Several Modes of Digitalization of Value Chains and Implications for Entrepreneurship:

The Case of the Apparel Industry

January 2022

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Abstract

In this paper, we examine how digitalization affects global value chain. By using empirical evidence at firm level, the paper analyzes the process of the value chain digitalization in the apparel industry. We find that the digitalization of value chains usually originates in downstream stages where platforms emerge and disrupt traditional retailers. Traditional distributional channels such as department stores and mass merchandise stores are replaced by online marketplaces and E-commerce platforms. This type of value chain digitalization, or E-commerce, may be called platform digitalization. In this mode, manufacturers still own design and make production decisions, but the products are digitally distributed through E-commerce platforms, thus bypassing traditional methods of distribution such as department stores and mass merchandise stores. In other words, the value chain is flattened, allowing customers to purchase apparel products at their homes with a few clicks. This transformation of GVC digitalization may have opposite implications for the SMEs and startup manufacturers. On the positive side, the platforms lower customer acquisition cost and results in a higher level of labor productivity. On the negative side, firms have to pay a significant amount of platform provider fees to platform owners. Further, there could be asymmetric impacts on SMEs/startups and old/incumbent firms since the latter face a trade-off between revenue/customer growth and profitability. Alternatively, a full range mode of digitalization is also possible and observed. This mode involves the rise of platform owners who are also brand managers and designers. Here platforms are trying to go beyond the primary role of a two-sided marketplace to penetrate deeper into higher value-added stages of designs and/or brands. The consequent emergence of new hybrid firms has sizable economic consequences.

Keywords: Digitalization, Digital Platform, E-commerce, Platform Provider Fee, Value Chain, Upgrading, Apparel

JEL code: F23; O33

1. Introduction

Global value chain is a dominant feature of the global economy. GVCs embody global production networks and shed light on the value creation process. Since participation in GVC promotes economic growth, supports job creation, and enhances firm performance (UNCTAD, 2013; OECD, 2013; WTO, 2019), understanding the dynamics of GVC and enhancing the capacity to cope with changes in GVC, especially after the pandemic, are critical for any country and organization. This study aims to improve our understanding of the digitalization process, a major trend which is reshaping the global value chain (Brun et al., 2017).

Digitalization is closely related to topical concepts such as digital economy, Industry 4.0 and the fourth industrialization revolution (4IR). The notion of 4IR was first coined by Klaus Schwab at the 2016 World Economic Forum in Geneva. 4IR is powered by state-of-the-art technologies such as 3D-printing, Big Data, and AI. It differs from the first three industrial revolutions in which mechanization, electricity, and ICT, in that order, were the main driver of industrial changes (Davis, 2016; Schwab, 2016). According to Rüßmann et al. (2015), the nine key technologies that power Industry 4.0 are autonomous robot, simulation, horizontal and vertical system integration, industrial Internet of Things, cybersecurity, cloud computing, additive manufacturing, augmented reality, and big data and analytics.

UNCTAD (2017a) defines Industry 4.0 as a "platform-based ecosystem of ICT-based products and services". Gawer and Cusumano (2014) best capture the platforms in UNCTAD's definition. They categorize platforms in internal and external platforms. Internal platforms, or company or product platforms, are defined as "a set of assets organized in a common structure from which a company can efficiently develop and produce a stream of derivative products". External platforms or industry platforms are products, services, or technologies that provide the foundation of a business ecosystem for external innovators to develop their own products, services, or technologies. Examples of external platforms include Amazon, Apple App Store, Google Cloud, Uber, and WeWork.

In this paper, the concept of GVC digitalization is understood as that of Mussomeli et al. (2016), who define it as "the use of advanced data analytical tools and physical technologies to improve the digital connectivity and technological capabilities of supply chains". Based on the definition, there are three key characteristics that differentiate a digitalized GVC from the traditional GVC.

First, parts of the value chain are digitalized. Examples include online shopping in downstream stages, E-auctions among suppliers in upstream stages, and the digital automation of plant operations during the internal production stage (UNCTAD, 2017a). Second, platforms are involved in the value chain. Platforms like Apple Play Store, Amazon, and Alibaba, armed with superior technological capabilities, are penetrating into the value chain and disrupting traditional business models. Not surprisingly, platforms are increasingly capturing more value from the global value chain.

For instance, despite the video game industry not being their core businesses, Apple and Google ranked 4th and 6th, respectively, in game revenues among listed companies in 2018

(Newzoo, 2018). In the apparel industry, Morgan Stanley Research estimates that Amazon has become the second apparel retailer in the U.S market (CNBC, 2018). Summarizing the power of platforms in the world economy, Kenney and Zysman (2016) state that "we are in the midst of a reorganization of our economy in which the platform owners are seemingly developing power that may be even more formidable than was that of the factory owners in the early industrial revolution".

Another defining characteristic of a digitalized GVC is the data-driven value chain. Information from different sources and locations are incorporated into production decisions. A typical example of the data-driven value chain can be found in the Indonesian aquaculture sector. eFishey, a successful startup which was founded in 2013, developed sensors-based IoT applications that track fish behavior data, which are used to analyze fish behavior and improve feeding performance.[1] The surge of such IoT platforms and startups that focus on data collection is the key to the emergence of the digitalized GVC (UNCTAD, 2017a).

The on-going shift to digitalization is observed in countries, industries, and organizations. For instance, the Bureau of Economic Analysis (BEA) estimates that the digital economy accounted for 6.9% ($1351.3 billion) of the United States gross domestic product in 2017. Digital transformation also added billions of values to many US industries in 2018. The industries where digitalization adds the most values are broadcasting and telecommunications ($424.4 billion); computer systems design and related services ($328.2 billion); data processing, internet publishing, and other information services ($187.6 billion); publishing industries ($179.5 billion); computer and electronic products ($149.7 billion) and retail trade ($87.5 billion). The growing digitalization of the value chain raises a fundamental question. What is the impact of digital globalization on firms, value chains, and the economy?

One of the first papers that looks at the impacts of GVC digitalization is Mussomeli et al. (2016). They elaborate on how the usage of the latest technologies can transform the traditional linear GVCs into a more open and interconnected system. They also emphasize the positive impact of a digitalized GVC as the collection of information from different sources and locations which can be utilized to arrive at better production decisions. UNCTAD (2017b) points out that digitalization can have a large positive impact on all stages of value chain, including upstream stages, internal production process, downstream stages, and end-to-end process.

There is evidence that an engagement in online business can create value added for retail companies (Xia & Zhang, 2010), enhance the efficiency of manufacturing firms (Quiros Romero & Rodriguez, 2010), and boost firm productivity in Taiwan (Liu et al., 2013) and in Europe (UNCTAD, 2015). While much of the literature focuses on the positive effect of digitalization, some studies point out the negative impact of a digitalized value chain. For instance, Kenney and Zysman (2016) raise concerns about dependence on platforms, the economic relation between platforms and their partners (i.e. gig employment), and the legal and institutional framework needed to regulate the platform economy. Foster and Graham

[1] From eFishery's website at https://efishery.com/en/home/. Accessed June 10th, 2019

(2015) express concerns that SMEs might find digitalization challenging since many of them lack the required technological capacity.

By looking at firm-level empirical evidence, we take the perspective of SME manufacturers in the apparel industry. The main research question in the paper is: "Is the digitalization of GVC good or bad for manufacturers?". Due to the broad range of impacts of digitalization on value chain covered in UNCTAD (2017b), we look primarily at internal production stage and downstream stages.

More specifically, in answering the main research question, we delve into two specific dimensions. First, we elaborate on the economic consequences of GVC digitalization. Unlike the existing literature, which looks largely at the positive effects of GVC digitalization, we look at both positive and negative effects. On the positive side, we discuss how a partnership with platforms can enhance labor productivity by lowering customer acquisition costs. On the negative side, we quantify the magnitude of the platform provider fee, which manufacturers have to pay to platform providers for using their platforms. Platform provider fee is unique to the digitalized GVC and differentiates it from conventional GVCs. To the best of our knowledge, ours is the first paper that measures such fee in the apparel industry.

Second, by taking a GVC perspective, we examine whether the digitalization of GVC has any implications for governance and upgrading, the two most fundamental GVC issues (Gereffi, 2019). Regarding governance, we explore bargaining power between manufacturers and platform owners primarily through the ability to negotiate favorable partnership contracts, especially platform provider fee. Regarding upgrading, the central question which we address is whether digitalization becomes an additional barrier or it can serve as a window of opportunity for companies in the process of moving up the value chain.

The remaining parts of the paper are organized as follows: Section 2 describes the three modes of GVC digitalization and their economic consequences. Section 3 discusses the process of GVC digitalization in the apparel industry, focusing on mode 1, platform digitalization. Section 4 discusses full-range GVC digitalization which turn platforms into new competitors who compete directly with incumbent brands and manufacturers. Section 5 concludes and discusses some policy implications.

2. Modes of GVC Digitalization and Their Economic Consequences

According to UNCTAD (2017b), there are three kinds of digitalization in GVCs - thin integration, platform digitalization, and full digitalization. Although the UNCTAD classification is only applicable to MSMEs (micro, small and medium enterprises), this classification can be expanded to all firms regardless of size.

