sell apparel. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
For Restless Sleepers	2021	Italy	1. Offers luxury ready-to-wear apparel. With online, PS, and e-com. presence, it also collaborates with multi-brand retailers and e-com. platforms. The brand storytelling reflects the conversion of sleepwear into luxury for restless hours while staying home during a pandemic. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Heraux	Dec. 2020	USA	1. Luxury skincare brand that specializes in stem cell biology R&D its core HX-1 technology. With online, PS, and e-com. presence, it doesn't sell apparel. It specializes in skin inflammation solutions. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Jonathan Cohen	2021	USA	1. Women's ready-to-wear luxury apparel brand. With online, PS and e-com. presence, its apparel and accessories represent the transformation and imaginative creation. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. It also provides customization and curation services that lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
La Bouche Rouge	Apr. 2021	France	1. Women's luxury cosmetics brand. With online, PS, and e-com. presence, the brand is reintroducing the cosmetics industry to traditional hand-made and French craftsmanship. It focuses on the use of recycled and upcycled materials. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Its luxurious, and refillable leather cases made from sustainable upcycled materials lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
L/Uniform	Apr. 2021	France	1 L/Uniform is a luxury accessories manufacturer, ranging from ready to use and customization services i.e., on demand printing. With online, PS, and e-com. presence, bags, and accessories are major products made of canvas fabric and leather. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. The use of sustainable textile materials and customization services lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Lumira	Dec. 2020	Australia	1. Luxury niche fragrance brand with online, PS, and e-com. presence. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Marina Moscone	2021	USA	1. Luxury women's ready-to-wear apparel brand reflecting the philosophy of timeless fashion. With online, SM, MM, and e-com. presence. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. It also provides customization and curation services that lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
MATEO New York	2021	USA	1. Specializes in men's jewelry representing Jamaican heritage. With online, PS, and e.com. presence, products are sold in well-known retailers such as, Net A Porter, Matches Fashion, Browns, Far Fetch, 1stDibs etc. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. It also provides customization and curation services that lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Missoni	May. 2021	Italy	1 Luxury apparel brand offers ready to wear, and customized apparel. With online, PS and e-com. presence, it also collaborates with multi brand retailers. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching.

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Table 6 (*continued*)

2 Development of Luxury Stores (2) – 24 Luxury Brands joined by June 2021			
Brands	Time of launch	Label	Prospect of omnichannel
			3. The use of sustainable textile materials, and customization services lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Nomad NOE	Dec. 2020	USA	1. Luxury fragrance brand that specializes in fragrance oils and candles. With online, PS, and e.com. presence it also collaborates with multi-brand retailers. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. The use of sustainable textile materials and customization services lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Rodarte	2021	USA	1. Luxury ready to wear apparel and accessories brand. It also provides customization services. With online, PS, and e-com. presence, it also collaborates with multi-brand retailers. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. It also provides customization and curation services lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
ROSE 1845	Dec. 2020	USA	1. Luxury fragrance brand. It does not sell apparel. With online, PS, and e-com. presence, it collaborates with multiband retailers. It represents the craft of Paris with the storytelling of Los Angeles. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Satisfaction of individual customers' needs leads to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Royal Fern	Dec. 2020	Germany	1. Plant powdered luxury skincare brand. With online, PS, and e-com. presence, it does not sell apparel. 2. By utilizing *ADFs* experience, Amazon will provide increased visibility, digital-merchandising solutions to personalize brands' content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching in broader apparel businesses. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
The Harmonist	2021	France	1. The harmonist is a fragrance brand. It does not sell apparel. With online, PS, and e-com. presence, it collaborates with multiband retailers. It represents the craft of Paris with the storytelling of Los Angeles. 2. By utilizing *ADFs* experiences, Amazon will provide customers with a fully integrated online experience, digital merchandising tools with 360-visualization technology, global presence, virtual storefronts, and free and fast delivery 24/7 cs. leading to seamless switching. 3. Satisfaction of individual customers' needs leads to Amazon's ODM, thereby co-evolution among *ADFs,* luxury brands, and ODM can be expected.
Votary	Dec. 2020	UK	Luxury skincare brand. With online, PS, and e-com. presence, it does not sell apparel. 2. By utilizing *ADFs* experience, Amazon will provide increased visibility, digital-merchandising solutions to personalize brands' content, international presence, virtual storefronts creation, multiple touchpoints, and free and fast delivery 24/7cs. leading to seamless switching in broader apparel businesses. 3. Amazon's digital merchandising solutions and satisfaction of customer's needs lead to Amazon's ODM, thereby co-evolution among ADF, luxury brands, and ODM can be expected.

