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Creating Shared Value from Collaborative Logistics Systems: The Cases of ES3 and Flexe

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ABSTRACT

Shared value enhances the competitiveness of a company while simultaneously reducing societal burdens. By allowing companies to share their resources, collaborative logistics systems provide companies with an opportunity to create shared value, namely, not only economic value by enhancing the utilization of resources, but also social value by reducing energy consumptions and greenhouse gas emissions associated with logistics and transportation. Emerging businesses, such as ES3 and Flexe, have recently demonstrated how they created shared value through collaborative logistics services, for example, ES3's collaborative warehousing and direct-to-store (D2S) program, and Flexe's on-demand warehousing platform. However, the development of collaborative logistics systems is currently at a nascent stage. There are quite a few socio-technical barriers to overcome for sharing resources (data as well as infrastructure). Drawing on the socio-technical approach, this research examines how companies create both economic and social value from collaborative logistics systems. We highlight socio-technical barriers, particularly one set of social barriers, that is, competition-oriented conservatism prevalent among companies. Using the case study methodology and interview data, we closely investigate ES3 and Flexe, which provide collaborative logistics services, and demonstrate how technical and social barriers are addressed to create shared value from collaborative logistics systems.

Keywords: Shared Value, Economic and Social Value, Socio-Technical Approach, Socio-Technical Barriers, Collaborative Logistics, Data and Infrastructure Sharing

Ⅰ. Introduction

Shared value enhances the competitiveness of a company while simultaneously reducing societal burdens (Porter and Kramer, 2011). Creating shared value thus advances economic and social conditions in the communities in which a company operates. The recent development of interconnected, collabo-

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rative logistics systems[1] provides companies with an opportunity to create shared value through collaboration.

Collaborative logistics systems make transportation and logistics more efficient and sustainable by enabling the sharing of data and infrastructure that are interoperable and standardized. By allowing companies to share their resources, collaborative logistics systems not only enhance the utilization of resources but also reduce energy consumptions and greenhouse gas emissions associated with logistics, production, and transportation (Montreuil, 2011).

The sharing of resources is not new in today's sharing economy. Ride-sharing (or ride-hailing) companies, such as Uber and Lyft, and room-sharing companies, such as Airbnb, employed a new business model that used online platforms to allow shared access to unused goods and services (Jain, 2013). However, unlike sharing resources among individual consumers as realized in the ride-sharing and room-sharing businesses (C2C or B2C), collaborative logistics systems facilitate resource sharing among separate businesses (B2B), thereby creating shared value. Emerging businesses, such as ES3 and Flexe, have recently demonstrated how they created shared value through collaborative logistics services. For example, ES3's collaborative warehousing and direct-to-store (D2S) program brought manufacturers and retailers together to share resources and eliminated waste by streamlining supply chains. Flexe's on-demand warehousing platform created a marketplace by connecting supply and demand and matched excess warehousing capacity with seasonal inventory overflows among warehouse operators and third-party logistics (3PL) providers. However, the development of collaborative logistics systems is currently at a nascent stage. There are quite a few socio-technical (both social and technical) barriers for collaboration and sharing resources (data as well as infrastructure), which should be overcome by collaborative logistics service providers such as ES3 and Flexe.

In general, companies put their survival and competitiveness ahead of collaboration. Competition is a deep-rooted barrier for collaborative (or interconnected) logistics systems. Conservatism is prevalent in industries and discourages building and using collaborative systems for shared value. Without changing the way companies behave, the potentials of collaborative logistics systems will not be fully realized. In this research, we examine how collaborative logistics systems create shared value by using two case examples of ES3 and Flexe. We employ the socio-technical approach to identify the barriers, both social and technical, to the implementation of collaborative logistics systems. In particular, we highlight one set of social barriers, that is, competition-oriented conservatism prevalent among companies, which should be overcome to create shared value with collaborative logistics systems. We focus on barriers because once addressed, barriers often become drivers (Lewin, 1939). Drawing also on the concepts of the sharing economy and shared value, this research identifies the ways to facilitate collaboration among companies to create shared value (both economic and social value) with collaborative logistics systems. We consider competition and collaboration on a continuum where both can coexist. What is required for creating shared value is not just interconnected logistics systems in place, but the changes in the mindset of companies more toward collaboration by reducing competition-oriented conservatism.

1) The interconnected (collaborative) logistics system is also termed as the Physical Internet by Montreuil (2011). The Physical Internet is a new concept, which can be defined and named differently across various fields and disciplines.

