

Integration of Delivery Services Business Cases for improvement of Business and Environmental Sustainability of E-Commerce Solutions

Valentyn M. Yanchuk¹[0000-0002-6715-4667], Dmitry S. Antoniuk¹[0000-0001-7496-3553],
Andrii G. Tkachuk¹[0000-0003-2466-6299], Elena Maestri²[0000-0002-8745-9564], and Oleksandr
Vizghalov¹[0000-0003-0985-4929]

¹ Zhytomyr Polytechnic State University, Zhytomyr 10005, Ukraine

² University of Parma, Parma, 43124, Italy

v.yanchuk@gmail.com, dmitry_antonyuk@yahoo.com,
andru_tkachuk@ukr.net, maestri@unipr.it,
aleksandrvizur@gmail.com

Abstract. Nowadays society is tangible to introduce and widely support sustainable technologies and systems especially if they are involving a high level of various services integration. As E-commerce systems are playing a major role in our life the current work aims to analyze the sustainability of different levels of delivery services in combination with return exchanges, automated ordering, replacement retrieval, and even recycling of old items supported. The bright example of automated services implementation will be made with the involvement of real cases implemented in contemporary international eCommerce systems with the possibility to simulate how organizations can adopt additional services, attractive to B2C and B2B users. The analysis of usability and cost-effective parameters indicates the distinction of applied approaches in companies with different incomes and infrastructure indicating how the level of integration enables the company to become more sustainable and environmentally friendly. The work reviews the infrastructural composition of the contemporary E-Commerce system and its implication on the level of sustainability of the company itself and the environmental impact the sustainable development may do to an E-Commerce application. The work reviews the results of the impact evaluation on the financial and sustainable parameters of the models related to different organizations.

Keywords: customer behavior; usability evaluation; e-commerce, environmental, and business sustainability.

1 Introduction

1.1 Formulation of the problem.

When someone first hears about E-commerce at that very moment the person thinks of emotions that are coming to us and bring positive impressions of the design, colors, attractiveness, suggestions and best experience ever that may be potentially developed by electronic means and human experience; supported by customer success teams working hard to make the application successful.

At the same time, it is well known that each E-commerce system is the highly intelligent integration of subsystems, that are designed to serve and cut corners of possible overpayments and over-storage bringing ease of logistics, effective analysis and thorough filtering of the search results and intelligent faceting. All these integrated parts were highlighted in various publications [1-3], indicating benefits and possible improvements of approaches to apply subsystems or web-services, and above all, the most important studies investigated the verification segments and statistical information related to the particular study.

Thus far mankind does not associate E-Commerce with Sustainable environments due to overproduction that is involved in Manufacturing systems, that feed E-commerce with stocks and assortments, and whatever is not sold in the E-commerce system may still be dusting in regular stores and waiting for the customer in search of End-of-Life products. Nowadays the E-commerce systems are serving better to sell and take better care of End-of-Life products offering them in the separate aggregators and platforms offering maintenance and refurbishment services. All of them are different facets of the sales process, that aims at the quicker turnover and cleaning up the stock. In the context of overproduction, over-purchase - the support of returns and recalculation of sold "used items" back to the vendor will keep the balance of sustainability of E-Commerce platforms. Besides, the sale of used products make the platform even more sustainable, however, this should still be properly traced through the funnel of how the item comes from manufacturer to the customer, come in use and then returns to the manufacturer for revitalization, refill, refurbishment, renovation or recycling.

Many reviewers estimated U.S. online retail sales were \$97.3 billion in second-quarter 2016, a 15.8% increase from the previous year, and at the same time the number of possible returns is not even counted here. According to Forrester, that growth is expected to continue with U.S. online retail sales anticipated to exceed \$520 billion by 2020. Globally, online sales are growing three times faster than GDP [4]. According to the 2016 UPS Pulse of the Online Shopper study, 38% of purchases combine store visits with online research or purchase, and half of the surveyed respondents ship purchases to regular stores for pickup. Adding to this mix is a trend toward recurring deliveries. For more predictable items, consumers are increasingly willing to trust automatic refills, where one request results in ongoing fulfillment.