PS: Physical store, e-com.: e-commerce, SM: social media, MM: media mix.
360-degree view technology: Amazon introduced view in 360 technology in 2018 to millions of sellers around the world. This technology improved product visualization that resulted in improved revenues, improved customers satisfaction, and reduced product returns [76].

luxury brands, and ODM can be constructed, as illustrated in the right-hand side of Fig. 12.

This co-evolution enables Amazon to find an answer to a previously impossible conundrum to solve "the Internet dilemma" [7] as reviewed earlier. The solution that emerges is a cloud-based fashion platform where *ADFs*, luxury brands, and all sales channels are integrated in one place. This enables personalization and customization by way of seamless switching on an on-demand basis. Consequently, big data on customers, vendors, manufactures, global influencers, and social trends can be collected, which advance AWS's function by enjoying learning orchestration externality. AWS, as computational science infrastructure, grows and expands by learning digital advancement initiated by the preceding endeavors [3,102,103]. Advanced AWS, in turn, further accelerates co-evolution among *ADFs*, luxury brands, and ODM. Activated co-evolution further advances cloud-based fashion platforms leading to a virtuous cycle between them. Thus, dual co-evolution between the foregoing co-evolution among *ADFs*, luxury brands and ODM, and cloud-based fashion platform advancement is emerged as illustrated in the left-hand side of Fig. 12.

Through the course of this dual-co-evolution, a "chasing game" between luxury brands' exclusivity seeking and Amazon's mass-customization seeking will continue, similar to an inferior mirage as an increasing number of customers seek exclusive value [32,104]. Inferior mirage is a phenomenon in which it looks like there are superior mirages in the distance ahead under the scorching sun due to different refractive indices [105,106]. In trying to get closer, it looks like the mirages are moving together and cannot be caught up no matter how much the effort to chase them intensifies, as illustrated in Fig. 13.

This chasing game leads to a supra-omnichannel approach that enables apparel to grow seamless switching. Blanckenberg [108] pointed out that "Already the most significant e-commerce niche, the online apparel industry is growing at an incredible rate. This growth means online clothing stores need to constantly evolve in terms of trend shifts, technology and market changes, and emerging markets."

Seamless switching among multi-channels grows both quantitively and qualitatively as this chasing game activates.[6] This growing seamless switching is anticipated by the analysis in section 3 on the *ADFs'* AI-driven development trajectory demonstrating self-propagating development (Table 1). With growing and expanding function, AWS plays a core role in this dynamism [103]. The result is like running a small laboratory for Amazon [3].

By means of SWOT analysis, Table 8 demonstrates the significance of growing seamless switching expected to be realized by synchronizing *ADFs*, luxury brands, and ODM as follows:

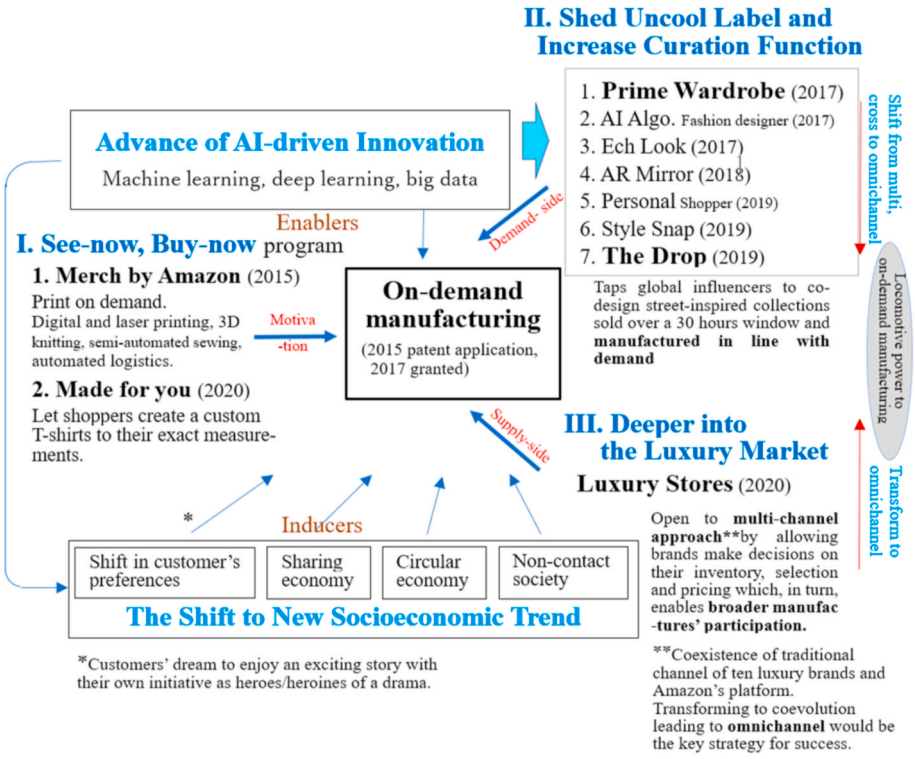

Fig. 11. Amazon's three-dimensional streams toward on-demand manufacturing.

Table 7
SWOT analyses of Amazon's *ADFs* and Luxury Stores.

7–1 *ADFs*

Strengths	Weaknesses
1. Effective development and utilization of core assets such as AWS, AI, big data, and omnichannel approach. 2. Maximizing learning orchestration externality. 3. Improving curation system function for developing customer's ability. 4. Intensifying density of omnichannel dependence by enriching functions as ADF advance. 5. Developing a function of a testbed for Luxury Stores and ODM. 6. Amazon Prime with free shipping and returns, 24/7cs. 7. Advancement in customization and personalization technologies and improvements in AR/VR, virtual try-on, and virtual personal assistants.	1. Only for Amazon Prime subscribers. 2. Limited involvement of luxury brands. 3. Dependence on growing third-party sellers.
Opportunities	**Threats**
1. Co-evolution with involving luxury brands. 2. Self-learning technologies as a frontier of innovations. 3. On-demand apparel manufacturing. 4. Development of ML algorithms for trends, patterns, and design search. 5. Flexible supply chain.	1. Stagnation of apparel demand in a non-contact society 2. Rapidly evolving data analytics techniques. 3. Pioneer competitors such as Stitch fix and Trunk Club. 4. Saturation of new growth.

7–2 Luxury Stores in 2020

Strengths	Weaknesses
1. Non contact sales. 2. Exploration of sales and distribution routes. 3. Strategic alliances and partnerships with luxury brands. 4. Mass customization and personalization. 5. Fast delivery with free shipping and returns policy. 6. Amazon Prime with free shipping and returns, 24/7cs. 7. Presentation of Luxury Stores in a protected environment. 8. Product visualization in 360-degree view.	1. Co-exist without seamless switching. 2. Absence of fashion physical stores. 3. Counterfeits and mistrust due to improper regulation of unauthorized third-party sellers. 4. Absence of higher end luxury brands.
Opportunities	**Threats**
1. Potential to transform from co-existence to co-evolution. 2. Effective utilization of sophisticated merchandising tools, customers database and AWS for customer preferences analysis and learning. 3. **ML based brand registry and transparency systems for overcoming counterfeit misuse, and mistrust issues.** 4. **On demand apparel manufacturing.** 5. Digital tangibilization of luxury. 6. Personalized product assortment and content delivery.	1. Increase in counterfeit issues caused by the third-party sellers. 2. Growing price competition and other luxury focused e-com platforms such as Farfetch etc. 3. Resistance against Amazon's control over brands inventories, prices, and commissions.