Mode 1: Thin Integration

The first mode of GVC digitalization is thin integration or "thin integration", which is based on Murphy and Carmody (2015). It is the simplest level of value chain digitalization and mostly

used by MSMEs. In this mode, small firms incorporate ICT into their business. Using digital technologies improves cooperation within the chain. However, it does not affect the fundamental structure of the chain since there is no significant change in the role of firms in the chain or the value captured by firms.

This level is prevalent in low- and middle-income countries where the development of ICT is evolving[2] and MSMEs are resource-constrained[3]. The ICT used at this level are usually cheap and simple - e.g. emails, smartphones, fax, postal box, intranet/extranet, and informational websites. McNamara (2008) finds that small apparel Chinese firms used emails to receive orders and communicate with their business partners. Based on a survey, Apulu et al. (2011) discover that more than half of 66 SMEs were using applications such as mobile phones and telephones, broadband, fax, intranet, and LAN for communication purpose. The usage of more sophisticated technologies such as commercial websites is applicable to only 2% of the SMEs. These findings are also consistent with Esselaar et al. (2007). In a study of nearly 3700 SMEs in 14 African countries, Esselaar et al. (2007) find that SMEs use ICTs mostly in six forms, namely mobile phones, telephones, fax machines, post boxes, computers, and internet connection.

Even in its simplest form, the GVC digitalization contributes to the improvement of business performance of MSMEs. Ongori and Migiro (2010) summarize the five main benefits of the ICTs adoption for MSMEs as i) access to market and customers; ii) access to robust information; iii) knowledge management; iv) efficient, admiration, control, and accountability; and v) managing resources efficiently. The first advantage is explained in Raymond et al. (2005) and Esselaar et al. (2007). These papers find that the adoption of ICTs has a positive correlation to revenue generation. The second impact of "thin integration" is stressed by Irani (2002, p.12). ICTs enable SMEs to gain access to robust information, which improves their competitiveness (Kohli & Devaraj, 2004, p. 56). The remaining three are related to the positive effect of adopting ICT on SMEs' efficiency and business performance. ICT enhances efficiency, effectiveness, and competitiveness (Hamilton & Asundi, 2008; Mahmood & Mann, 2000); boosts labor productivity (Black & Lynch, 2001; Esselaar et al., 2007), and improves the efficient administration of SMEs (Schware, 2003; Mutula & Brakel, 2006, p.409).

There is clear evidence of a positive correlation between the usage of ICT and SMEs' business performance. But the digitalization process in MSMEs is held back by several factors. Mehrtens et al. (2001) look at factors which influences ICT adoption. Those factors are divided into three categories: (1) perceived benefit of using ICTs, (2) organizational and environmental readiness degree to apply ICTs, and (3) external pressure. While the external pressure from trading partners or competitors usually pushes SMEs toward ICTs adoption, perceived limited benefit of using ICT and lack of readiness to implement ICT can hinder adoption.

Since the benefit of digitalization is somewhat subjective, there are diverse views on ICT adoption. While many SMEs found the incorporation of ICT into their business to be profitable,

[2] See Ihua (2009), Terero and von Braun (2005), Weiner and Rumiany (2007).

[3] Computer is too expensive is the reason that 45% of SMEs state that they do not have a computer (Esselaar et al., 2007). Ashrafi amd Murtaza (2008) find that more than 70% of 51 Oman SMEs considered in their research spend less than 10% of budget for ICTs.

some did not. For instance, Esselaar et al. (2007) find that among SMEs that do not have any computers, 45% of them said that it is because there is no need to buy one. In other words, these SMEs believe that the potential benefits of having a computer do not outweigh the cost of purchasing one. The readiness to implement ICTs is another obstacle. Environmental factors such as the lack of support facilities and services providers can hinder the ICTs adoption process. This is the case of Nigerian SMEs where lack of electricity and lack of ISP providers were reported as major constraints in adopting ICTs (Apulu et al., 2011). In addition, many SMEs lack IT experts and skilled employees who have sufficient knowledge to operate new technologies. Indeed, skills shortage is one of the main constraints in ICTs adoption in many countries. Examples include Brazilian and Indian SMEs (Basant et al., 2006) and American SMEs (Wielicki & Cavalcanti, 2006).

Mode 2: Platform Digitalization

The second mode of GVC digitalization is platform digitalization. It refers to the involvement and integration of platforms into the value chain. The original concept of platforms was mainly used in the high-tech sector where IT companies like Microsoft, IBM, Intel, and Cisco develop software and hardware for a platform-based ecosystem with the participation of thousands of partners (Moore, 1996; Iansiti & Levien, 2004). The term platform later becomes ubiquitous and is widely used in, among others, operation management (Meyer & Lehnerd, 1997); industrial economics (Rochet & Tirole, 2003; Evans, 2003) and technology strategy (Gawer & Cusumano, 2002; Eisenmann et al., 2006).

Recent years have witnessed the proliferation of platforms. As pointed out by Eisenmann et al. (2011), platform markets "comprise a large and rapidly growing share of the global economy". Largest platforms include Facebook and Twitter (social network); Alibaba and Amazon (E-commerce); Apple App Store and Google Play Store (app stores); Uber and Grab (ride-hailing); and Airbnb and Booking (hospitality). The success of these platforms in attracting users and building an ecosystem that is hard to compete is highly intriguing and driven by network effect (Katz & Shapiro, 1985; Gawer & Cusumano, 2014). The value of platform adoption for any user is positively correlated with the number of interactions with other users. Thus, the more users a platform has, the more valuable the platform becomes for users and firms.

Due to the concrete benefit of expanding the customers base, many firms now come to platforms to do business. Meanwhile, customers increasingly find platforms convenient for purchasing products and services. Platform adoption by both sides, in turn, accelerates the integration of platforms into the value chain.

From the customer's perspective, the adoption of platforms by huge numbers of users creates a huge marketplace. For example, the world largest social network, Facebook, has approximately 2.91 billion monthly users as of the third quarter of 2021[4] while Apple App

[4] Facebook's announcement. Information retrieved on December 15, 2021 at https://investor.fb.com/investor-news/press-release-details/2021/Facebook-Reports-Third-Quarter-2021-Results/default.aspx.

Store, a leading ecosystem for apps, received 600 million visitors per week as of June 2021[5]. Furthermore, in the era of platform digitalization, customers are shifting toward online shopping. UNCTAD (2015) shows that more than 50% of individuals in 10 countries purchase products online in 2013.[6] The COVID-19 pandemic has accelerated the shift toward online shopping due to social distancing restrictions which restricted offline shopping.

From the firm's perspective, many MSMEs are starting to incorporate platforms into their businesses. Agriculture exporters in Ethiopia and Nairobi are using various platform-based exchanges to trade commodities (EuropeAid, 2012). Platforms are also integrated into the South African tourism industry to support online reservation and booking system (Murphy et al., 2014). Large enterprises and MNCs too are shifting toward platforms. For instance, in an unconventional move in 2017, world-famous apparel brand Calvin Klein announced that their latest underwear collections for winter holidays were available exclusively in Amazon before being sold in brick-and-mortar department stores.[7]

On the one hand, the adoption of platforms in the value chain benefits firms in many aspects. In agriculture, Goyal (2010) finds that the usages of platforms can raise export price for commodity exporters. The involvement of platforms facilitates efficient trading according to Waema and Katua (2014). Regarding information storage and management, an essential task for any company, adopting cloud computing brings several advantages, including cost reduction, flexibility, mobility, and share resources (Erdogmus, 2009; Gangwar & Ramaswamy, 2015). Using platforms facilitates overall industrial upgrading as noted by Hinson (2010), Tiamiyu et al. (2012), and Li et al. (2019).

On the other hand, the involvement of platforms in the value chain raises several concerns. Since the power of platforms is increasing over time due to the network effect, value is now concentrated in the hand of a few powerful platform providers. These elite platform owners, in turn, protect their positions in the value chain by utilizing their formidable market power to muscle out competitors and reduce competition in the market, often leading to monopoly or oligopoly and potential antitrust or anti-competitive violations (Kenney & Zysman, 2016).

For instance, Google has been fined a total of €8.24 billion ($9.3 billion) by EU Commission for antitrust violations related to of its three dominant platforms: search engine platform - Google search, mobile operating platform - Google Android, and online advertising platform- Google AdSense (EU Commission, 2019). As dependence in platforms increases over time, an unfavorable change in platform policies initiated by platform providers can adversely affect the whole value chain. Therefore, despite the clear benefits of joining platforms, some companies are still reluctant to adopt platforms. For instance, while several apparel brands such as Adidas and Calvin Klein are selling their products on Amazon, Zara decided to expand

5 Apple's announcement at Apple's Worldwide Developers Conference 2021. Information retrieved on December 15, 2021 at https://www.cnbc.com/2021/06/07/apple-wwdc-live-updates-ios-15.html.