Ukraine, Europe, and US markets are sharing the same trends in the investigation as the market analyzed mainly based on ERP-based E-commerce systems, thus the

subject of the current study is focused on a review of the sustainability processes for E-commerce system analyzing the trends of the retail channels.

The purpose of this paper is to describe the experience in the development of different approaches for tracking the packages from the perspective of usability, sustainability, and customer satisfaction, which results in the client's retention.

1.2 Analysis of recent research and publications.

The solution proposed is aimed to investigate the closed-loop of e-commerce processes, help vendors and increase the trust of users into the delivery services using better insight into what route the parcel takes to get to the final destination.

To cover this multidisciplinary approach let us disclose the existing relationships between e-commerce investigations made for shipments deliveries [3], including domains of domestic deliveries [4], customer purchasing habits [6-8], improvement of usability experience to create the trust of users to the delivery channels and be ready to cover the operating expenses related with automation.

The authors highlighted the approach of integration of delivery [2] were combined with the e-commerce solution with API services provided at the existing market. Overlapping of that work with publications of Routhier (2013) and Morganti and Dablanc (2014) uncovered the city and outside city delivery approach covering the transportation perspective and possible ways of further optimizations in that domain. Authors constantly suggested considering the direct and combined approaches of using the transportation system to optimize the time of delivery, however, the time is not always leading to a cost-effective solution.

Reichheld and Schefter (2000), Abrham et al. (2015), Zelazny (2017) or Ehrenberger et al. (2015) observe that there is a significant relationship between long-term growth of companies' profitability and customer purchase intention [13] however that indicated a good insight that analyzing mid-size companies and trace the turnover and orders circulation it will be easier to identify the dependencies between the options people usually chooses and possible shipment options the current vendors can offer.

Applied approaches were projected to the constantly ongoing process of e-Commerce applications improvements and its reflection to sustainable solutions that close the loop of e-commerce turnover and that should cover the main challenges of contemporary e-commerce systems.

2 The method

Day-by-day web-shops are selling more items that are produced and assembled with higher technological parts or processes, that increase the impact on the environment. More and more people are requesting the items be delivered from the internet platforms, so, the simple click "Add to Cart" that starts the full chain of transformations in E-Commerce systems and processes

The demand for a seamless shopping experience positively influences visitors and customers however merchants now face challenges of offering faster and easier shipping and return options, as well as the growing expectation that returning an item should be as seamless as receiving and as convenient as a simple handover. If the returns process is harsh, the customer experience level drops, and what started to be a satisfied consumer soon becomes a frustrated one [4].

The below diagram indicates the subsystems of the contemporary E-Commerce platform, that integrates a lot of external Software vendors offering services (fig 1.).



Fig. 1. E-Commerce system components integration.

As retailers deal with an ever-increasing number of packages that must be delivered in minimal time and remain competitive and profitable while also reaching customers across channels in the most effective, efficient, and sustainable in pre-order and post-order processing periods. The delivery of e-commerce products has reached unexpected heights in the last few years. Most deliveries made with e-commerce consist of parcels, small packages, and food containers. Forrester Analytics builds the trends that the share of online retail will continue to grow steadily in the next years in the US [1]. Deliveries may have a variety of options like collection points, pickup locations, or direct delivery to the customer location.

With goods flowing in multiple directions among manufacturing facilities, warehouses, stores, and consumers, traditional supply chain models are insufficient. The workload of the online shop team is entirely packed. Every day the web-shop or any other online service operational employee collects items for an order then carefully packs them and sends via delivery service to the end-users. The great ease of this brings the online rate shopping tools that can calculate the costs precisely. With the variety of different vendors carriers and modes of delivery, the end-user may choose between cost speed and flexibility.

E-commerce brings new considerations on standard processes from packaging and fulfillment to returns, as well as new possibilities to create and implement innovative and sustainable solutions. Businesses are partnering with logistics providers to reduce impact and improve the effectiveness of operations.

It is known that the variety of consumer-friendly services available, like UPS, USPS, DHL, FedEx allow residential customers to choose and possibly even modify their delivery times and locations, as well as provide access to an extensive network that supplies customers with new ways to receive deliveries at an alternative location – especially important for deliveries to apartments or other locations [5-7].