Ⅱ. Theoretical Background

2.1. The Sharing Economy and Shared Value

The sharing (or collaborative) economy refers to a socio-economic system that enables shared access to goods, services, and resources, including data, infrastructure, and talent (Abel, 2013). The research on the sharing economy is dispersed across various fields and disciplines, and there is a lack of common terms and definitions for the sharing economy (Arvidsson, 2018; Palgan et al., 2017; Perente et al., 2017; Sutherland and Jarrahi, 2018). According to Sundararajan (2016), the sharing economy is characterized as largely market-based, high-impact capital (utilization of resources to their full capacity), crowd-based networks (capital and labor supplied by crowds of individuals), and blurring lines between personal and professional as well as fully-employed and casual labor. Research also indicates that the sharing economy is characterized by unused or underutilized assets or services being shared or exchanged, temporary or on-demand access to these assets or services through a digital platform, and significant network effects (Frenken and Schor, 2017; Perente et al., 2017; Sutherland and Jarrahi, 2018). Research also shows that the sharing economy leads to "platform capitalism," in which socio-technical intermediaries (or platforms) focus on data sharing and analytics, as well as on market coordination to appropriate rents from transactions (Langly and Leyshon, 2017; Parente et al., 2017; Sundararajan, 2016). These characteristics of the sharing economy are well illustrated in the cases of ride-sharing and room-sharing companies. As seen in the examples of Zipcar and more recently Uber and Airbnb, the sharing economy improves efficiency and effectiveness by enhancing the utilization of goods, services, and resources through sharing (or collaboration) while capitalizing on current and emerging technologies. However, there are emerging sharing economy companies, such as ES3 and Flexe. Unlike sharing resources among individual consumers (C2C or B2C), these companies make possible resource sharing among separate businesses (B2B), thereby creating shared value.

Shared value refers to not only economic but also social value (Porter and Kramer, 2011). Social value can be created with policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the communities in which it operates (Porter and Kramer, 2011). The concept of value here reflects benefits relative to costs, not just benefits alone. Shared value considers societal harms that can create internal costs for companies, such as wasted energy and pollution. According to Porter and Kramer (2011), addressing societal harms does not necessarily raise costs for companies, but rather increase their productivity and market share by developing new ways of doing business through using new technologies, operating methods, and management approaches.[2)]

ES3 provides shared infrastructure, such as collab-

2) The concept of shared value has been popularized by Porter and Kramer (2011), but it is not that it has not received any critiques. Crane et al. (2014) state that social problems relevant to the corporation can be transformed into business opportunities, which can contribute to the solving of critical societal challenges while simultaneously driving greater profitability. Thus, the concept of shared value makes some significant progress towards enhancing attention to the social dimensions of business, and may act as a spur for better practice. However, they argue that it suffers from a number of serious shortcomings: it is unoriginal, it ignores the tensions between social and economic goals, it is naïve about the challenges of business compliance, and it is based on a shallow conception of the corporation's role in society [refer to Crane et al. (2014) for more detailed critiques].

orative warehousing and trucking to both manufacturers and retailers. Manufacturers benefit as they avoid owning or investing in fixed assets that are not always at maximum capacity. Trucking facility builds and ships fuller trucks with products from various manufacturers, reducing the number of shipments and wasted space in containers. ES3's D2S program removes a leg of transportation, as the product travels directly to the store, making going green not only better but faster. Shared infrastructure also helps retailers achieve just-in-time (JIT) by lowering the economic order quantity (EOQ). JIT also helps retailers shorten lead times and lower inventory levels. Overall handling, inventory, and transportation costs are dramatically reduced as the supply chain becomes more streamlined and efficient. The technologies and operational model of ES3 create shared value, not only reducing societal harms by reducing energy consumption, wastes, and pollution (fewer trucks placed on the road with fuller containers) but also creating economic value—flexibility and optimum utilization of resources—to both manufacturers and retailers.

Unlike ES3, Flexe does not have any physical warehouse infrastructure. It is a technology company that builds a marketplace (or platform) to connect demand and supply for sharing each other's warehousing capacity. Since warehouse operators incur costs on space, whether it is occupied or not, Flexe creates value for the supplier's end by providing means to convert an otherwise empty space into a revenue-generating stream by connecting them with customers. On the demand end, value is created by allowing access to a larger footprint with flexible durations. Thus, Flexe provides access to spaces available in an on-demand format without the rigid commitments of having to sign a long-term lease or investing high capital in building a facility.