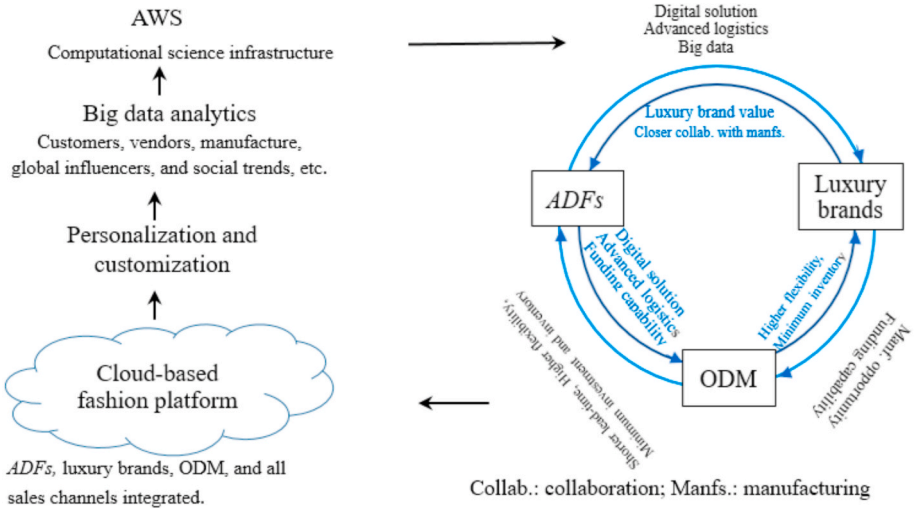

Fig. 12. Dual co-evolution among *ADFs*, luxury brands, ODM co-evolution, and cloud-based fashion platform advancement.

Table 8
SWOT analysis -after synchronization of *ADFs*, luxury stores and ODM.

Strengths	Weaknesses
1. Synergies among *ADFs*, luxury brands, and ODM. 2. Seamless switching among a growing variety of channels. 3. Digital solution to the historical demand, shifting to sharing economy and circular economy. 4. Design-driven thinking leads to design-driven innovations. 5. Digital tools to identify the best and worst selling items. 6. Data collection and analysis through multiple on and offline touch points.	1. Untimely countermeasures to shedding Amazon's image of brand cannibalization.
Opportunities	**Threats**
1. Cloud –based fashion platform, big data analytics, and AWS. 2. **On-demand basis personalization and customization.** 3. **Learning orchestration externality that advances AWS.** 4. Dual co-evolution between cloud-based fashion platform, and co-evolution among ADF, luxury brands, and ODM. 5. Supra-omnichannel approach that enables growing seamless switching. 6. Explore new frontiers tr explores new frontiers beyond current business models. 7. Decisions based on BD analytics. 8. Open innovation with new resources for more innovations.	1. Unexpected shift in customers' preferences. 2. Emergence of new luxury brand platforms beyond foresight.

(i) Through the synchronization, seamless switching among growing variety of channels can be expected [11,15,16] leading to a digital solution to the historical demand, shifting to a sharing economy, and circular economy [26,109,110].
(ii) While this synchronization depends on the construction of co-evolution among *ADFs*, luxury brands, and ODM, untimely countermeasures to shedding Amazon's image of brand cannibalization can be its structural weakness [27,111].
(iii) However, this weakness can be a springboard for constructing dual co-evolution between cloud-based fashion platforms and co-evolution among *ADFs*, luxury brands, and ODM which induces further innovation toward growing seamless switching that explores new frontiers beyond current business models [9,10,75,112].
(iv) It should be noted that unexpected shifts in customers' preferences and the emergence of new luxury brand platforms beyond foresight could be fatal threats in the fashion business [26,113].

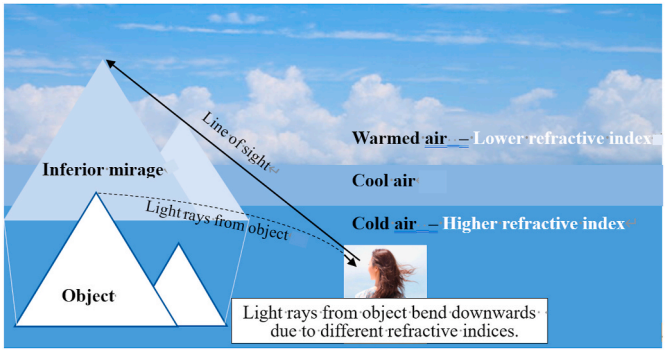

Fig. 13. Scheme of a chasing game in the inferior mirage.
Source: Authors' elaboration based on Brittain [107].