These services help online shoppers avoid missed deliveries and eliminate the environmental impact associated with wasted trips caused by multiple delivery attempts.

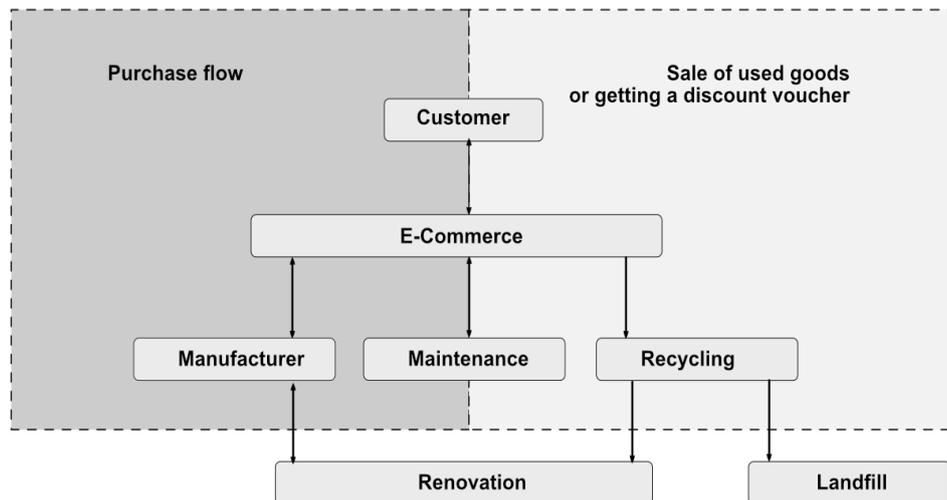


Fig. 2. The closed-loop approach of sustainable E-Commerce solution.

Another area worth taking a closer look at its packaging. Properly packaged goods have a better chance of arriving intact, reducing the number of returns and the overall environmental footprint. When a shipment is packed correctly and arrives undamaged, no replacement goods need to be picked, no additional transport is required to replace the item, and no broken items have to be managed, recycled, or

sent to a landfill. Packaging made from sustainable materials also helps to further reduce the environmental impact and reduce waste, while demonstrating to customers that the company is using best practices [8].

And it's not just large companies that are committed to navigating e-commerce sustainably. Small businesses are also using smart partnerships to enhance sustainable business practices. The company now uses shipping boxes made of recycled cardboard that are right-sized to prevent the use of excess materials, and crush tested to prevent product damage, as well as to reduce the rate of return shipments. Additionally, many companies ship orders via carbon-neutral, where carbon offsets are purchased to balance out the emissions produced by the transportation of shipments [9-11].

Along with environmental problems important business aspects are improving: customer satisfaction, brand attractiveness, trust, and turnover. Environmentally friendly companies are becoming more and more popular in the environmental caring world. Besides the payments companies have to incur are highly dependent on the usage of landfills for many countries. In addition to this, the logistic component of delivery has an indirect impact on the CO₂ emission problem which is relatively connected to transportation growing these days, however, this is not the main subject of the current paper.

The most important approach of the closed-loop indicated in fig. 2 highlights the closed cycle of delivery of goods to the customer and in case of repair or renovation or simply recycling – the same chain is used. It increases the trustworthiness of the client to the service, the distribution networks, and have a lot of other positive effects.

Here are a few ways retailers can navigate the changes taking place to boost their sustainability factors:

1. **Optimization of delivery chains.** Businesses evolving to meet the demand for e-commerce must re-evaluate current delivery chains that were created to support in-store and clients' deliveries. Using the same channels E-commerce brings novelty applying return deliveries for product returns.

This slight improvement brings ease for new ways of improvements for fuel reduction if the carrier can bring packages and fetch returns at the same time keeping the environment healthy [12].

2. **Investigating user's habits.** The flow of goods throughout delivery chains generates analytical data and recurring deliveries impact the merchant's accounts giving more and more discounts in the future. By partnering with a logistics provider that can tap into the power of this data, retailers can gain insight into customer preferences and trends, learn about hidden issues (e.g., ineffective processes or packaging), and fine-tune supply chain movement so that valuable assets such as resellable returns don't get lost or overlooked.