6 10 countries are United Kingdom, Denmark, Australia, Germany, Luxemburg, Sweden, Norway, United States, Netherland and New Zealand

7 Company's announcement. Information retrieved on June 09th 2019 at https://www.wsj.com/articles/calvin-klein-to-begin-selling-new-underwear-only-through-amazon-1510792184

online sales without working with Amazon,[8] while Nike also cut ties with Amazon in late 2019, ending their two-year pilot partnership.[9]

Mode 3: Full Range Digitalization

The third and most advanced form of GVC digitalization is full digitalization. UNCTAD (2017b) defines full digitalization as a "fully digitally integrated systems", which is close to the concept of "digital supply network" put forth by Mussomeli, Gish, and Laaper (2016). Information and data via various levels, sources and locations are integrated into a single system that is used in making production decisions (Sniderman et al., 2016). The role of information, especially information from the market and input suppliers, is critical to the success of new product development and commercialization (Ottum & Moore, 1997; Petersen et al., 2005). In the digital era where everything is interconnected and information flows are enriched, making use of information and turning them into valuable insights holds the key to company success.

In general, the full digitalization of value chain usually begins with data collection and utilization. Mobile apps, IoT applications, and sensor networks are now adapted to collect real-time and massive data in various circumstances and industries.

Brugger (2011) points to the use of mobile applications to collects data in agriculture. Foster and Graham (2015) find the adoption of on-field data collection devices in Rwanda's tea sector. Based on projects with clients, Sniderman et al. (2016) discover that a pharmaceutical company uses sensors in its inhaler products to collect real-time data. In manufacturing, in an attempt to improve the performance of coal-fired steam power plant, General Electric introduced a "Digital Power Plant" in which more than 10000 sensors are incorporated into the system to monitor plant's operation and real-time performance (GE, 2016).

The next step after data collection is data utilization, i.e., the creation of digital solutions based on the data. Generally, the massive amount of data collected is used to improve business performance and customer satisfaction. From the firm's perspective, data can be utilized to understand customer insights, project customer's needs, and develop algorithms for a real-time data-based pricing strategy (Sniderman et al., 2016). For example, Uber's surge price policy during high-demand hours is based on a complicated algorithm that tracks the real-time data of drivers and customers. This pricing model is effective because it reduces the waiting time of a ride during the peak hours and enhances the efficiency of the whole system (Hall et al., 2015). Real-time data-based pricing also applies to Deutsche Bahn AG, a cargo rail consortium. The company uses real-time data on available capacities and customer ordering information to customize pricing (OptaSense, 2014). GE's "Digital Power Plant" system analyzes the data from sensors network to model the real-time plant conditions so that administrators can

[8] Company' announcement. Information retrieved on June 09, 2019 at https://www.reuters.com/article/inditex-internet/corrected-zara-launches-online-sales-in-106-new-countries-idUSL8N1XI3YT

[9] Company' announcement. Information retrieved on January 05th 2022 at https://risnews.com/nike-ending-partnership-amazon

effectively adjust inputs and materials. The system can run simulations based on the collected data to predict supply and demand in different weather conditions (GE, 2016).

3. The Digitalization of Value Chain in the Apparel Industry

In this section, we sift through firm-level data from the apparel industry to delve into the digitalization of value chain.

3.1. Data and Methodology

We examine firm-level data to assess the impact of the last two modes of GVC digitalization. We focus our attention on a select group of companies and leading platforms. The data of these firms and platforms are collected mainly from companies' official annual and quarterly reports, fillings, statements, and websites.

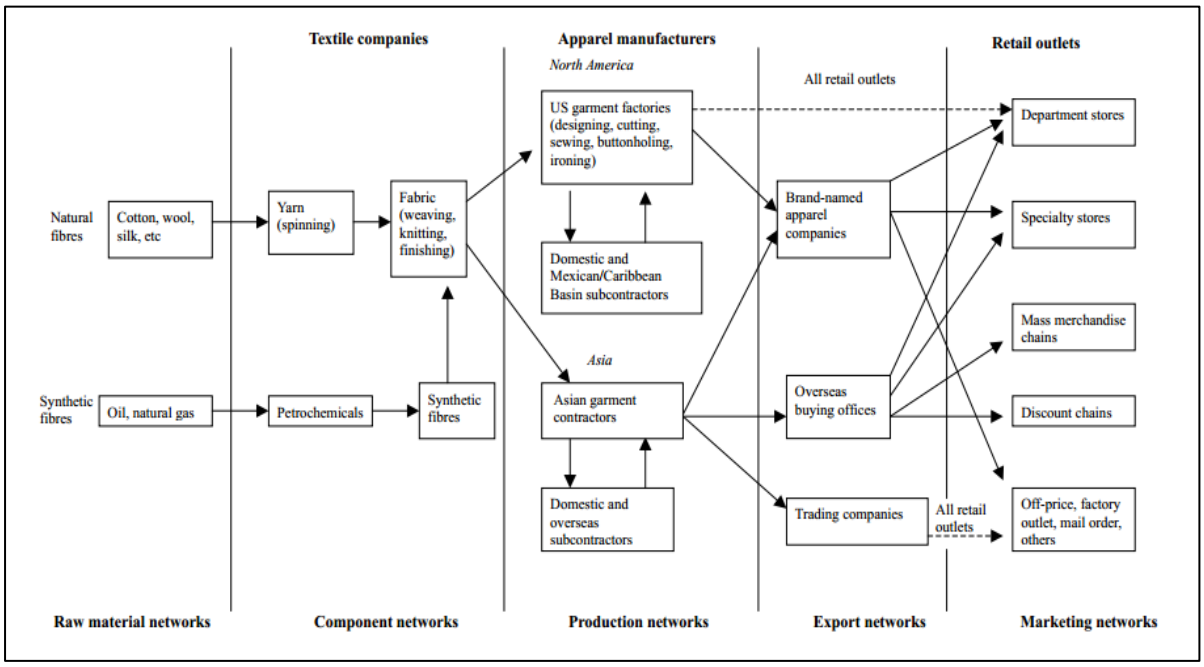
In the apparel industry, the three main kinds of E-commerce platforms are B2B (business to business), B2C (business to customer) and C2C (customer to customer). We look only at B2B and B2C platforms because our primary objective is to examine the economic impact of GVC digitalization on apparel brands and manufacturers. Several indicators are used to identify leading B2C and B2B platforms, including customer base size, gross merchandise volume, and number of monthly visitors. In the end, the selected E-commerce platforms include Amazon (US, UK, France); eBay (US, UK); Asos (UK); Cdiscount (France); Rakuten (Japan, US); Otto (Germany); Gmarket, Coupang (Korea); Tmall, Tmall Global, JingDong Marketplace, JingDong Global, Yanxuan (China); MercadoLibre (Brazil, Argentina, Mexico); B2W Marketplace (Brazil/ Latin America); Lazada and Shopee (Southeast Asia).

Our selected apparel brands and manufacturers are mostly SMEs. They consist of four Korean companies (Good People, Chuu, 8seconds, and Realcoco), one company each from four countries: Singapore (Mary Craft), China (Yanxuan), Australia (Cahill+), and the United States (Taylor Swift Fashion). Overall, we consider 8 manufacturers/brands and 23 platforms in the apparel industry in 12 countries/ regions.

3.2. Mode 2-Type Digitalization: Platform Digitalization

The traditional apparel value chain involves many players and primarily consists of five stages, namely raw material network, component network, production network, export network, and marketing network (Figure 1). Retailers such as department stores and mass merchandise stores play an important role in the success of apparel brands since they are the only channel for apparel products to reach consumers. The traditional apparel value chain is a buyer-driven value chain in which a small number of global lead firms control production and distribution network (Gereffi, 1999). These leading global firms decide where to buy their materials and designate the manufacturers that produce their products. Their information collection and utilization enable these companies to maintain a strong bargaining power and a dominant market position, making it difficult for latecomers to compete (Gereffi, 1997; Coe et al., 2004).

Figure 1: The Traditional Apparel Value Chain

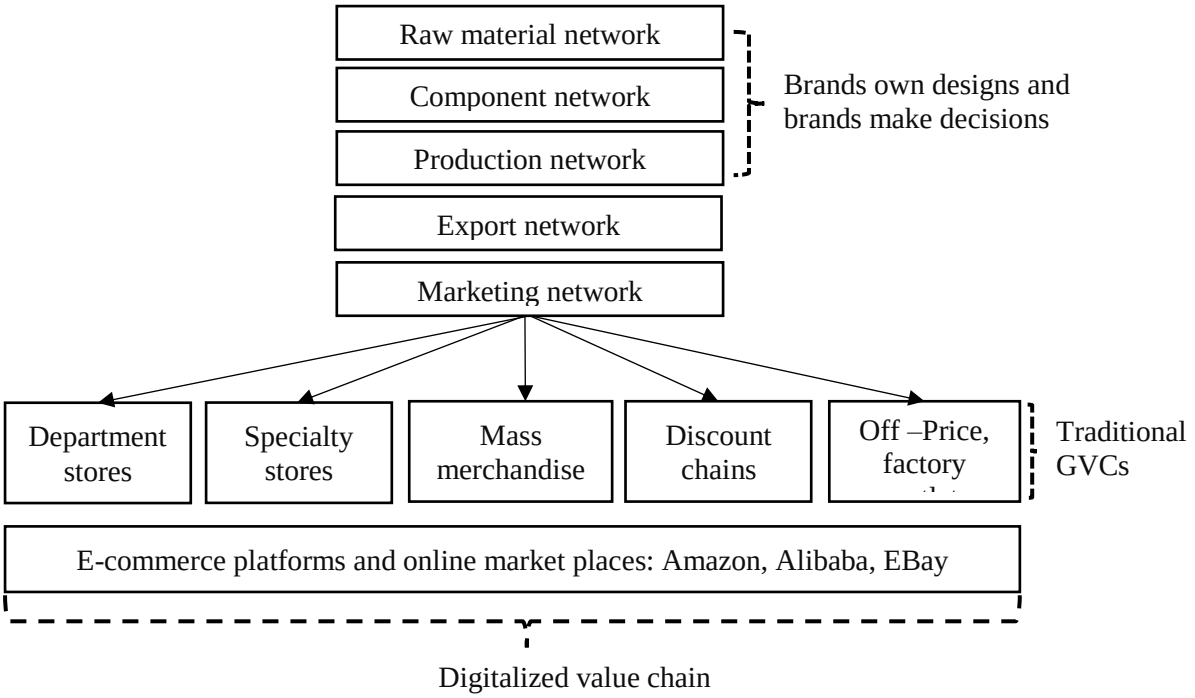


Source: Appelbaum and Gereffi (1994), p. 46.