5. Conclusion

In light of the increasing shift to explore a new frontier beyond current business models toward a non-contact society after COVID-19, and Amazon's ambitious attempt to pursue this exploration in digital fashion (including luxury brands) by utilizing its innovative assets, this paper attempted to demonstrate the significance and credibility of this endeavor by explaining its dynamism.

An empirical analysis was conducted focusing on the development trajectories of Amazon's development of a series of seven *ADFs* businesses over the period 2017–19 as well as 34 luxury brands that joined its Luxury Stores in 2020/2021, together with possible application of its patented ODM by using techno-economic analysis, an analogical evidence approach, literature review, and SWOT analysis.

While COVID-19 has caused a significant decline in sales, the apparel industry was undergoing digital solution-oriented transformations even before the crisis. Preempting its highly profitable potential, Amazon has been expanding its fashion-driven apparel business by developing series

of *ADFs* businesses that intensified omnichannel dependence based on seamless switching by utilizing its innovative assets such as AWS, AI, big data, and maximizing learning orchestration externality.

With this development, and in response to the increasing necessity for luxury brands to provide extra channels for a non-contact society, Amazon introduced a long-lasting digital platform for luxury fashion, Luxury Stores in September 2020.

While seamless switching expects the consistent availability of products and services on all available channels, luxury brands confront "the Internet dilemma," which is the reluctance to integrate online technologies into their business model, leading to the reluctance to collaborate with Amazon.

Benefits of ODM increase as digital innovation advances leading to providing a sustainability base, particularly to luxury brands toward a non-contact society. Thus, ODM contributes to transforming the reluctance of luxury brands into a sustainable opportunity to operate in a non-contact society. This in turn provides manufacturing industry digital solutions, advanced logistics, and funding capabilities.

Thus, co-evolution among *ADFs*, luxury brands, and ODM can be constructed. This co-evolution led to the emergence of a cloud-based fashion platform where *ADFs* and luxury brands are integrated in one place, enabling on-demand basis personalization and customization by way of seamless switching.

Consequently, big data on customers, vendors, manufacturers, global influencers, and social trends can be collected, which advance AWS's function by enjoying learning orchestration externality. AWS, as computational science infrastructure, grows and expands by learning. This in turn further accelerates co-evolution among *ADFs,* luxury brands, and ODM.

Activated co-evolution further advances cloud-based fashion platforms, leading to a virtuous cycle between them. Thus, dual co-evolution between the co-evolution among *ADFs*, luxury brands, and ODM, and cloud-based fashion platform advancement is emerged.

This dual-co-evolution leads to a supra-omnichannel approach that enables apparel growing seamless switching and explores new frontiers beyond current business models. The development trajectory of *ADFs* with self-propagating growth supports this expectation to growing seamless switching.

These findings give rise to the following insights for exploring a new frontier beyond current business models toward a non-contact society after COVID-19:

(i) Taking COVID-19 as a springboard for the apparel industry to transform and advance digital fashion, luxury brands, and ODM should be accelerated by complementing their respective strengths and using the effects of learning orchestration externality.
(ii) Synchronization should be endeavored for co-evolution among them.
(iii) The supra-omnichannel approach should be broadly applied to other product and service categories.
(iv) Growing seamless switching should be further developed in the broad fields expecting to embrace the novel concept of R&D that embeds a growth characteristic during an R&D process.
(v) Resilient business strategies for sustainable growth in a new normal state beyond COVID-19 should be sought by incorporating a growing seamless switching function.

Limitations of this research include focusing solely on Amazon with a limited number of statistical data and indirect evidence to analogical evidence approaches.

Following the further advancement of Amazon's Luxury Stores and ODM, future research should focus on in-depth explanation, conceptualization and operationalization of the functions that the above dynamism leads to explore new frontiers for the apparel industry beyond current business models.

Comparative analysis of the similarity and disparity of the supra-omnichannel approach that enables growing seamless switching in other industries should be also undertaken with a priority basis.

Acknowledgements

The research leading to these results is the part of a project: Platform Value Now: Value capturing in the fast emerging platform ecosystems, supported by the Strategic Research Council at the Academy of Finland [grant number 293446], and a grant provided by Jenny and Antti Wihuri Foundation.