3. **Flexibility on logistics.** Collaboration and innovation of the user's habits may lead to a shift in logistics. Simple steps, such as providing customers with a way to shift their delivery to a time and location that meets their needs, reduces the environmental impact and results in a better experience for everyone [13].

4. Bonus programs and compensation for goods recycling. More and more companies are collecting the remaining emissions. This, in turn, demonstrates company concern that goes beyond capturing immediate revenues. This type of positioning can help support the company's reputation and offer a competitive advantage when driving consumer preference.

The cultural shift to e-commerce has brought about new expectations for immediate gratification from consumers, and with that, increased environmental impacts as retailers attempt to meet those demands. However, when companies are willing to invest in creating sustainable solutions to navigate the evolving demands of today's shopper, they will see a return on their investment beyond operational efficiencies.

Scientific and educational aspects of measurements of real-time systems that are usually used for investigation and how companies are added to that.

Let us combine these possibilities and review the case-study of implementation of the use-case for order delivery with and without tracking of its delivery as a demonstration of customer trust to the delivery systems and its application for returns.

Analysis of the feedback channel will uncover the results of the use-cases applied in the group of companies selling similar items in the period of 2-years.

3 The approach

Let us focus on Post-order processing involves the monitoring activities especially on tracking and tracing of the parcels. Both B2B and B2C segments have activities. For the closed-loop of the delivery process and return delivery, we may review the assignment of the return order of items recently delivered.

Let us create several business cases:

- Simple order implementation;
- Order implementation with the tracking number;
- Order with multiple links and listing of bypassed stages of delivery;
- Order tracking with the GPS;
- Return order tracking.

Post-order processing involves the monitoring activities and Tracking or tracing of the parcels.

Simplistic implementation of the order details page with mentioned shipping costs have the lowest level of usability from the standpoint of order tracking. In such conditions, the highest load will be to the customer support team to respond to all requests of orders with the reference to the Order Number for each submitted document.

ORD-1711000005 ORDER

Order no.	ORD-17110600005	Order date	02/6/2020
Order status	Delivery in progress	Payment method	Pay Pal
Shipping Carrier	DHL	Payment terms code	
Shipment date	02/7/2020	Due date	02/09/2020
Sell-to-contact	Frank Collinson		

SELL-TO ADDRESS

Daughter Emily via
Frank Collinson
1156 N. 6th Street
Brooklyn, NY 12345
United States

SHIP-TO ADDRESS

Frank Collinson
128 N. Victory Street
Stemford, CT 24345
United States

Item No.	Title	Status	Ship. d.	Price	Qty	UOM	Ship.	Inv.	Outst.	Total	
AB122348	Product name	Not shipped	11/7/2017	\$ 1.127,95	1	piece	0	0	1	\$ 1.127,95	
										Subtotal	\$ 1.127,95
										Invoice discount	\$ - 37,57
										Shipping costs	\$ 50

Fig. 3. Examples of the standard order with calculated shipping costs.

Posted order in the E-Commerce system contains the list of items, that can be rate-shopped either via flat fee for shipping costs or rate-shopped at Delivery service. The image above indicates that the order has indicated shipping costs of 50 USD, however, that does not have the tracking indication at the order.

The example of better implementation of usability towards user tracking is posting the tracking number indicated in the order header are indicated in fig.4.

ORD-1711000005 ORDER

Order no.	ORD-17110600005	Order date	02/6/2020
Order status	Delivery in progress	Payment method	Pay Pal
Shipping Carrier	DHL	Payment terms code	
Shipment date	02/7/2020	Due date	02/09/2020
Sell-to-contact	Frank Collinson	Tracking code	D1578922355 D1578922356

SELL-TO ADDRESS	SHIP-TO ADDRESS
Daughter Emily via	Frank Collinson
Frank Collinson	128 N. Victory Street
1156 N. 6th Street	Stemford, CT 24345
Brooklyn, NY 12345	United States
United States	

Item No.	Title	Status	Ship. d.	Price	Qty	UOM	Ship.	Inv.	Outst.	Total	
AB122348	Product name	Not shipped	11/7/2017	\$ 1.127,95	1	piece	0	0	1	\$ 1.127,95	
										Subtotal	\$ 1.127,95
										Invoice discount	\$ - 37,57
										Shipping costs	\$ 50

Fig. 4. Examples of the order with several tracking links for an order of E-Commerce system.