Schor (2014) argues that by facilitating sharing and cooperation in the production and consumption of goods and services, the sharing economy can create fairer and more transparent, more sustainable, and more open and socially connected societies. Sharing economy firms may contribute to environmental sustainability in that platform-based collaborative consumption relies less on the individual, private ownership, and instead is dependent more on temporary access to assets underutilized by others. In the process, consumers do not only save money but would also lower the demand for new materials or the construction of new facilities, thereby reducing energy consumption. However, it might be a viewpoint only looking at partial or first-round effect. Thus it would be necessary to analyze all the changes (e.g., ripple or rebound effect) brought by the sharing platforms by using the systems (or ecosystems) approach (Frenken and Schor, 2017; Schor, 2014); rent generated by platforms can be used to buy new products or construct new facilities, and sharing practices may also shift income across classes (for C2C) or industries (for B2B). Thus, the question of whether sharing economy companies contribute to lower energy consumption (or carbon emissions) is subject to empirical studies (Frenken and Schor, 2017; Schor, 2014).

2.2. The Socio-Technical Approach

In the study of the introduction of electric vehicles in China, Xue et al. (2014) conceptualize the road transport system as a socio-technical system and define it as a configuration of a set of elements including technology, markets, suppliers, consumers, and infrastructures necessary to fulfill societal functions, co-evolving and interacting each other. They argue that technologists and policymakers usually separate technical concerns from social concerns when portraying the development of electric vehicles, but social barriers may pose as much of a problem as technical (Egbue and Long, 2012; Xue et al., 2014). Sovacool et al. (2011) also argue that most studies have emphasized technical barriers facing technology systems, but not cultural and social barriers. For example, in the case of the global distribution of renewable energy technologies, such as solar home systems, significant initial capital investments, the capabilities required to install and maintain the systems, and defining and implementing appropriate pricing systems are key challenges. But what is missing and extremely important is the latent but meaningful cultural attitudes and values, which can impede the greater use of such renewable energy technologies (Sovacool et al., 2011; UNDP, 2010).

The socio-technical approach conceptualizes collaborative logistics systems as a socio-technical system, which is an open system that is embedded in an environment that affects the way it behaves (Mumford, 2006). It considers technical and social structures as two systems that are both parts of one inclusive system. Rooted in the socio-technical design principles for technological systems (e.g., computer systems), which facilitate the joint optimization of both social and technical aspects, the socio-technical approach emphasizes human needs when technical systems are introduced. As a results, it leads to not just the efficient use of technology, but also an improvement in the quality of working life (Mumford, 2006). According to Hughes (1987), “technical” refers to the physical components (artifacts) in a technological system. He states that a technological system includes not just physical (or technical) components, but also organizational (or social) components, such as organizations, management, business strategy, university teaching and research programs, and regulations, etc., and it is socially constructed and society shaping. Compared to the earlier socio-technical studies focusing on organizational computer systems, we employ the socio-technical approach to examine how collaborative logistics systems, inter-organizational or interconnected systems, can overcome barriers, in particular social barriers, and create not just economic value but also social value (so-called shared value).

Ⅲ. Social Barriers to Collaborative Logistics Systems

Digital connectivity has enabled the sharing of data and infrastructure, thereby changing the way logistics is done. A neutral platform (digital or physical) can be developed for companies to collaborate and share resources. However, in order to capture the full potentials of collaborative logistics systems, emerging businesses, such as ES3 and Flexe, should address potential barriers, both technical and social. Technical barriers can be lowered through the adoption and use of platforms and infrastructure that are interoperable and standardized. Challenges are to build a network of interconnected warehousing capacity in a truly automated and seamless format without human intervention. Compared to technical barriers, however, social barriers are much harder to address since social changes are relatively slower than technological changes (Cutcher-Gershenfeld et al., 2016).

There are several potential social barriers: 1) recognition of the value of collaboration among companies, 2) trust-building, 3) lack of incentives for companies to participate in collaborative logistics systems. Companies typically compete against each other and are likely not to collaborate when the relationship is occasional or bound in short-term contracts. However, as businesses recognize that collaborative logistics systems reduce social harms, not just create economic value, more companies would participate in the systems. As a result, costs would be further lowered, and the systems would sustain better. As Porter and Kramer (2011) state, creating shared value (both economic and social value) will be the key to unlocking new business innovations as well as societal and economic progress. Trust is hard to build and will be the biggest hurdle for collaborative logistics systems since contractual obligations should be abode by involved parties. Thus, they often bring up haggling and disputes (Klappich et al., 2016). Another barrier is the lack of incentives for companies to participate in collaborative logistics systems. Companies put competitiveness ahead of collaboration and often take positions that can achieve a competitive advantage. Thus, unless real evidence for cost reduction (not only economic costs but also societal costs, e.g., environmental costs) and value creation (not only economic value but also social value) is provided by collaborative logistics systems, companies will not participate in the systems, and their full potentials will not be realized.