However, the relationship and bargaining power between players in the apparel value chain has been shifting due to the integration of digital platforms into the value chain. Generally speaking, the digitalization of apparel value chain originates in the downstream stages—i.e. traditional distributional channels such as department stores and mass merchandise stores are replaced by online marketplaces and E-commerce platforms (Figure 2). This level of value chain digitalization, or E-commerce, corresponds to mode 2 or platform digitalization mode.

In this form, manufacturers still own designs and make production decisions. However, the apparel products are now digitally distributed through E-commerce platforms, bypassing traditional brick-and-mortar distribution channels. The value chain is becoming flatter and customers can now purchase apparel products at their homes within several clicks. This trend is very similar to what happened in the video game industry when the emergence of app store platforms displaced traditional distribution methods.

Figure 2: Platform Digitalization in the Apparel Value Chain (E-commerce)



Source: Author.

In what follows, we explore both positive impact—e.g. large number of potential customers—and negative impact—e.g, paying platform provider fee—of platform digitalization in the apparel industry. We also explore the possibility that industrial upgrading is facilitated by E-commerce platforms.

3.3. Benefits: Wider Customers Reach

The emergence of E-commerce platforms offers a great opportunity for apparel manufacturers and brands to reach a much bigger number of potential customers. Although concerns such as fake products, security, and privacy issues persist, E-commerce undoubtedly brings an array of benefits. Perhaps the biggest advantages of purchasing products online is convenience. Anyone with an internet connection can instantly access an E-commerce website and order apparel products within minutes. In addition, the listed prices on E-commerce websites are highly competitive in the sense that they are usually lower than the prices listed elsewhere. Furthermore, customers buying online have much more information about products since they can read others' reviews and compare with other available products.

Thus, it is not surprising that E-commerce platforms are increasingly popular with consumers. As more buyers come to E-commerce platforms to purchase products, more and more sellers are shifting to E-commerce platforms to gain more sales. The entry of more suppliers, in turn, strengthens product diversity and availability in the platforms. It makes E-commerce platforms a more attractive place for customers of apparel products. This network effect is reinforced over time and gives leading E-commerce platforms a huge number of customers (Table 1). All

nine E-commerce platforms in Table 1 are operating in countries/regions with large populations (US, Japan, China, Germany, France, UK, Latin America).

Table 1: Selected E-commerce Platforms' Customers in 2018

E-commerce Platforms	No. of membership/ customers (millions)	Note
Amazon	Over 100	Paid Prime members, globally
eBay	179	Annual active customers, globally. StubHub customers included
Rakuten	100.2	Only in the Japanese market
JingDong	305.3	Annual active customers
Tmall	636	
MercadoLibre	267.4	Confirmed registered users, Latin America region
	37.4	Annual active customers, Latin America region
Asos	18.4	Active customers globally
Cdiscount	9	Active customers in France
Otto	6.6	Active customers, 2017 data

Source: Author from companies' websites and reports.

3.4 Costs: Platform Fee in the Apparel Industry

To be included in a platform, apparel sellers have to pay a fee to the E-commerce provider. A platform provider fee in the apparel industry usually consists of three components: Listing fee, commission fee, and additional fee:

$$\textbf{Platform provider fee} = \textbf{Listing fee} + \textbf{Commission fee} + \textbf{Additional fee}$$

Listing fee (variously subscription fee, platform service fee, insertion fee or usage fee) refers to the fee that apparel sellers have to pay to E-commerce platform provider to be included in the provider's platform. The listing fee usually comprises a registration fee plus a monthly or yearly fee ranging from as low as $24 for Asos Marketplace to as high as $946 for Rakuten Japan. Rakuten Japan is the only platform listed in Table 2 that charges sellers a one-time registration fee of $568. It is worth noting that some platforms allow sellers to join for free. This is the case for Mercado Libre, the leading E-commerce platform in Latin America, and Shopee and Lazada, two leading E-commerce sites in Southeast Asia. To encourage sellers to enhance their products' quality, some E-commerce platforms even conditionally return listing fee to sellers if some requirements are met. For instance, Tmall refunds annual service fee to sellers with a strong record of sales performance and positive customer reviews.

Commission fee (variously referral fee or real-time transaction fee) refers to the fee that E-commerce platforms collect on a per sale basis. There are two popular methods of calculating commission fee—relative measure and absolute measure. The relative value is usually calculated as percentages of the final transaction value. Most E-commerce platforms examined

in this paper follow this method. For instance, the commission fees on apparel products are 13% for Gmarket, 5% for Tmall, and 5% for Lazada. Mercado Libre's commission fee consists of both relative term and absolute term. Some platforms use quite different pricing strategies. For instance, Amazon sets a minimum value and eBay US sets a maximum value for the commission fee. The lowest commission fees belong to Rakuten Japan, Shoppe, and Lazada. Rakuten Japan collects a small commission fee because it charges a lot for registration fee and monthly listing fee. Shoppe and Lazada charges a low fee primarily to attract more sellers since E-commerce is less developed in Southeast Asia compared to the other regions and countries in Table 2.

Additional fees are other fees which are specific to each E-commerce platform. For instance, some E-commerce platforms require sellers to pay a small fee for platform enhancement (0.1%, Rakuten) or contribute to promotional programs (customer loyalty program of Tmall, 0.5%). In addition, sellers have to pay a payment processing fee, which typically ranges from 1% to 4%. However, this fee is not mentioned in Table 2 since it is not a core capability of E-commerce platforms.[10]

Table 2 shows that one of the most prominent characteristics of the platform provider fee in the apparel industry is its diversity and complexity. This is due to the fragmentation of E-commerce platform market. In the video game industry, the app store platform market is concentrated in just two platforms, namely Apple App Store and Google Play Store. In contrast, in the apparel industry, there is no globally dominant E-commerce platform. For instance, Amazon, one of the world's largest E-commerce platforms, is popular in the United States, Canada and Europe countries such as the United Kingdom and Germany. Rakuten is the most popular E-commerce platform in Japan while Alibaba (Tmall) and JingDong Marketplace dominate the Chinese market. Each E-commerce provider develops a unique pricing model to compete with other E-commerce platforms.

Beside complex fee structure, group pricing is another popular characteristic of platform provider fee in the apparel industry. Based on the size of sellers, in term of potential sales and number of merchants, E-commerce platforms offer different fee rates and other additional benefits. Rates are typically lower for big sellers who generate greater benefits for platform providers. Big sellers enjoy additional benefit such as unlimited listing and more image capacity (Rakuten) or unique flagship pages and the ability to sell products on foreign countries (Amazon). Some E-commerce platforms differentiate domestic versus foreign sellers. Local sellers usually enjoy a lower rate compared to foreign sellers (Lazada, Rakuten, and JingDong Marketplace). US sellers on Rakuten Japan have to pay a higher fee than domestic sellers.

[10] Tmall Global charges 1% for Alipay fee while Rakuten Japan charges US entity 4% for card payment fee. Lazada generally collects 2% payment fee.