Appendix

Appendix 1. Data Construction

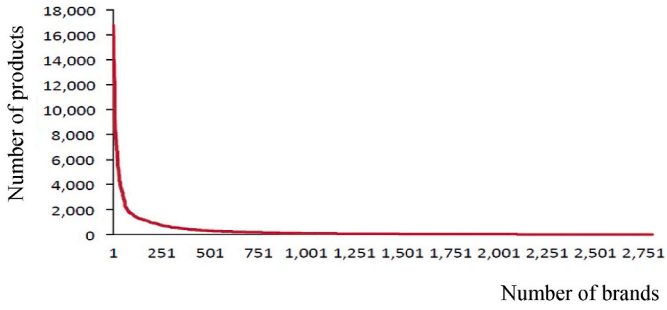

Fig. A1. Correlation between Number of Brands and Number of Clothing Products Listed in Amazon Fashion (2018). Source: Coresight Research [29].

Table A1
Trend in Amazon's Sales by Product Group (2014–2019)

	Online stores	Physical stores	Third-party seller services	Subscription services	AWS	Other	Net sales	Apparel sales
2014	68.5 (77.0)	–	11.8 (13.3)	2.8 (3.1)	4.6 (5.2)	1.3 (1.5)	**89.0**	10.7 (12.0)
2015	76.9 (71.9)	–	16.1 (15.0)	4.5 (4.2)	7.9 (7.4)	1.7 (1.6)	**107.0**	12.0 (11.2)
2016	91.4 (67.2)	–	23.0 (16.9)	6.4 (4.7)	12.2 (9.0)	3.0 (2.2)	**136.0**	17.8 (13.1)
2017	108.4 (60.9)	5.8 (3.3)	31.9 (17.9)	9.7 (5.5)	17.5 (9.8)	4.7 (2.6)	**177.9**	39.3 (22.1)
2018	123.0 (52.8)	17.2 (7.4)	42.7 (18.3)	14.2 (6.1)	25.7 (11.0)	10.1 (4.3)	**232.9**	44.8 (19.2)
2019	141.2 (50.3)	17.2 (6.1)	53.8 (19.2)	19.2 (6.8)	35.0 (12.5)	14.1 (5.0)	**280.5**	50.7 (18.1)
2020	197.4 (51.1)	16.2 (4.2)	80.5 (20.8)	25.2 (6.5)	45.4 (11.8)	21.5 (5.6)	**386.1**	60.1 (15.6)

Figures in parentheses indicate the share (%).
Apparel sales were estimated as follows.
[(Apparel sales in the US) × (Amazon's apparel share in the US)] × [(Amazon's global market)/(US market sales)].
Original sources: Statista [114].

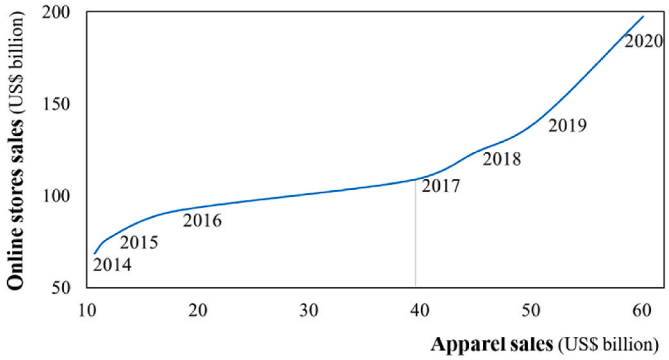

Fig. A2. Correlation between Apparel Sales and Online Store Sales in Amazon (2014–2020).
Source: Same as Table A2.