Ⅳ. Case Studies

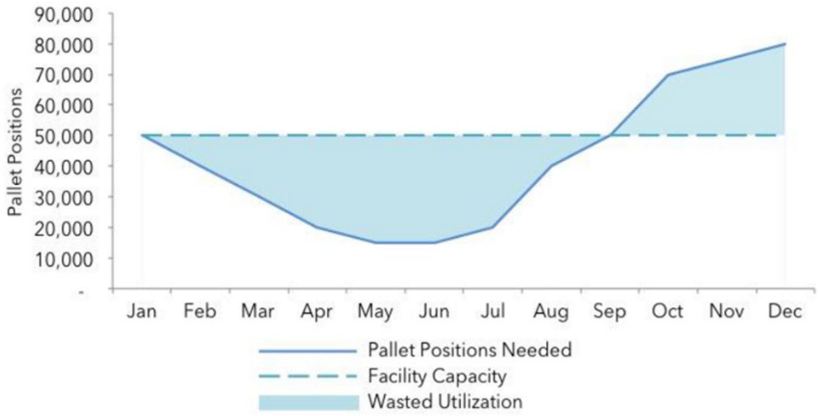
This section investigates the case examples of ES3 and Flexe to examine how collaborative logistics systems create shared value. The two case studies were conducted using the companies' website resources and documents, including white papers, as well as with the interviews conducted with senior managers of the two companies in August 2016.

4.1. ES3: Shared Warehouse and Trucking

ES3 was founded in 1999 to save time and reduce costs in the consumer-packaged goods (CPG) supply chain. Since its founding, ES3 has focused on eliminating waste and sharing resources by providing shared infrastructures, such as collaborative warehouse and trucking to both manufacturers and retailers. ES3's first collaborative warehouse was opened in 2002 in York, PA, and housed 140,000 pallets, and the company expanded by opening other facilities in Dallas in 2003 and Atlanta in 2004. Today, ES3's flagship collaborative warehouse facility in York, PA, supports storage of 400,000 pallets, shipping of more than 300 million cases annually, and management of more than 20,000 items.

ES3's flagship York facility, so-called "Really Big Consolidated Warehouse (RBCW)," is a 5 million square foot facility. It combines multiple manufacturers' supply chains into a single, very large supply chain by consolidating the manufacturers' mixing centers (MCs) in the same facility as the retailers' distribution centers (DCs). Owning facilities typically lead to an inefficient use of storage space, wasting money, as shown in <Figure 1>. For most of the year, a facility is operating either under or over capacity due to fluctuation in demand. ES3's collaborative warehouse adopts an outsourced model, where payment is made only for space actually used. This eliminates wasted storage space during offseason and saves spending on outside storage during peak season, which typically carries a high cost. In other words, ES3's collaborative warehouse allows manufacturers and retailers to be more flexible and better utilize their money (ES3, 2014).

Coupled with RBCW, ES3 rolled out the direct-to-store (D2S) program in 2010, which was created to streamline the supply chain further by eliminating a distribution center and leg of transportation. D2S made delivery not just faster, but greener, as product travels directly to the store. ES3's D2S program puts the manufacturers' mixing centers and