Table 2: Leading E-commerce Providers' Fee for Apparel Products

Platforms	Country/ Region	Listing fee	Commission fee	Additional fee	Note
Amazon	US	$39.99	17% min: $0.3 on per item basis		Professional plan
eBay		$299.95 (yearly renewal)	10% (max: $250 per sales)	5% if the performance level is below standard	Anchor eBay Store subscription
Rakuten		$39	15% per sale + 99 cents per item sold		
Amazon	UK	$30 (£25)	15% min: £0.25, per item basis		Professional plan
eBay		$480 (£399)	10%	4% if the performance level is below standard	Anchor eBay Shop subscription
Asos Marketplace		$24 (£20)	20%		
Amazon	France	$44 (€39)	15% min: €0.3 on per item basis		Professional plan
Cdiscount		$45 (€39.99)	• Used product: 17% • New product: 15%		
Amazon	Japan	$46 (¥4,900)	15%		Professional plan
Rakuten		$946 (¥100,000) plus a one-time registration fee of $568 (¥60,000)	For purchase made via • PC: 2-4% • Mobile: 2.5-4.5%	0.1%-1% and 8% more for sales through affiliates	Mega Shop Plan, Japanese entity
			• PC: 3.5-5% • Mobile: 4-5.5%		Mega Shop Plan, US entity
Gmarket	Korea	-	13%		
Coupang		-	10%		
Tmall	China	$4500-9000 annually (RMB 30000-60000)	5%	Deposit of $425-21250 (RMB 30000-150000)	Chinese sellers
JingDong Marketplace		$142 (RMB 1000)	8%		
Tmall Global		$5000-10000 annually	5%	0.5% + deposit of $21250 (RMB 150000)	Foreign sellers

JingDong HK		$3000 annually	6%	Deposit of $15000	
Mercado Libre	Brazil	-	16%+ $1.27 per unit (for sales below $44.2 only)		Premium Plan
	Mexico		17.5%		
	Argentina		27% + $0.22 per unit (for sales below $30.5 only)		
B2W Marketplace	Brazil/ Latin America	-	16%		
Lazada	Southeast Asia	-	5%		LazMall sellers
Shopee		-	2-5%		Shopee Mall sellers

Source: Collected by authors from E-commerce providers' websites, data as of August 12th, 2019.
Notes: The listing fee is the monthly listing fee unless stated otherwise. The exchange rate is retrieved from XE.com on August 12th, 2019.

Further, the fee rates and fee structure in the apparel sector is somewhat different from other sectors, the mobile game sector in particular. Above all, while mobile game developers have no choice but to distribute their mobile games through third-party platforms, apparel manufacturers and brand owners have alternative distribution options. Traditional distribution channels are still optimal in many countries since they are based on well-established networks. In developing countries where online payment and other supportive functions are not well-established, traditional distribution channels are still dominant. In addition, selling products on third-party E-commerce platforms and online marketplace is not the only available digital distribution channel. Indeed, apparel manufacturers and brand owners can develop their own E-commerce platforms to sell products directly to customers. As such, compared to video game sector, platform providers in the apparel industry are less powerful and have substantial lower bargaining power. Consequently, the provider fee in the apparel industry is generally much lower than that in the video game industry, where the fee ranges from 15% to 30%. Platform provider fee in the apparel industry ranges from as low as 2% (Shopee, in the Philippines) to as high as more than 27% (MercadoLibre, in Argentina).

3.5. Possibility of Upgrading via Platform Participation

So far, we looked at the benefit of E-commerce platforms adoption in the apparel industry. We now explore the possibility that platform adoption can contribute to the overall industrial upgrading of small and medium apparel manufacturers. Industrial upgrading is a key dimension of research on global value chains (Gereffi & Fernandez-Stark, 2016).

End market upgrading refers to the diversification of sales to new buyers and new geographic areas (Frederick & Gereffi, 2011, p.73). Traditionally, when apparel companies want to do business abroad, they usually have to set up their own store chains. That is how big foreign brands like Uniqlo (2002), Zara (2006), and H&M (2007) entered the Chinese apparel market.

However, this method is usually costly, risky, inflexible and time-consuming. It not only takes a lot of time to obtain necessary documents, establish links with domestic partners, and find optimal locations but the initial investment is often costly. As such, expanding abroad is out of reach for many companies, especially small and medium enterprises. However, thanks to platform digitalization, apparel companies can now sell abroad without establishing physical stores. Li et al. (2019) point to the successful end-market upgrading of small Chinese SMEs which sell apparel products directly to US customers. In this paper, we discuss two other cases.

The first case is foreign apparel brands that sell in the Chinese market. Many foreign apparel brands decided to enter Chinese market for the first time through partnerships with leading E-commerce platforms. Small Korean apparel brands such as Chuu, Good People, 8seconds, and RealCoCo entered the Chinese apparel market for the first time in 2016 by listing their products on E-commerce platforms (Fung Business Intelligence, 2016). While Chuu, Good People, and 8seconds formed partnerships with Tmall, RealCoCo decided to partner Mengdian. In 2016, Australian apparel brand Cahill+ worked with Tmall to enter the Chinese apparel market. One year earlier, JingDong announced the opening of the first official online store of Taylor Swift Fashion, a famous US famous brand.[11].

The second case is a Singapore-based apparel brand that sells in the US market. MaryCraft is a small women's apparel company with 80 to 100 employees. This company was founded in 2013, with headquarter in Singapore and production plant in Vietnam. MaryCraft is a classical Amazon success story and was officially introduced as such on the Amazon websites. Since the company started selling on Amazon in 2015, the company's sales have grown by 150%. Using the Fulfillment by Amazon services, the company can deliver its products to US customers within a day or two compared to ten days via traditional distribution channels. At present, the company is also expanding its market outside the US by selling on Amazon UK and Amazon Canada.

4. Emergence of Another Mode: Full Range Digitalization of Value Chain

In this section, we discuss a more advanced form of value chain digitalization, namely full range digitalization.

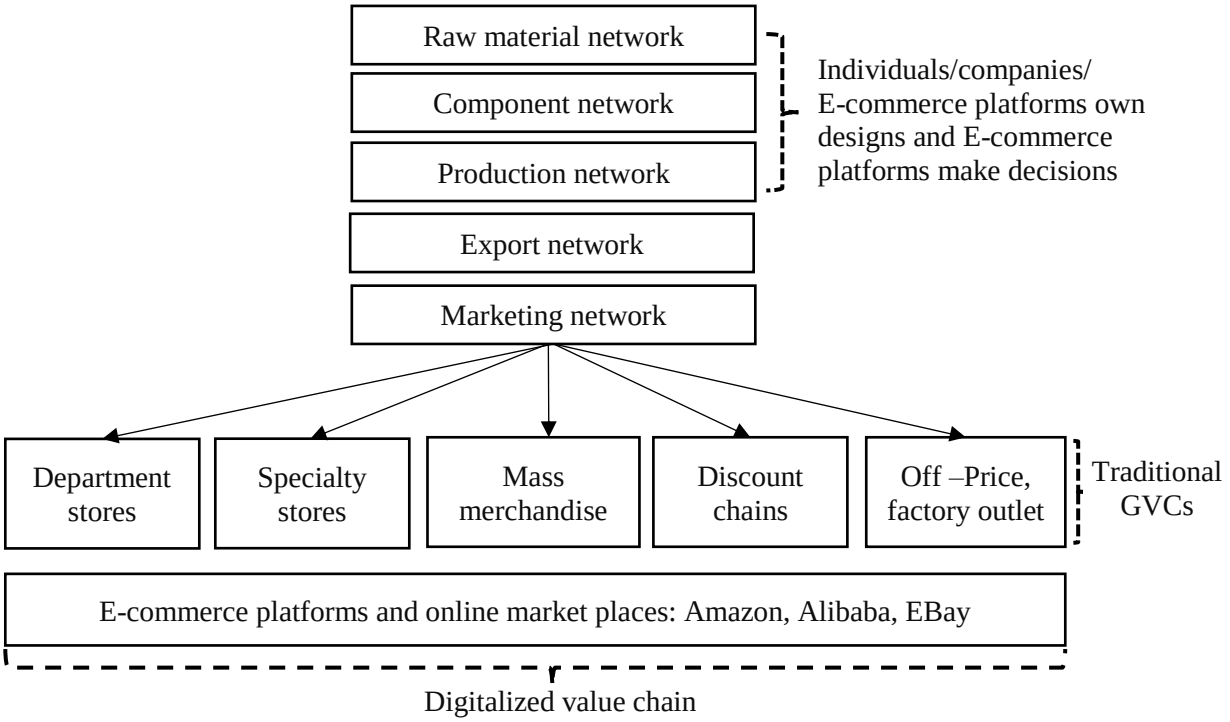
4.1. More Involvement of Platforms in Value Chains

A higher and more advanced form of digitalization in the apparel value chain is full range digitalization. Going beyond a two-sided marketplace that connects sellers and buyers for a small transaction value, some E-commerce platforms are now trying to penetrate into the higher value-added stages of the value chain. By exploiting the large loyal customer base and utilizing the massive amount of data collected, E-commerce platforms are reshaping business models in

[11] Company's announcement. Accessed June 27th, 2019 at https://ir.jd.com/news-releases/news-release-details/jdcom-announces-first-and-only-official-taylor-swift-online

apparel the industry. More specifically, under this digitalization, E-commerce provider is not only the product distributors but also the product designer and brand owner (Figure 3).

Figure 3: Full Digitalization in the Apparel Value Chain



Source: Authors.

The E-commerce platform's involvement in the value chain ranges from the downstream stages to the production network. In this full digitalization mode, the E-commerce providers can capture a larger part of the value chain by capturing value at both downstream stages as distributors and production stages as design owners and product manufacturers. In addition, expanding beyond the core business of a marketplace can benefit E-commerce providers by enhancing efficiency via economies of scope derived from the better utilization of intangible and tangible assets (Panzar & Willig, 1981).

In the case of E-commerce providers, the core intangible assets are invaluable connections with a large number of customers in the platform's ecosystem. These intangible assets are then translated into a massive amount of information collected from huge numbers of daily transactions that can be analyzed to identify key trends in customer behaviors. In general, such analysis requires very advanced technologies. Big data are used to derive insights into customer preferences which are useful in production decision making. Advanced technologies such as 3D printing can be applied to the production process. We delve into two typical cases below to better understand full digitalization of the apparel value chain.

