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Ecommerce in Rural Areas and Environmental Sustainability: The Last-Mile Delivery

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Abstract: Ecommerce models offer many benefits for business operations, such as convenience and easiness, decreased cost of inventory management, expanded customer base, enabled globalization and business analytics, etc. Virtual business models also promote sustainability by reducing energy and resource usage. Despite its pronounced benefits, ecommerce is still subject to challenges of environmental sustainability especially in rural areas. This research-in-progress study intends to better understand environmental implications of ecommerce in rural areas with the exploration of three questions: 1) how are sellers and buyers conscious about ecommerce sustainability in rural areas, 2) What eco-innovation practices are engaged by business, and 3) what are environmental consequences associated with various types of deliver innovations.

Keywords: Ecommerce in Rural Areas, Delivery Innovation, Environmental Sustainability

1. INTRODUCTION

Ecommerce deals with the buying and selling of products and services online and it refers to the use of the Internet to conduct commerce. Ecommerce sales remained strong around the globe, and according to the U.S. Commerce Department, online sales in the U.S. market alone have continued to grow at about 15% increase rate since 2010 and the fastest growth is typically expected in rural areas. Ecommerce represents a dominant force in digital revolution, and it comprises more than 10% of the overall U.S. retail market today.

Ecommerce business models offer many benefits, such as convenience and easiness, decreased cost of inventory management, expanded customer base, enabled globalization and business analytics, etc. Virtual business models also promote *sustainability* by reducing energy and resource usage. Sustainability is the ability of humans being responsible towards nature, one another and future generations [1], and is aimed to improve environmental and social systems [2]. Ranganathan identified four elements for environmental performance (i.e., material use, energy consumption, non-product output and pollutant release) and four elements for social performance (i.e., employment, community relations, ethical sourcing and social impact) [3]. From an environmental perspective, online purchases are less carbon intensive than purchasing in physical stores, especially when consumers live far away (such as in rural areas) from the store. As indicated in a study, online shoppers expend much less carbon per transaction than in-store shoppers at distances of more than 8.6 miles, and consumers would have to buy 24 items to make the trip equal to the carbon footprint of just one item ordered online [4]. As a result, ecommerce makes positive environmental impacts through dematerialization (i.e., reducing material consumption via digitization), decarbonization (i.e., reducing greenhouse gas emissions), and demobilization (i.e., reducing the need for transportation and its associated costs and consequences) [5].

Despite its pronounced benefits, ecommerce is still subject to challenges of environmental sustainability. Especially in rural areas, shipping, emissions, packing, and data centers deserve important considerations. As represented by low population density and scattered households, rural areas may be more resource consuming on certain dimensions. For instance, to guarantee a positive delivery and return experience, ecommerce business may engage in transportation modes that that increase fuel consumption exponentially and may lead to inefficient utilized transport capacities. Home delivery involves unbundled shipments and small packages and

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compromises the efficiency of consolidated logistics systems. Also, the growth of returns (free of charge in many cases) resulting from the rise of e-commerce requires additional resources and operations [6]. In fact, although retailers considered increased sales resulting from online shopping, they also believed ecommerce was detrimental to costs [7].

To better understand environmental implications of ecommerce in rural areas, such as those associated with packing and emission challenges, this study aims to answer the following questions: 1) how are business and consumers conscious about ecommerce sustainability in rural areas, 2) What eco-innovation practices are engaged by business, and 3) what are environmental consequences associated with various types of deliver innovations?

2. ECO-INNOVATIONS RELATED TO LAST-MILE DELIVERY

Eco-innovation refers to a novel product, service, business process, or management method that results in a reduction of environmental risk and negative impacts of resources use [8]. Eco- innovation (a.k.a. green innovation) can be categorized as eco-product innovation, eco-process innovation and green managerial innovation [9][10].

Emerging innovations have been focused on the last-mile delivery, which is the movement of goods from a transport hub to a delivery address. A research conducted by Barclays [7] predicted a fall of direct deliveries to the consumer's address and a growth of letterbox-sized packages that can fit into a letterbox thus reducing cost of repeat delivery. Consumers also reported increased anticipation of more use of in-store and locker collection services in the future. As a result, opportunities exist to increase delivery efficiencies.

New business models for last-mile delivery have emerged. According to a Stanford white paper [11], three models from the perspective of who arranges delivery exist: seller-arranged delivery, intermediary-arranged delivery, and buyer-arranged pickup (Figure 1). Within each model, ecommerce business may utilize advanced algorithm and analytics to match task with courier, determine delivery price, select courier, and perform dynamic routing. Delivery drones and robots, as well as driverless cars may be used to speed up delivery and reduce environmental impact. Figure 2 summarizes the advantages of limitations of these innovations.