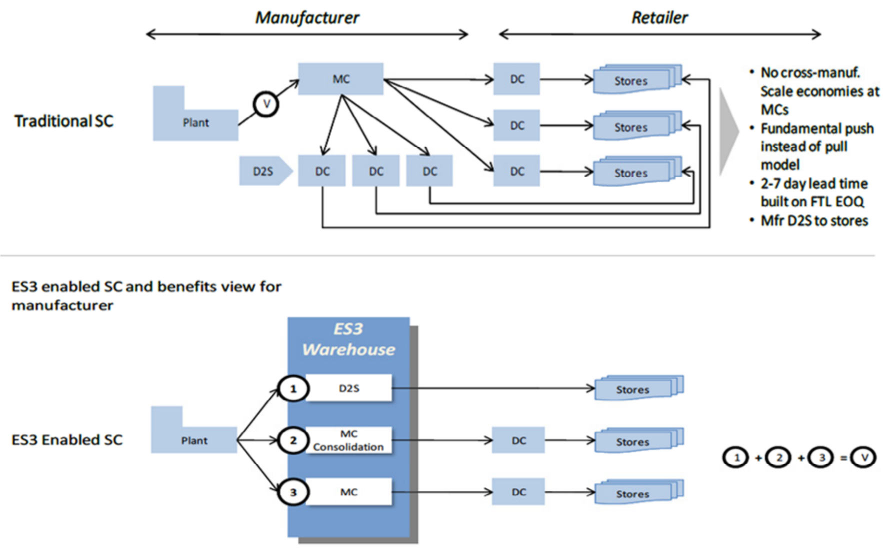
<Figure 1> Wasted Utilization of Owned Warehouse Facility (ES3, 2014)

the retailers' distribution centers together under the same roof. Products flow from the factory to the collaborative warehouse and then directly to the store, in 24 hours or less (ES3, 2015).

Traditionally, a large manufacturer created mixing centers where product from all of its manufacturing facilities was shipped.[3] The retailer could order a truckload of products, across all of the manufacturer's product lines. The truckload of mixed products was then shipped to the retailer's distribution center (DC) for selection into store orders and distribution out to the stores with the product from other manufacturers. The creation of MCs helped to reduce the economic order quantity (EOQ) to a truckload of all items sold by the manufacturer from a full truckload shipped from a single manufacturing plant. This improved the efficiency of getting fast movers to the shelves. However, the EOQ of a truckload was still not economical enough for a slow mover (an item ordered in a pallet or less). If a slow-mover is out of stock, the retailer has to wait until there is sufficient demand for the fast-movers to allow the creation of a full truckload order. In this case, the EOQ is not in line with the demand quantity, resulting in inefficiencies in the supply chain and lost sales.

ES3's RBCW aimed at providing the infrastructure to cost effectively change the EOQ for the CPG industry. By combining multiple manufacturers' mixing centers, it allows the reduction of the EOQ from a truckload to a case. Unlike a typical warehouse that serves a manufacturer exclusively, ES3 serves multiple manufacturers (and retailers) and can optimize warehousing and transportation. It is an end-to-end supply chain solution that is faster, cheaper, and greener than existing supply chain models, which makes the benefits of the delivery of just-in-time inventory truly realized－selling a case shipping a case (ES3, 2015). This scale changes the delivery time from 5 days to 24 hours or less on average. These changes in the supply chain enable to replace the product on the shelf just-in-time and avoid out-of-stocks in a more efficient and cost-effective way than the individual manufacturer and retailer supply chains. In other words, inventory handling and transportation costs are dramatically reduced as the supply chain becomes more streamlined and efficient. <Figure 2> shows the traditional supply

3) A mixing center can be outsourced, but it typically serves one manufacturer exclusively.



<Figure 2> Traditional Supply Chain and ES3's Consolidated Supply Chain (ES3, 2015)

chain and ES3's consolidated supply chain based on collaborative warehousing and direct-to-store program.

ES3's consolidated model, the collaborative warehouse coupled with the D2S program, delivers value to consumers, retailers, and manufacturers by getting the product to shelves faster, also lessening the amount of carbon emissions. Due to the quick replenishment cycle, retailers could store inventory for less time, reducing stock to its most efficient and optimal level. Less inventory means less waste, such as unsaleables, wasted touches, time and money. By removing a leg of transportation and increasing truckload utilization through the consolidation of multiple manufacturers' products, both transportation costs and carbon emissions are reduced. As a result, retailers can place smaller and more frequent orders without increasing transportation costs and leaving valuable space empty on hauls. ES3 builds and ships fuller trucks, reducing the number of annual shipments, as trucks do not ship with any wasted space. Emissions are significantly reduced with every truck taken off the road. For example, for every 500 miles haul, a truck eliminated from being on the road reduces a carbon footprint of 846 kg over a year.

Sharing infrastructure, such as warehouses and trucks, reduces environmental impact. One full truck can transport multiple manufacturers' products, rather than each manufacturer sending a partial truck. As product variety increases, replenishment orders would continue to be smaller and more frequent. Therefore, it will become increasingly important for manufacturers to be able to deliver small quantities quickly. ES3's collaborative model is designed to meet with decreased minimum order sizes and to increase delivery speed, without increasing cost.