4.2 The Case of Merch by Amazon

Merch by Amazon is a program that was launched in 2015 by Amazon. Until early 2019, it has specialized on print-on-demand T-shirt productions as the core business model. The basic idea behind Merch by Amazon is very similar to that of ridesharing company Uber or co-working place We Work. That is, to make a profit by utilizing under-used decentralized assets. In the case of Uber, it is utilization of personal vehicles. In the case of Merch by Amazon, it is the utilization of individual talent in T-shirt designs. Thousands of individuals have the creativity to make beautiful and funny designs but most of them have few chances to commercialize their artwork due to limited funding and difficulty in acquiring customers and handling production.

Merch by Amazon program allows all content creators to simply upload their artwork to Amazon, choose an appropriate product type and color, add a product description, and set the price. Amazon will then handle all remaining tasks with no upfront costs incurred by individuals. Amazon will create a product page on Amazon.com and when customers buy a product, Amazon will handle production, fulfillment, distribution, and customer service. Using a print-on-demand business model, individuals do not have to worry about inventory risk since products are printed only after customers submit orders.

To handle the production, Amazon signs contracts with two US manufacturers—Port and Company and Bella + Canvas—to produce the T-shirts. For every T-shirt sold, the individual will receive a royalty ranging from 13% to 40% of the product price. Generally, the higher the price of the product, the larger the amount of royalty the individual receives. For examples, if a T-shirt sells for $25.99 in the US market, the designer will receive a royalty of $9.77 (37.6%). For a $15.99 T-shirt, the royalty is only $2.21 (13.8%). Enjoying royalty without any risks, thousands of individuals can become "Individual Original Design Manufacturer" in the apparel industry.

Beyond ordinary individuals, Merch by Amazon program is expanding to attract designs from entertainment brands, social influencers, musicians, singers, and other artists. Famous partners of Merch by Amazon include Disney, Marvel, CN cartoon network, and Dr. Seuss. All these companies reported an increase in sales and profitability growth. In particular, the sales of Dr. Seuss through Merch by Amazon grew rapidly by 40% since it partnered Amazon in late 2017 (Reuter, 2019).

The Merch by Amazon model works well because Amazon capitalizes on two key assets. The first is the huge number of loyal customers who frequently purchase on Amazon. The second is the world-class printing technology which allows production to be completed within a few days. To reinforce this competitive advantage, Amazon is investing heavily in printing technology that can further reduce cost and improve quality. In fact, Amazon has been granted several US patents related to on-demand-printing technologies which use lasers and robotic systems for cutting fabric.

4.3. The Case of NetEase's Yanxuan in China

Merch by Amazon takes part in the production process but not product design. Product design remains the intellectual property of its partners. However, there are some cases where E-commerce platforms go even deeper into value chains by participating in product designs and even brands. This business model is exemplified by NetEase Yanxuan.

Yanxuan is an E-commerce platform owned by Chinese internet giant NetEase. It was launched in April 2016. While most products sold on E-commerce platforms are sold under third-party seller's name, all products sold in Yanxuan are sold under the company-owned brand as private label products. Thus, being very different from B2C and C2C models which dominate the Chinese E-commerce market, Yanxuan's business is a self-run E-commerce platform rather than the typical two-sided marketplace platform for commodities, manufacturers, and brands.

Yanxuan' slogan is "a better life doesn't have to be costly". It competes in the E-commerce market by proving "consistent high-quality products at competitive price".[12] The company claims that it sells products of world-class quality at a much lower price. The starting point of the Yanxuan model is data collection and analysis. By analyzing the massive amount of data and information generated through customers' daily transactions, Yanxuan derives valuable insights about customer behavior. In particular, the most relevant and powerful insights on popular patterns, colors, fabrics, and other attributes are gathered to help create product designs.

At the next stage, Yanxuan works with big Chinese apparel manufacturers to improve product designs and handle mass production. The company chooses manufacturers on merit basis. The manufacturer should have sufficient production capacity and above all, experience in working with global brands. In many cases, the selected producers are original design manufacturers (ODM) for famous global apparel brands. The partnership welcomes both sides. For Yanxuan, since production know-how is not its core capability, working with experienced ODMs is the best way to ensure product quality and other production-related aspects such as on-time delivery. For ODMs, since many global apparel brands are re-locating from China to low-cost countries such as Bangladesh, India, and Vietnam, many Chinese ODMs are facing difficult times. In this context, working with Yanxuan offers a much-needed alternative market. In fact, Yanxuan deploys more than 3,000 manufacturers, including around 100 foreign suppliers (Fung Business Intelligence, 2019).

In the final stage, the apparel products produced by the ODMs are sold directly to customers through Yanxuan's E-commerce platform. This business model enables the company to provide products which combine major-brand quality and much lower price by avoiding major-brand premium and reducing the high cost associated with layers of distributors and retailers. For instance, as of August 2018, UGG ankle boots were sold for $200 by the two authorized Chinese sellers JD.com and Tmall but a very similar product made by "a manufacturer of UGG" was sold for just $45 by Yanxuan (Forbes, 2018).

[12]Company' press release in 2018. Information retrieved on June 20th at http://media.corporate-ir.net/media_files/IROL/12/122303/2019/NetEase%20Explores%20An%20Innovative%20Model%20For%20China.pdf

By offering good quality products at a very affordable price, Yanxuan has achieved great success. Staring from textiles and home products, Yanxuan expanded its business to 10 categories and more than 20,000 stock keeping units as of December 2018 (Fung Business Intelligence, 2019). According to NetEase annual reports, net revenues from the E-commerce segment, mainly from Yanxuan, increased sharply by 287% from $170.8 million in 2015 to $661.0 million in 2016. Net revenues rose further to $1,698.8 million in 2017 and US$2,797.7 million in 2018. (Fung Business Intelligence, 2019).

Intriguingly, Yanxuan is acting like a "true brand owner". Besides its own E-commerce platform, the company opened online flagship stores on other E-commerce platforms to sell its brand products. Yanxuan has online stores in other E-commerce platforms in China (JingDong and Sunning), Southest Asia (Shopee Singapore and Shopee Malaysia) and the United States (Amazon). The online store of Yanxuan in JingDong attracted more than 2 million customers as of September 2018 (Fung Business Intelligence, 2019).

It is worth noting that Yanxuan's ODM model is increasingly becoming popular. The two E-commerce giants in the Chinese market, Alibaba and JD, have launched their own products (Alibaba launched Taobao Xinxuan in 2017 and JD launched Jingzao ub 2018). Platforms in other countries, for instance, Coupang in Korea, also have their own products. In fact, Yanxuan's model of shifting from a marketplace owner to a brand owner is not new in the apparel industry. Amazon was the first to launch this business model by introducing its private-label AmazonBasic in 2009. As of January 2019, Amazon had a total of 109 apparel labels (TJI Research, 2019).

5. Summary and Concluding Remarks

Digitalization is a major trend that is fundamentally reshaping the global economy. Digitalization has gained even more since the COVID-19 pandemic, which forced a lot of economic activity to shift online. By using firm level data, we elaborate upon the value chain digitalization process in the apparel industry. We find that the digitalization of the value chain usually originates in the downstream stages where platforms emerge to disrupt conventional linear value chains and displace traditional distribution channels. At this level of value chain digitalization, the chain becomes dis-intermediated and flattened with the involvement of fewer players. The platforms connect decentralized buyers and sellers, make transactions faster and easier, and facilitate the market entry of SMEs.

A higher, more advanced level of value chain digitalization also exists in the apparel industry. After achieving success in downstream stages, platform owners penetrate deeper into the production network. By exploiting their technological prowess and massive data collection, these platforms are going beyond their primary role of a marketplace and expand into production-related tasks. Some serve as the principal agents in the production network (Amazon with Merch by Amazon) while others directly join product design stage and become brand owners (Yanxuan). Platform owners can thus capture a larger share of the value chain

since they capture value at both downstream stages as distribution partners and production stages as production agents.

From the viewpoint of SME manufacturers, such digitalization of value chains may cause opposite effects. On the positive side, partnership with platforms provides a great opportunity to expand the customer base, increase sales, and eventually improve productivity. Both domestic and global customers can be reached through leading platforms, which typically have a large number of loyal users. This is especially valuable for small and medium companies and startups constrained by limited resources and capabilities. For larger companies too, working with platforms can be an effective way to lower customer acquisition cost and attain thus achieve more revenues. As time passes, network effects reinforce the dominant positions of leading platforms.

On the negative side, to be included in platforms, companies have to pay a fee to platform providers. Platform provider fee is the new component of the digitalized value chain. In the apparel industry, the fee ranges from 2% to 27%.[13] The fee is fixed and unnegotiable in the video game industry but in the apparel industry, it has a complex structure with various pricing models. The difference reflects the divergence in the bargaining power of platform owners in the two industries. In the video game sector, mobile game publishers have almost no choice but to publish their mobile games in global dominant app store platforms. Thus, platform providers have dominant bargaining power, which leads to very high fees. In stark contrast, in the apparel industry, there are no global dominant E-commerce platforms and the traditional distribution channels are still prevalent in many countries. As a result, the leading E-commerce platforms are less powerful and cannot charge high fees.