Costs related to the API call to the shipment provider are negligibly small but significantly increase the accuracy of the costs calculation and appropriate subtotals, totals, and tax calculation. The above case is the most simplistic implementation that involves only the programming costs and integration with an ERP. It is recommended to remember the license costs, that cover the updates of the system itself keeping your application healthy.

This goes without saying that demanding clients will expect compensation of additional parcel tracking via the client phone line, so, in case you have the voice chat or integration with the Client Support System keeps the best experience. However, looking into the Google Analytics and Extended analytics with heat-maps indicates that orders are just reviewed to make sure all the items are in it, however not traced from the delivery standpoint. See the user experience of tracking ID transformation into the link, that leads to the site of the Shipping provider, where the customer may see the latest route point for a parcel, fig. 5.

ORD-1711000005 ORDER

Order no.	ORD-17110600005	Order date	02/6/2020
Order status	Delivery in progress	Payment method	Pay Pal
Shipping Carrier	DHL	Payment terms code	
Shipment date	02/7/2020	Due date	02/09/2020
Sell-to-contact	Frank Collinson	Tracking code	D1578922356

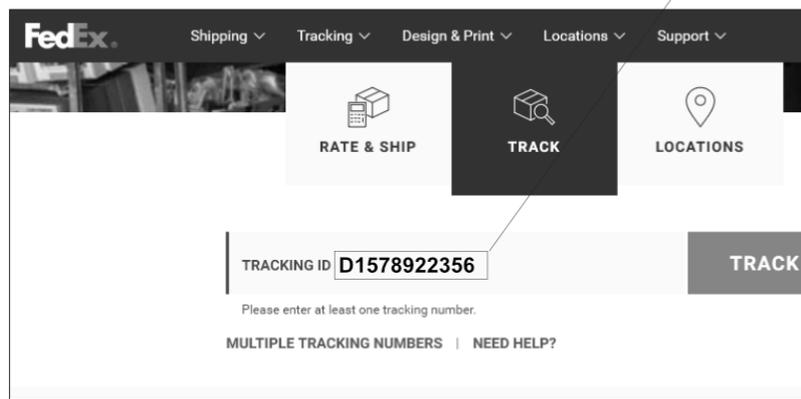


Fig. 5. User experience for order tracking with the link to the shipping provider.

Contemporary shipment providers are keen to update the delivery date depending on the situation at the roads and may update the shipment information from the carrier directly in case of appropriate integration. The use-case of the above order is not reflecting this possibility and a great deal of these problems is the absence of solution integration with the shipping provider. The above case indicates semi-integrated solution where the order tracking number may be assigned in the ERP system directly and further reflected in the E-commerce solution, where the client may either click the link and be delivered to the web-site of a vendor or retrieve the list of points the parcel bypassed directly into the E-Commerce control of the Shipment Provider (fig. 6).

To close the sustainability loop of the production process authors decided to generalize the recent approaches and suggested using the latest solution for tracking the return order. As the item that belongs to the client acts as a sort of a possible future discount for the next order, tracking of the delivery should have the maximum comfort.

ORD-171100005 ORDER

Order no.	ORD-17110600005	Order date	02/6/2020
Order status	Delivery in progress	Payment method	Pay Pal
Shipping Carrier	DHL	Payment terms code	
Shipment date	02/7/2020	Due date	02/09/2020
Sell-to-contact	Frank Collinson	Tracking code	D1578922356

Fig. 6. Example of tracking number assignment for single package order.

See the suggestion of the return order at the fig. 7.