Figure 1. Business Models for Last-Mile Delivery [11]

WHO ARRANGES DELIVERY	HOW *	USING WHAT		
		KEY ALGORITHMS & ANALYTICS	VEHICLES	DELIVERY PERSON
Seller	Seller collects orders, outsources delivery (e.g., UPS, USPS, UberRUSH, FedEx Express)	• Integrated inventory management • Product search & match • Task-courier matching • Determining delivery price • Courier selection • Dynamic routing • Communication with customers • Demand forecast • Rating system	• Cars/trucks/bikes • Drones • Robots • Self-driving cars	• Full-time/part-time employees • Crowds • No delivery person **
	Seller collects orders, insources delivery (e.g., Amazon)			
Intermediary	Intermediary collects and delivers orders (e.g., UberEATS, Postmates, Google Express)			
Buyer-Arranged Pickup	Buyer orders online and arranges pickup from store or other location (e.g., Roadie, self pickup)			• Buyer • Crowds • No delivery person **

* *Companies listed as examples are illustrative. Companies may fall under more than one category in practice.*

** *"No delivery person" indicates that a person is not involved in the delivery. Rather, an automated vehicle such as a drone, robot, or self-driving car is used.*

Figure 2. Summary of Technology Disruptions in Last-Mile Delivery [11]

	ADVANTAGES	LIMITATIONS	STAGE OF DEVELOPMENT
Algorithms and Analytics	• Fast / cheap / flexible delivery • Low capital cost; low barriers to entry • Open the door for new delivery models	• Some companies have yet to demonstrate a viable business case • Trust issues with crowdsourcing	Large-scale adoption
Delivery Drones	• Fast / flexible delivery • Environmentally friendly • Can reach remote / hard-to-reach locations more cheaply • Can bypass crowded / poor roads	• Strict regulatory restrictions • Safety and privacy issues • Capacity limitations • Delivery distance limitations • Remaining technological challenges	Pilots
Delivery Robots	• Fast / cheap / flexible delivery • Environmentally friendly • Fewer safety and privacy issues compared with drones • Higher capacity compared with drones	• Delivery distance and speed limitations • Cannot operate in crowded areas • Theft issues • Limited ability to overcome obstacles in their way	Pilots
Driverless / Autonomous Cars	• Fast / flexible delivery • Low operating cost • Environmentally friendly • Cost-efficient to reach remote locations	• Strict regulatory restrictions • High cost of driverless vehicles • Many technological challenges still exist	Experimental

3. RESEARCH PLAN

Being aware of these possible opportunities, we question to what extent the U.S. ecommerce businesses and consumers are considering these innovations, to what extent these innovations are currently being implemented (if any), and what are the social consequences of these innovations. A two-stage study is designed to explore these questions from both the perspectives of sellers and buyers.

First, secondary data will be collected to study the existing delivery methods utilized by major ecommerce businesses in the U.S. as a way to understand retailers' consciousness and effort in enhancing environmental sustainability. We plan to identify the top 200 or 300 ecommerce websites operating in the U.S. market, and examine the categories of products sold on the website and the delivery methods and charges associated with different product types. The intention of this investigation is to recognize the currently implemented last-mile delivery mechanisms and innovations (if any) from the perspectives of sellers.

Second, online survey data will be collected from consumers (particularly those living in the rural areas) to understand their ecommerce experiences and expectations. Questions will be asked to capture consumer delivery preferences and purchasing behaviors associated with different types of products, and their attention to environmental issues related to ecommerce.

Finally, the two stages will be linked together through the nature of the products sold online to identify endogenous patterns. This can be done by exploring such questions as: 1) how are different types of products delivered by sellers and what incentives (e.g., free delivery, and no-minimum purchase requirement for free shipping, etc.) are provided to enhance or damage environmental sustainability, and 2) for the same type of products, what purchasing behaviors are typically engaged by consumers (e.g., purchasing one item at a time with no intentions to consolidate) and what delivery outcomes are expected by consumers. We hope that by answering these questions, we will understand the existing environmental issues related to ecommerce (especially in rural areas) and offer recommendations for future ecommerce operations.

4. CONCLUSIONS

Presently, the first stage is being undertaken and is expected to complete within two months. In the meanwhile, questionnaires to be distributed to ecommerce consumers are being designed and are targeted to launch in late spring of 2017. Data analysis will be performed in early summer and we hope to present some preliminary results and exchange ideas with other scholars at the Sixteenth Wuhan International Conference on E-business.

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