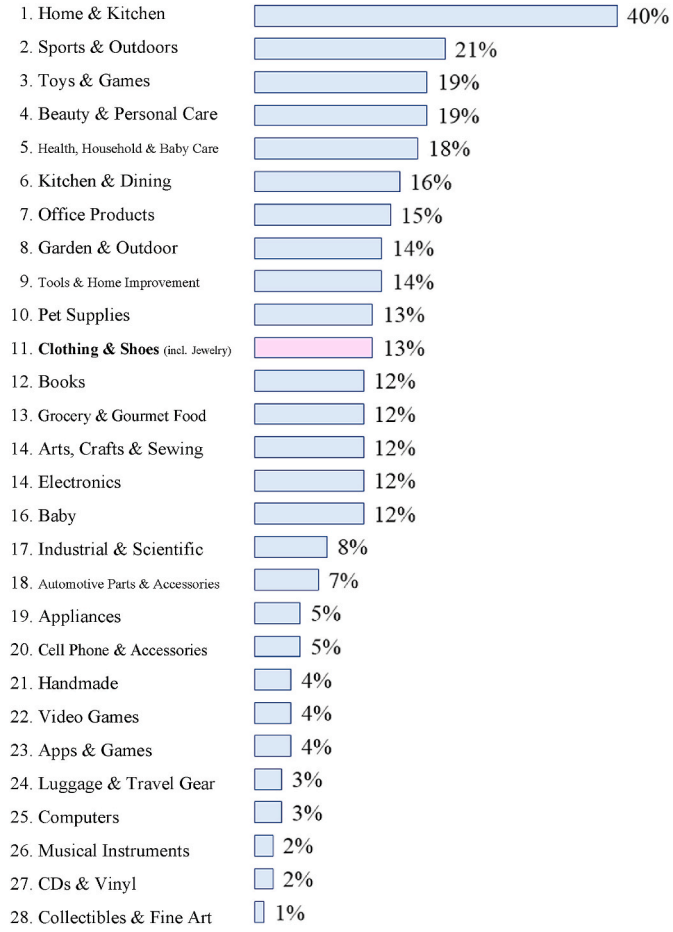

Fig. A3. Popularity of Product Categories in Amazon's Third-party Seller Services (2020) - % of sellers listed in the third-party seller services. *Sellers could select multiple categories.
Source: Authors' elaboration based on Jungle Scout [115].

Table A2
Trend in Amazon's Apparel Sales Share in the US (Jan. 2014–Dec. 2019)

1	201401	2.43
2	201402	2.47
3	201403	2.5
4	201404	2.53
5	201405	2.57
6	201406	2.6
7	201407	2.62
8	201408	2.63
9	201409	2.65
10	201410	2.7
11	201411	2.75
12	201412	2.8
13	201501	2.83
14	201502	2.86
15	201503	2.9
16	201504	2.93
17	201505	2.97
18	201506	3
19	201507	3.03
20	201508	3.07
21	201509	3.1
22	201510	3.13
23	201511	3.17
24	201512	3.2
25	201601	3.23
26	201602	3.27
27	201603	3.3
28	201604	3.32
29	201605	3.33
30	201606	3.35
31	201607	3.4
32	201608	3.45
33	201609	3.5
34	201610	3.57
35	201611	3.63
36	201612	3.7
37	201701	3.88
38	201702	4.07
39	201703	4.25
40	201704	4.63
41	201705	5.02
42	201706	5.4
43	201707	5.87
44	201708	6.33
45	201709	6.8
46	201710	7.17
47	201711	7.53
48	201712	7.9
49	201801	8
50	201802	8.1
51	201803	8.2
52	201804	8.27
53	201805	8.33
54	201806	8.4
55	201807	8.45
56	201808	8.5
57	201809	8.55
58	201810	8.6
59	201811	8.65
60	201812	8.7
61	201901	8.78
62	201902	8.87
63	201903	8.95
64	201904	9.02
65	201905	9.08
66	201906	9.15
67	201907	9.2
68	201908	9.25
69	201909	9.3
70	201910	9.37
71	201911	9.43
72	201912	9.5

Original sources: Lieber [34]; Statista [35]; Keyes [36]; PYMNTS [39]; Sabanoglu [40].
Annual data were disaggregated to monthly data by

using the Denton-Cholette temporal disaggregation method.