The interaction between the negative impact and positive impact of value chain digitalization gives rise to its ultimate economic consequences. Regarding SMEs and startups, it is more likely that the benefits outweigh the costs, so that digitalization adoption is beneficial on balance. The fundamental reason is that value chain digitalization drastically lowers entry barriers and can facilitate industrial upgrading. This implies that value chain digitalization can serve as a window of opportunity for SMEs to move up the value chain. Indeed, this argument is borne out by several companies which successfully upgraded themselves in the end market.

The precise costs and benefits of value chain digitalization may vary depending on the degree and mode of digitalization. Full platform digitalization is most beneficial since it amplifies the positive effect of value chain digitization by creating a strong network effect that can be self-sustaining over a long period of time. Meanwhile, this kind of network effect is not present in a partial platform digitalization.

Overall, the contributions of the paper are as follows. Firstly, by discussing the nature and role of the platform provider fees as a new component in the digitalized GVC, we show the asymmetric impacts of value chain digitalization on SMEs and incumbent firms. GVC digitalization is generally beneficial for SMEs and startup since it lowers entry barriers and facilitates upgrading. On the other hand, in the apparel industry, value chain digitalization may

[13] In the video game industry, it ranges from 15% to 30%, somewhat higher than in apparel industry.

hurt some incumbent firms since the digitalization of the value chain may enable platform owners to transform themselves into potent competitors.

The paper has several implications for business practice and policymakers. The first implication pertains to the governance of platforms and value chain digitalization. The network effect reinforces the positions of leading platforms in the value chain over time. In the future, it is conceivable that a very small number of platforms exercise substantial power over the global flow of goods and services. The involvement of platforms in the value chain has both negative and positive economic consequences. Therefore, the question should not be how to resist platforms and protect traditional players but how to harness the positive impact while mitigating the negative impact. In this sense, the regulatory sandbox approach which enables experimentation of new technologies and business models should be facilitated (UNSGSA, 2018).

The second implication relates to the digital transformation of SMEs. Digitalization can help small and medium firms to join the value chain and thus serve as an engine of their growth. Government agencies should thus prioritize policies that facilitate the adoption of digitalization by SMEs. With limited resources and technological capability, it is challenging for SMEs to adopt digitalization. Government assistance and support should thus be provided. Policy packages must ideally include financial and technical assistance as well as training in good practices in digitalization adoption (OECD, 2019).

The third implication pertains to the "naïve" digitalization and strategic digitalization of large organizations. Digitalization is becoming a universal phenomenon and many incumbent firms are planning for an "as fast as possible" digital transformation. However, digital transformation is not an easy task. Besides having to pay a substantial amount to platform providers, incumbent firms face other potential risks. The fact that digitalization facilitates entry into the value chains means that competitors are not only the other companies already in the market but also potential competitors who come out of nowhere and sometimes grow rapidly. Furthermore, platforms who are partners in the digitalization can turn into formidable competitors in the future. Therefore, strategic digitalization requires a realistic and holistic assessment of the costs and benefits.

References

Apulu, I., Latham, A., and Robert, M. 2011. Factors affecting the effective utilization and adoption of sophisticated ICT solutions: Case studies of SMEs in Lagos, Nigeria. *Journal of Systems and Information Technology*. 13(2). pp.125-143.

Appelbaum, R., and Gereffi, G. 1994. Power and profits in the apparel commodity chain. In Edna, B. et al., eds. *Global Production: The Apparel Industry in the Pacific Rim*. Philadelphia, PA: Temple University Press. pp.42-64

Ashrafi, R., and Murtaza M. 2008. Use and Impact of ICT on SMEs in Oman. *Electronic Journal of Information Systems Evaluation*. 11(3). pp. 125-138

Basant, R., Commander, S.J., Harrison, R., and Menezes-Filho, N. 2006. ICT Adoption and Productivity in Developing Countries: New Firm-Level Evidence from Brazil and India. *IZA Discussion Papers 2294, Institute of Labor Economics (IZA).*

Black, S., and Lynch, L. 2001. How to Compete: The Impact of Workplace Practices and Information Technology on Productivity. *Review of Economics and Statistics*. 83(3). pp. 434-445.

Brugger, F. 2011. *Mobile applications in agriculture*. http://www.gsma.com/mobilefordevelopment/wpcontent/uploads/2011/12/Syngenta_Report_on_mAgriculture_abridged_web_version.pdf.

Brun, L., Gereffi, G., and Zhan, J. 2017. *Industry 4.0 and light lead firms*. Background paper for 2017 Globalization, Regional Growth, and the 4th Industrial Revolution Conference. Bologna. 19-20 October.

CNBC. *Amazon's 100 million Prime members will help it become the No.1 apparel retailer in the US.* https://www.cnbc.com/2018/04/19/amazon-to-be-the-no-1-apparel-retailer-in-the-us-morgan-stanley.html (accessed 27 September 2019).

CNNIC. 2011. *China's Online Shopping Market in 2011 Research Report. China Internet Network Information Center*. http://www.cnnic.cn/research/ bgxz/dzswbg/201106/P020110602594116726720.pdf (accessed 04 June 2019).

Coe, N.M., et al. 2004. Globalizing Regional Development: A Global Production Networks Perspective. *Transactions of the Institute of British Geographers.* 29(4). pp. 468–484.

Davis, N. 2016. What is the fourth industrial revolution? *World Economic Forum.*

Eisenmann, T., Parker, G., and Van Alstyne, M.W. 2006. Strategies for two-sided markets. *Harvard Business Review*. 84(10). p.92

Eisenmann, T., Parker, G., and Van Alstyne, M.W. 2011. Platform envelopment. *Strategic Management Journal*. 32. pp. 1270–1285

Esselaar, S., et al.. 2007. *ICT Usage and Its Impact on Profitability of SMEs in 13 African Countries*. Background paper for the 2006 International Conference on Information and Communication Technologies and Development. Berkeley, CA. 25-26 May.

Erdogmus, H. 2009. Cloud computing: Does Nirvana hide behind the Nebula? *IEEE Software*. 26(2). pp. 4-6

EU Commission. 2019. *Competition Policy.* http://ec.europa.eu/competition/elojade/isef/index.cfm?fuseaction=dsp_result&policy_area_id=1,2,3 (accessed 05 June 2019).

EuropeAid. 2012. *Agricultural markets and small-scale producers: Access and risk management tools*. https://ec.europa.eu/europeaid/sites/devco/fles/study-agricultural-markets-small-scale-producers-201205_en_5.pdf.

Evans, D.S. 2003. The antitrust economics of multi-sided platform markets. *Yale Journal on Regulation*. 20(2). pp. 325–82

Forbes. 2018. *NetEase challenges Chinese E-commerce giants on now battleground: Own Label Retail*. https://www.forbes.com/sites/janeho/2018/04/20/netease-challenges-chinese-e-commerce-giants-on-new-battleground-own-label-retail/#d8542324b130 (accessed in 20 June, 2019).

Foster, C., and Graham, M. 2015. Connectivity and the tea sector in Rwanda. *Oxford Internet Institute Report*, Oxford: University of Oxford.

Frederick, S., and Gereffi, G. 2011. Upgrading and Restructuring in the Global Apparel Value Chain: Why China and Asia Are Outperforming Mexico and Central America. *International Journal of Technological Learning, Innovation and Development.* 4 (1/2/3). pp. 67–95.

Fung Business Intelligence. 2016. *Foreign Brands Continue to Foray into China's Retail and Consumer Products Sector in the New Normal.*

__2019. *Venturing into private label business – the next big thing for e-commerce operators.*

Gangwar, H., Date, H., and Ramaswamy, R. 2015. Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of Enterprise Information Management*. 28(1). pp. 107–130.

Gawer, A., and Cusumano, M.A. 2002. *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation*. Boston, MA: Harvard Business School Press.

Gawer, A., and Cusumano, M.A. 2014. Industry Platforms and Ecosystem Innovation. *Journal of Product Innovation Management*. 31(3). pp. 417-433.

GE. 2016. *GE introduces Digital Power Plant for Steam to Enhance Efficiency and Reduce Emission of Coal-Fired Plants.* https://www.genewsroom.com/press-releases/ge-introduces-digital-power-plant-steam-enhance-efficiency-and-reduce-emissions-coal (accessed 07 June 2019).

Gereffi, G. 1997. Global Shifts, Regional Response: Can North America Meet the Full-Package Challenge? *Bobbin*. 39 (3). pp. 16–31.

__1999. International Trade and Industrial Upgrading in the Apparel Commodity Chain. *Journal of International Economics.* 48 (1). pp. 37–50.

__2019. *Global Value Chain and Development: Redefining the contours of 21st century capitalism*. Cambridge: Cambridge University Press.

Gereffi, G., and Fernandez-Stark, K. 2016. Global Value Chain Analysis: A Primer 2nd edition. *Duke Global Value Chain Center*. https://gvcc.duke.edu/wpcontent/uploads/Duke_CGGC_Global_Value_Chain_GVC_Analysis_Primer_2nd_Ed_2016.pdf (accessed 10 June 2019).