4.1.1. Socio-Technical Barriers: Findings from Interviews

There are barriers, however, both technical and social, that should be addressed for the collaborative model to achieve full benefits. A major technical challenge is to build infrastructure for collaboration through sharing resources. One is to build a neutral platform, whether it is physical, digital, or both, which interconnects manufacturers as well as retailers, allowing them to interoperate as partners in a truly automated and seamless format. It is a challenging requirement for a collection of manufacturers and retailers since they not just compete, but also see each other as the enemy in a zero-sum game as they negotiate trade dollars. No partner has a home team advantage on a neutral platform where they collaborate. ES3 provides the platform, the collaborative warehouse enabling the D2S program, which treats all parties fairly. It serves as the clearinghouse for information on cost and inventory that each partner views as confidential and ensures that each partner sees only the information necessary for their transactions (ES3, 2015). A former chief marketing and strategy officer of ES3 states:

> "We sign confidentiality agreements with each of the participants. We have strict guidelines about what we can share and what we cannot share."

ES3's collaborative warehouse is fully automated, supporting pallets where the cases can be sequenced to match the category layout of each retailer store. This improvement in pallet design, along with greater shipping accuracy and enhanced paper and electronic documentation, reduces the labor required to move the product from the back room of the store to the shelf.

Apart from the technical barriers, there are social barriers. A major social barrier is a competition that leads to a lack of trust and shared vision. Collaboration is unheard of among companies with competing for product lines. A former chief marketing and strategy officer of ES3 states:

> "The challenge is getting more people to understand that sharing is going to be the way forward. This concept of sharing infrastructure is hard for existing supply chain professionals to grasp."

Therefore, for collaboration, they need a neutral platform where they feel comfortable working together, thereby reducing the supply chain (or logistics) costs. Then, the activity can be more focused on holding the product price and managing the increasing cost of goods. The development of a business model is also a challenging requirement, which motivates partners to collaborate and participate in collaborative logistics systems. If they recognize the economic and social value created from the sharing of resources and collaboration through collaborative warehouse coupled with the D2S program, they will participate in it. A former chief marketing and strategy officer of ES3 states:

> "What we did was look at, essentially the cost of the supply chain to the participants before collaboration and after collaboration. So there is the economic portion wherein after collaboration you collapse the number of warehouses, reduce the number of warehouses and amount of transportation that there are financial savings that can be passed onto each of the participants."

She continues:

> "Everybody said 'show me the value passed onto me through collaboration' before they would say 'yes' to doing it. So, we said, 'okay, we will make the savings contractual.' We built the savings into the rate we charged manufacturers, so they are guaranteed to see the benefits of collaboration."

The business model ES3 developed is the so-called "shopping mall model," based on which the more space they use, the lower the rate they pay. She states:

> "ES3's business model is based on volume made. So, the bigger you are, the less you pay."

4.2. Flexe: On-demand Warehousing

Flexe was founded in August 2013. It is a cloud-based marketplace that connects warehouse operators and third-party logistics (3PL) providers. Flexe provides on-demand warehousing services from pallet overflow storage to fulfillment operations, by creating a peer-to-peer marketplace that connects demand and supply for sharing each other's warehousing capacity (Klappich et al., 2016).

Since it was founded, FLEXE has built a network of more than 750 warehouses across the US and Canada by providing solutions for companies that need additional warehousing space (excess inventory) and companies that have excess capacity. It had more than a three-fold growth during the period of 2016-2018 (a network of 200 warehouses in 2016 to a network of 750 warehouses in 2018). Flexe's on-demand warehousing services create huge economic and social value by creating a platform of the marketplace where warehousing companies can buy and sell warehouse space (sharing warehouse space) when needed. By storing other organizations' inventories as well as their own, companies could improve the utilization of warehouse capacity, thereby saving energy consumed, e.g., electricity, and monetize what would otherwise result in wasted space.

A typical problem warehouse companies and 3PL providers face with is the fluctuation of the utilization levels of warehousing capacity. There are periods when a company's warehouse capacity is idle. Likewise, there are companies in need of additional capacity but do not want to extend the current lease terms or to make long-term contractual commitments. It is also challenging for companies to find each other to deal with excess warehousing capacity and inventory overflows for the secure and efficient handling of goods between them. Flexe solves this problem by allowing companies with the excess capacity to rent it to companies looking for additional capacity on a cloud-computing platform. This platform also matches shippers and warehousing providers and enables scheduling inbound and outbound shipments, tracking inventory, managing billing, and legal agreements. By getting on-demand services, companies do not need additional capital investment (e.g., building more warehouses) or long-term space leases to prevent interruptions in their inventory management processes.