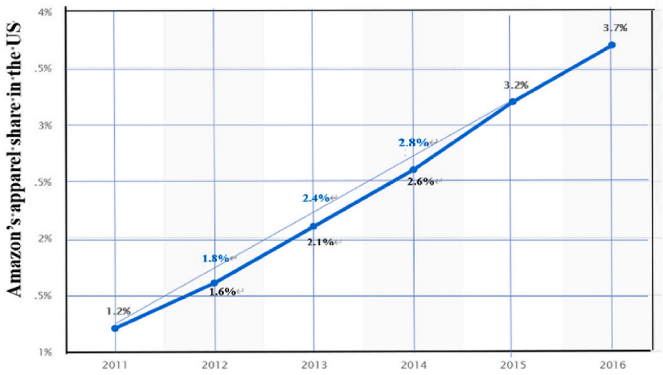

Fig. A4. US Amazon Share of Total Apparel Sales from 2011 to 2016. Estimates of the earlier stage before A*DFs* (2011–2016) were based on Lieber [34] and Sabanoglu [40]. Bold line is based on Sabanoglu [40] ,[7] while thin line is authors' modified estimate for 2012–2014 based on Lieber [34] .[8]

Appendix 2. Development Trajectory of Amazon's Fashion-driven Apparel

ICT in which network externalities function to alter the correlation between innovations and institutional systems - which creates new features of the innovation leading to exponential increase. Schelling [116] portrayed an array of logistically developing and diffusing social mechanisms stimulated by these interactions. The advancement of the digital innovation centered on Internet and AI further stimulates these interactions and accelerates ICT's logistically developing and diffusing feature, which is typically traced by the sigmoid curve [44].

Given the logistic growth nature of Amazon's AI-driven digital fashion development, its development trajectory, proxied by apparel sales share in the US, $S(t)$, can be depicted by the following epidemic function that leads to a simple logistic growth function (*SLG*):

$$\frac{dS}{dt} = aS\left(1 - \frac{S}{N}\right) \tag{A1}$$

$$\mathrm{SLG} = \mathrm{S}(t) = \frac{N}{1 + be^{-at}} \tag{A2}$$

where t: time; N: carrying capacity; a: velocity of diffusion; b: coefficient indicating the initial level of diffusion.

As far as the development trajectory depends on the *SLG* trajectory, its digital value, $S(t)$, saturates with the fixed upper limit N. However, once the trajectory shifts to logistic growth within a dynamic carrying capacity (*LGDCC*), its digital value, $S(t)$, can continue to increase, as it creates a new carrying capacity during the process of development.

In particular innovation which creates new carrying capacity $N(t)$ during the diffusion process, equation (A1) is developed as follows:

$$\frac{dS(t)}{dt} = a\,S\left(t\right)\left(1 - \frac{S(t)}{N(t)}\right) \tag{A3}$$

Equation (A3) develops the following *LGDCC* function (A4) which incorporates self-propagating function as carrying capacity increases corresponding to $S(t)$ increase as depicted in equation (A5) [44]:

$$\mathrm{S}(t) = \frac{N_k}{1 + be^{-aR} + \frac{b_k}{1 - a_k/a}e^{-a_k R}} \tag{A4}$$

where N_k: ultimate carrying capacity; a, b, a_k, *and* b_k: coefficients.

Dynamic carrying capacity $N(t)$ in this *LGDCC* is depicted as follows:

$$N(t) = S\left(t\right)\left(\frac{1}{1 - \frac{1}{a}\cdot\frac{\triangle S(t)}{S(t)}}\right) \quad \triangle \mathrm{S}(t) = \frac{dS(t)}{dt} \tag{A5}$$

While Amazon's apparel sales have been leveraged by advanced digital fashion development (ADF) by creating new functionality as enhancing carrying capacity, this trajectory (trajectory B in Fig. 5) can be traced by *LGDCC,* this trajectory would have been remained *SLG* without ADF (trajectory A in Fig. 5).

[7] 1.6% in 2012, doubled by 2015 reaching 3.2%, and accounted for 3.7% in 2016.

[8] In 2011, Amazondebuted the membership-based flash-sale site MyHabit, a move to directly compete with Gilt Groupe, introduced the contemporary menswear website in the fall of 2013. That same year, photo studio in Brooklyn opened. The Amazon Fashion project was in full swing — because despite all of his high-profile launches and acquisitions, Bezos realized that building out a dedicated fashion space on Amazon was the only way to truly maximize profits. Amazon's clothing and accessories sales nearly quadrupled from $4.3 bil. in 2011 to $16.4 bil. in 2015.

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