Goyal, A. 2010. Information, direct access to farmers, and rural market performance in Central India. *American Economic Journal: Applied Economics*. 2(3). pp. 22–45

Hamilton, L.C., and Asundi, R. 2008. Technology usage and innovation. Its effect on the profitability of SMEs. *Management Research News*. 31(11). pp. 830-845.

Hall, J., Kendrick, C., and Nosko, C. 2015. The effects of Uber's surge pricing: A case study. *University of Chicago Booth School of Business*. http://faculty.chicagobooth.edu/chris.nosko/research/effects_of_uber's_ surge_pricing.pdf (accessed 10 June 2019).

Hinson, R. 2010. The value chain and e-business in exporting: Case studies from Ghana′s non-traditional export (NTE) sector. *Telematics and Informatics*. 27(3). pp. 323–340

Iansiti, M., and Levien, R. 2004. *The keystone advantage: What the new dynamics of business ecosystems mean for strategy, innovation, and sustainability*. Boston, MA: Harvard Business School Press

Ihua, U.B. 2009. SMEs key failure-factors: a comparison between the United Kingdom and Nigeria. *Journal of Social Sciences*. 18(3). pp. 199–207

Irani, Z. 2002. Information systems evaluation: navigating through the problem domain. *Information & Management*. 40. pp. 11-24

Katz, M.L., and Shapiro, C. 1985. Network externalities, competition, and compatibility. *American Economic Review*. 75. pp. 424–440.

Kenney, M., and Zysman, J. 2016. The rise of platform economy. *Issue in Science and Technology*. 32(3). https://www.nbp.pl/badania/seminaria/25x2016_2.pdf.

Kohli, R., and Devaraj, S. 2004. Realizing businesses value of information technology investments: an organizational process. *MIS Quarterly Executive*. 3(1). pp. 55-70

Li, F., Frederick, S., and Gereffi, G. 2019. E-commerce and industrial upgrading in the Chinese apparel value chain. *Journal of Contemporary Asia*. 49(1). pp. 24-53

Liu T.K., et al. 2013. E-commerce, R&D, and productivity: Firm-level evidence from Taiwan. *Information Economics and Policy*. 254(4). pp. 272-283

McNamara, K. 2008. The global textile and garments industry: The role of information and communication technologies (ICTs) in exploiting the value chain. Working Paper No. 47488. Washington, DC: World Bank.

Mahmood, M.A., and Mann, G.J. 2000. Special Issue: Impacts of Information Technology Investment on Organizational Performance. *Journal of Information Systems*. 17(1). pp. 3-10

Mehrtens, J., Cragg, P.B., and Mills, A.M. 2001. A model of Internet adoption by SMEs. *Information & Management.* 39(3). pp. 165-176

Meyer, M.H., and Lehnerd, A.P. 1997. *The power of product platforms: Building value and cost leadership*. New York: Free Press.

Moore, J.F. 1996. *The death of competition: Leadership and strategy in the age of business ecosystems*. New York: Harper Business

Murphy, J.T., Carmody, P., and Surborg, B. 2014. Industrial transformation or business as usual? Information and communication technologies and Africa's place in the global information economy. *Review of African Political Economy*. 41(140). pp. 264-283

Murphy, J.T., and Carmody, P. 2015. *Africa's Information Revolution: Technical Regimes and Production Networks in South Africa and Tanzania.* Oxford: Wiley-Blackwell.

Mussomeli, A., Gish, D., and Laaper, S. 2016. The rise of digital supply network. *Deloitte University Press*. https://www2.deloitte.com/content/dam/insights/us/articles/3465_Digital-supply-network/DUP_Digital-supply-network.pdf.

Mutula, S.M., and Brakel, P.V. 2006. E-readiness of SMEs in the ICT sector in Botswana, with respect to information access. *The Electronic Library*. 24(3). pp. 402-17.

Newzoo. 2018. *Top 25 public companies by game revenues.* https://newzoo.com/insights/rankings/top-25-companies-game-revenues/ (accessed 09 June 2019).

OptaSense. 2014. *OptaSense announces contract with Europe's biggest rail provider—Deutsche Bahn Netz AG*. www.optasense.com/2014/01/optasense-announces-contract-with-europes-biggest-rail-providerdeutsche-bahn-netz-ag/ (accessed June 07th, 2019).

OECD. 2013. *Interconnected Economies: Benefiting from Global Value Chain*. https://www.oecd.org/mcm/C-MIN(2013)15-ENG.pdf.

__2019. *Productivity in Digital Age*. http://www.oecd.org/going-digital/productivity-growth-in-the-digital-age.pdf.

Ongori, H., and Migiro, S.O. 2010. Information and communication technologies adoption in SMEs: literature review. *Journal of Chinese Entrepreneurship*. 2(1). pp. 93-104.

Ottum, B.D., and Moore, W.L. 1997. The Role of Market Information in New Product Success/Failure. *Journal of Product Innovation Management*. 14(4). pp. 258–273.

Panzar, J.C., and Willig, R.D. 1981. Economies of Scope. *American Economic Review*. 71 (2). pp. 268–272

Petersen, K.J., Handfield, R.B., and Ragatz, G.L. 2005. Supplier integration into new product development: coordinating product, process, and supply chain design. *Journal of Operations Management.* 23(3-4). pp. 371-388

Raymond, L., Bergeron, F., and Blili, S. 2005. The Assimilation of E-business in Manufacturing SMEs: Determinants and Effects on Growth and Internationalization. *Electronic Markets*. 15(2). pp. 106-118

Reuters. 2019. *Merch by Amazon t-shirt business increasing order from Disney to Dr. Seuss*. https://www.reuters.com/article/us-amazon-com-automation-merch/merch-by-amazon-t-shirt-business-increasing-orders-from-disney-to-dr-seuss-idUSKCN1T0128 (accessed 20 June 2019).

Rochet, J., and Tirole, J. 2003. Platform competition in two-sided markets. *Journal of the European Economic Association*. 1(4). pp. 990– 1029

Quiros Romero, C., and Rodriguez, D.R. 2010. E-commerce and efficiency at firm level. *International Journal of Production Economics*. 126(2). pp. 299-305

Rüßmann, M., et l. 2015. Industry 4.0: The future of productivity and growth in manufacturing industries. *Boston Consulting Group*. 9(1). pp.54-89.

Schwab, K. 2016. *The Forth Industrial Revolution*. Geneva: World Economic Forum.

Schware, R. 2003. Information and communications technology (ICT) agencies. *Journal of Information Systems*. 5(3). pp. 3-7.

Sniderman, B., Monica M., and Mark, C. 2016. Industry 4.0 and manufacturing ecosystems: Exploring the world of connected enterprises. *Deloitte University Press*. http://dupress.com/articles/ industry-4-0-manufacturing-ecosystems-exploring-world-connected-enterprises/

Terero, M., and Von Braun, J. 2005. Information and Communications Technologies for the Poor. *International Food Policy Research Institute*. 40. http://www.ifpri.org/pubs/ib/ib40.pdf.

Tiamiyu, M.A, Bankole, A.S, and Agbonlahor, R.O. 2012. Catalytic mechanisms for promoting ICT investment and use in cassava value chains in south-western Nigeria. *Information Development*. 28(2). pp. 132–148.

TJI Research. 2019. *Amazon Brand Database*. https://this.just.in/amazon-brand-database/

UNCTAD. 2013. *Global value chain and development: Investment and value-added trade in the global economy*. https://unctad.org/en/PublicationsLibrary/diae2013d1_en.pdf

__ 2015. *Information Economy Report: Unlocking the potential of E-commerce for developing countries*. https://unctad.org/en/PublicationsLibrary/ier2015_en.pdf

__2017a. *The new digital economy and investment*. https://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d08_en.pdf

__ 2017b. *Information economy report: digitalization, trade, and development*. New York, NY: United Nation Publication. https://unctad.org/en/PublicationsLibrary/ier2017_en.pdf

UNSGSA. 2018. *Briefing on Regulatory Sandboxes*. https://www.unsgsa.org/files/1915/3141/8033/Sandbox.pdf

Waema T., and Katua, C. 2014. The promises of fibre-optic broadband in tourism and tea sectors: A pipeline for economic development in East Africa. *School of Computing and Informatics, University of Nairobi, Nairobi.*

Weiner, A. and Rumiany, D. 2007. A new logic of reducing the global digital divide in Sub-Saharan Africa: from obstacles to opportunities. *ATDF Journal*. 4(1). pp. 14–21

Wielicki, T., and Cavalcanti, G. 2006. Study of digital divide: measuring ICT utilization and implementation barriers among SMEs of Central California. Background paper for 2006 9th International Conference on Business Information Systems. Klagenfurt. 31 May - 2 June.

WTO. 2019. *Global value chain development report: Technological innovation, supply chain trade, and workers in a globalized world*. https://www.worldbank.org/en/topic/trade/publication/global-value-chain-development-report-2019

Xia, Y., and Zhang, G.P. 2010. The impact of online channel on retailers' performance: An empirical evaluation. *Decision Sciences*. 41(3). pp. 517-546.