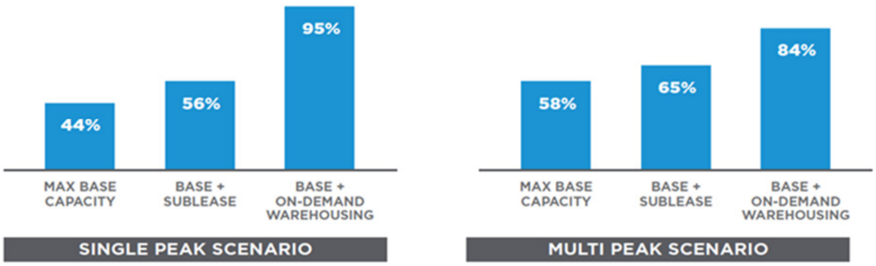
On-demand warehousing is "a spot market companion to the existing 'long market' built on warehouse leases and/or property ownership" (Flexe, 2015). It addresses the problem that warehouse capacity is typically fixed while inventory levels vary. Warehousing companies typically accept empty space incurred during the year as sunk costs and simply regard it as a cost of doing business. The use of subleasing is not common due to administrative overhead associated with it, particularly when excess capacity situations occur multiple times per year. 3PLs also are usually not used to solve short-term warehousing needs. Increasing base capacity to cover all the peaks of inventory levels throughout the year cannot be an option due to its inefficiency (max base capacity). Short-term subleasing can be difficult to execute—it can also cause excess sublease duration problem that is the same kind of sunk cost (base plus sublease). Flexe's on-demand warehousing services address all these issues. It provides additional capacity (buy space) only when it is needed with no minimums, while also providing an option to deal with over-capacity issues (sell space). <Figure 3> and <Figure 4> show differences in capacity utilization and cost reduction for three different warehousing models (max base capacity, base plus sublease, and base plus on-demand warehousing) with a single peak and multiple peak scenarios.

As shown in <Figure 3>, matching capacity closely to actual inventory levels (base plus on-demand warehousing) drives significantly higher utilization—upwards of nearly 100% improvement in a single peak scenario. Even in a multi-peak situation, on-demand warehousing can drive utilization over 40% higher. This improvement in capacity utilization has a direct impact on warehousing costs, as illustrated in <Figure 4>. The on-demand (dynamic warehousing) approach is nearly 100% (and 56%) more efficient than a max capacity (static warehousing) model in a single peak scenario (and a multi-peak scenario). It is also notable that the cost mark-up across the three models also differs (<Figure 4>).

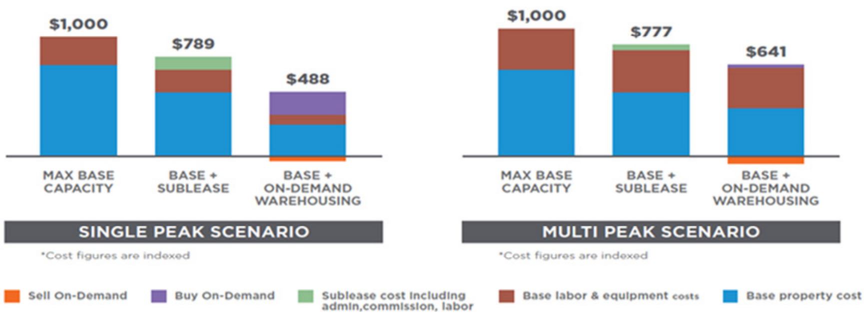
As shown in the above figures, Flexe's on-demand warehousing services reduce warehousing operation costs significantly by increasing the utilization of warehouse capacity. The better utilization of warehousing capacity may also reduce energy consumption used for warehouse operation, e.g., electricity. In other words, shared value (not only economic value but also social value) can be created by collaborative logistics systems, such as Flexe's on-demand warehousing services.