171100005 POSTED RETURN RECEIPT

Document no.	17110600005	Order date	02/09/2020
Order number	ORD-17110600005	Document date	02/09/2020
Shipment date	02/10/2020	Due date	11/7/2020
Sell-to-contact	Frank Collins	Payment discount	0
Reference no.	EXT DOC NO 019283746	Tracking code	D1758212367

SELL-TO ADDRESS

Daughter Emily via
 Frank Collinson
 1156 N. 6th Street
 Brooklyn, NY 12345
 United States

SHIP-TO ADDRESS

Frank Collinson
 128 N. Victory Street
 Stamford, CT 24345
 United States

Item No.	Title	Status	Ship. d.	Qty	UOM	Outst.
AB122348	Product name		11/7/2017	1	piece	1

Fig. 7. Return Order with the tracking-number link, that leads to the GPS tracking map.

4 Results

Looking into Google Analytics and Google Tag Manager it easy to identify the trend of implementation of tracking services and Map integration seriously increases positive feedback and Net Promoters Score of the company.

The authors decided to validate the number of orders submitted by each AB testing and real orders collected by the companies implementing the approach. The only data missing in this comparison are returned orders, however, they are closing the sustainability loop and are more interested in validation of the approach.

Below is provided the analysis of costs involved for implementation of the above use cases (fig 9.)

An interesting case is that comparison of Order tracking and Returns tracking confirm the interest of the audience of getting faster rewards or discounts.

The fact is that impatiently waiting for the order client increases the frequency of visits. However, for Return orders' tracking visits the client is tracking 2 places: where the parcel is delivered and if the discounted rate is added to the account.

Additionally, the analytics disclosed the interesting fact: the trend of returns increased for those platforms, which have good delivery/logistic support with a maximum of integration and respective configuration of the recycling mechanism supported. People are happy to form the return of the old items to get discounts on the new items.

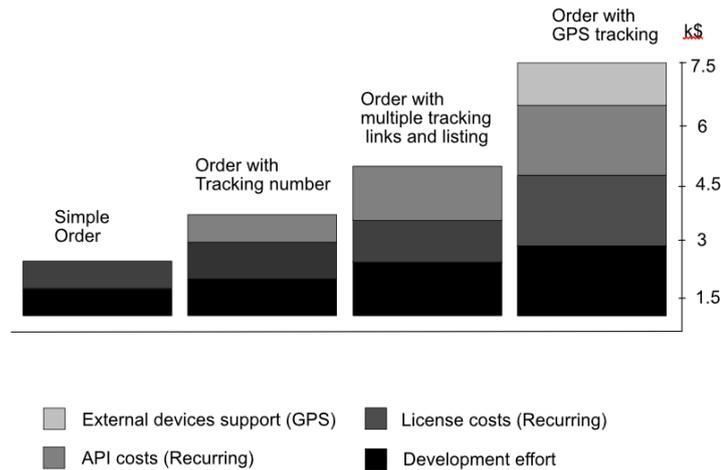


Fig. 8. Costs analysis of use-cases from the perspective of costs involved.

Additionally, the analytics disclosed the interesting fact: the trend of returns increased for those platforms, which have good delivery/logistic support with a maximum of integration and respective configuration of the recycling mechanism supported. People are happy to form the return of the old items to get discounts on the new items.

Looking into the NPS score for 4 cases and their projections to the companies we can compare the NPS score gain within 1 year of implementation as presented in table 1.

Table 1. Customers' satisfaction and NPS score review for NPS range 1-10 for 4 cases of implementation with initial NPS of 3.

The attribute	Simple order	Order with single tracking number	Order with multiple tracking numbers	Order with GPS tracking
NPS range after implementation	3-4	5-6	5-7	6-9
Reasons for NPS increase	Review of the document without printing	Customer tracks the number at the shipment provider site	Customer tracks several orders independently	The customer sees the geolocation of the parcel at the map in real-time.
ROI, %	105	130	140	178

5 Conclusion

As it is seen from the application of different aspects of presentations for delivery services integration with contemporary web-services rises customer's awareness and trust towards the delivery services use in the applications. The integration of different services and turnover of the client and increase of deliveries positively impact the merchant's rates for delivery calculation.

Costs incurred for implementation indicated that companies with lower cases may still apply cases without GPS and still have a sufficient level of customer satisfaction and keep the net promoters' score at an acceptable level.