4.2.1. Socio-Technical Barriers: Findings from Interviews

There are barriers, however, that should be addressed for collaborative logistics systems to achieve



<Figure 3> Capacity Utilization for Three Warehousing Models with Single Peak and Multiple Peaks (Flexe, 2015)



<Figure 4> Cost Reduction for Three Warehousing Models with Single Peak and Multiple Peaks (Flexe, 2015)

full benefits. They are both technical and social. A major technical challenge is to build neutral digital platforms that interconnect warehouse operators and allow them to interoperate in a truly automated and seamless format without human intervention. A VP of business development of Flexe states:

> "We have developed our own cloud-based software, which interconnects warehouses in North America. A particular customer once set up with Flexe's system has access to a warehouse in any geographical locations in North America in an on-demand format without having to sign a lease or invest a ton of money and capital for starting up a facility. Our system also provides our customers with clear visibility of control over the movements of goods and the duration of the shipments. However, managing different levels of complexity that customers require in warehousing operations is a barrier. Imagine they can just go online and book a shipment in a warehouse, plan a route, move the goods, and all that in a completely automated fashion. The challenge is how we can make this more automated and seamless, given that everybody's supply chain is unique in some way. That is where we are thinking of the collaborative logistics systems, namely the interconnection of logistics systems that are based on interoperable and standardized processes."

A major social barrier is a difficulty developing a business model that motivates warehouse operators to collaborate and participate in collaborative logistics systems. As mentioned earlier, they would not share resources (warehouse capacity) unless they recognize the economic and social value created from it. A VP of business development of Flexe continues:

> "We create value through a marketplace connecting supply and demand. If you are sitting on an empty space, as a warehouse operator, it is a cost. We add revenue streams to empty footprints by commercializing them and make them accessible to the demand side of the marketplace. On the customer side, we give our customers on-demand access to a larger footprint than they would otherwise have access to. Flexe's cloud-based platform also streamlines material handling operations. It requires no technology investments, long-term leases, or process interruptions. Adding warehousing and distribution capacity is now easier, more flexible, and more cost-effective than ever before."

Ⅴ. Conclusions

Investigating two different companies closely, ES3 and Flexe, this research examines how collaborative logistics systems create shared value, i.e., both economic and social value. To supplement the case studies, we also conduct a couple of interviews with senior managers of the two companies.

Collaborative logistics systems create shared value by providing neutral platforms (physical, digital, or both) where participants can share resources and collaborate. The two case studies on ES3 and Flexe show that collaborative warehouse and trucking and on-demand warehousing services significantly decrease supply chain costs, including inventory-handling costs and transportation costs, as well as societal (or environmental) costs, such as carbon emissions and energy consumptions.

However, collaboration is challenging, and the potentials of collaborative logistics systems might not be fully realized unless socio-technical barriers are overcome. Therefore, drawing on the socio-technical approach, this research highlights the requirements for addressing socio-technical barriers to create shared value from collaborative logistics systems. The requirements for addressing technical barriers are: 1) the development of a platform that is interoperable and standardized, 2) the development of a network of interconnected warehousing capacity that are truly automated and seamless with minimum human intervention, e.g., automated shipment scheduling, inventory tracking, billing and legal agreements. On the other hand, the requirements for addressing social barriers are: 1) increased awareness of social harms reduced from collaborative logistics systems, 2) trust-building through a neutral platform, on which nobody has a home-court advantage, and that has strict guidelines about what to share and what not to share, and 3) savings built into the rate charged to participants so that they can see the benefits of collaboration, so-called "collaborative advantage." Only when these requirements (for collaboration) are sufficiently met, the full potentials of collaborative logistics systems will be realized, and shared value will be created.

The contributions of this research are two-fold: First, compared to earlier research focusing on organizational computer systems, the present research applies the socio-technical approach to collaborative logistics systems (inter-organizational systems), which provide supply chain participants with sharing platforms to exchange underutilized resources (or excess capacity). By studying the two cases of ES3 and Flexe and conducting interviews, this research illustrates how collaborative logistics systems coordinate resource sharing among separate businesses (B2B), compared to other sharing economy companies providing services to individual consumers, e.g., Uber and Airbnb (B2C or C2C). Second, companies may solve societal problems by implementing corporate social responsibility. However, this research uses the concept of shared value (Porter, 2011) to suggest new ways of doing business (e.g., collaborative logistics systems) that can create social value while creating economic value at the same time.

By conceptualizing collaborative logistics systems as socio-technical systems, this research illustrates how socio-technical barriers can be overcome to create shared value. However, the companies facilitating B2B resource sharing are still emerging, and thus further studies are needed to assess the full impacts of sharing platforms. Future research may use the systems (or ecosystems) approach by employing a broader set of companies for a longer period. It also needs to use different methodologies that can corroborate the present research.

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