Usability approaches create a good level of trust in the commercial applications and their sustainability, especially in case of approach when the service vendor supports returns and keeps the same trustworthy channels of returns creation. This is a logical continuation of the approaches described in many recent publications tied to urban freight surveys [2] and transportation complication indications recently published.

Despite no new environmental methods are proposed – that has been proven that clients trust to green companies, that support closed-loop companies allowing making returns and further recycle retrieved items according to their manufacturing cycle and improvement of logistics that impact the CO₂ emission which is the key point of contemporary publications [3,7].

Developed approach and case study is very easy to use in the real industrial case and validate how the change of the flow positively impacts the customer experience.

References

1. Yanchuk V. Gumenyuk A., Tkachuk A integrated add-ons for shipment providers and their connection to the e-commerce solution – Proceedings of II International scientific-practical conference "Computer technologies: innovations, problems, and solutions". – Zhytomyr, – 2017, 17-18
2. Routhier, J. L. (2013). French cities' urban freight surveys. City logistics research: A transatlantic perspective. Conference proceedings 50 Summary of the First EU-US Transportation Research Symposium.(pp.9–14). Washington, DC: Transportation Research Board of the National Academies. doi:10.1108/IJPDLM-01-2016-0008
3. Morganti, E., Dablanc, L., Fortin, F., 2014. Final deliveries for online shopping: The deployment of pickup point networks in urban and suburban areas. Research in Transportation Business & Management, 11, 23-31. doi: 10.1016/j.rtbm.2014.03.002
4. World Economic Forum World Economic Forum <http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf>, last accessed 2020/02/20
5. Esser, K. (2006). B2C E-commerce impact on transport in urban areas. In E. Taniguchi, & R. G. Thompson (Eds.), Recent advances in city logistics (pp. 437–448). Amsterdam: Elsevier doi: 10.1016/b978-008044799-5/50118-2
6. Song, L., Cherrett, T., McLeod, F., Wei, G., 2009. Addressing the last mile problem. Transport impacts of collection and delivery points. Transportation Research Record: Journal of the Transportation Research Board, 2097, 9-18. doi: 10.3141/2097-02
7. Reyes, D., Savelsbergh, M., Toriello, A., “Vehicle routing with roaming delivery locations,” Transp. Res. Part C Emerg. Technol., vol. 80, pp. 71–91, 2017. . doi: 10.1016/j.trc.2017.04.003
8. Visser, J., Nemoto, T., & Browne, M. (2013). Home delivery and the Impacts on the urban freight transport: A review. Urban areas recent advances in city logistics: Proceedings of the VII international conference on city logistics, Bali, Indonesia, June 17–19 (pp. 14–31). doi: 10.1016/j.sbspro.2014.01.1452
9. Taniguchi, E., & Kakimoto, T. (2003). Effects of e-commerce on urban distribution and the environment. Journal of Eastern Asia Society for Transportation Studies, 5,2355–2366.
10. Weltevreden, J.W, 2008. B2c e-commerce logistics: the rise of collection-and-delivery points in The Netherlands. International Journal of Retail & Distribution Management, 36, 8, 638- 660. doi: 10.1108/09590550810883487
11. Schewel, L., & Schipper, L. (2012). Shop 'till we drop: A historical and political analysis of retail goods movement in the United States. Environmental Sciences Technology, 46–18, 9813–9821. doi: 10.1021/es301960f
12. Accenture (2015). Adding Value to Parcel Delivery. www.accenture.com Accessed on 9 Jan 2017.
13. The Digital Enterprise: moving from experimentation to transformation [http://www3.weforum.org/docs/Media/47538_Digital%20Enterprise_Moving_Experimentation_Transformation_report_2018%20-%20final%20\(2\).pdf](http://www3.weforum.org/docs/Media/47538_Digital%20Enterprise_Moving_Experimentation_Transformation_report_2018%20-%20final%20(2).pdf), last accessed 2020/02/20.
14. Digital Learning Environment Manifesto, <http://manifesto.edutainme.ru/en>, last accessed 2020/02/20