LUISS

Department
of Business and Management

Chair of Behavioural Economics and Consumer Decision Making

The last-mile delivery challenge: reducing the environmental impact of e-commerce deliveries

Nudging as a feasible strategy to foster online purchase behaviour

Prof. Giacomo Sillari

SUPERVISOR

Prof. Daniela Teresa Di Cagno

CO-SUPERVISOR

Alessia Romita (715941)

CANDIDATE

.

Academic Year 2020/2021

TABLE OF CONTENTS

Introduction 5

CHAPTER 1 7

1.1 Fast-moving e-commerce 7

1.2 Evaluating the environmental impact of online vs offline purchase process 10

1.3 The last-mile delivery challenge: logistics in terms of financial and environmental costs 15

1.3.1 Feasible solutions that address the last-mile delivery challenge 20

1.3.2 The green delivery option 23

CHAPTER 2 26

2.1 Behavioural economics 26

2.1.1 The concept of "homo economicus" in classical economics theories 27

2.1.2 Individual's rational choice in neoclassical economics theories 28

2.1.3 Individual's choice in the light of behavioural economics 31

2.1.4 Heuristics and biases 38

2.2 Nudge theory and choice architecture 43

2.2.1 Libertarian paternalism 47

2.3 Green nudging 49

2.3.1 Environmental problems and ecological behaviour barriers 50

2.3.2 Traditional environmental policy instruments 52

2.4 Typologies of green nudges 54

2.4.1 Eco-labelling 55

2.4.2 Green defaults 56

2.4.3 Feedback 57

2.4.4 Norm-nudges: descriptive and social norms 58

2.5 Research gap and research question 61

CHAPTER 3 63

3.1 The conceptual model and hypothesis development 63

3.1.1 The effect of different green nudges on sustainable online purchase behaviour 64

3.1.2 The moderating effect of environmental concern in online purchase behaviour 68

3.2 Research Methodology 71

3.2.1 Designing a Scenario-Based Questionnaire 71

3.3 Results 74

3.3.1 Sample description 74

3.3.2 Scale validity and reliability 76

3.3.3 Hypothesis testing 79

3.4 Discussion 83
3.4.1 Theoretical contribution and managerial implication 85
3.4.2 Limitations and future research opportunities 87
Conclusion 88
Appendix 89
Bibliography 100
Sitography 105
Summary 111

LIST OF FIGURES

Figure 1.1: "Retail e-commerce sales worldwide (2014 –2023)"

Figure 1.2: "E-commerce share of total global retail sales (2015 – 2023)"

Figure 1.3: "Significant transportation savings from e-commerce network"

Figure 1.4: "The erosion of company profits by last-mile deliveries"

Figure 2.1: "The individual utility function"

Figure 2.2: "EU energy label for washing machines, old (a) and new (b) design"

Figure 3.1: "Conceptual model"

Figure 3.2: "Product Categories"

Figure 3.3: "OUTPUT SPSS: Scree plot for Environmental Concern scale"

Figure 3.4: "OUTPUT SPSS: Willingness to choose green delivery option in response to Green Nudges, considering different levels of Environmental Concern"

LIST OF TABLES

Table 3.1: "Measurement items"

Table 3.2: "Respondent's profile"

Table 3.3: "OUTPUT SPSS: KMO and Bartlett's Test for Environmental Concern scale"

Table 3.4: "OUTPUT SPSS: Communalities for Environmental Concern scale"

Table 3.5: "OUTPUS SPSS: Total variance explained for Environmental Concern scale"

Table 3.6: "OUTPUT SPSS: Cronbach's Alpha for Environmental Concern scale"

Table 3.7: "OUTPUT SPSS: Inter-Item Correlation Matrix for Environmental Concern scale"

Table 3.8: "OUTPUT SPSS: Item-Total Statistics for Environmental Concern scale"

Table 3.9: "OUTPUT SPSS: Descriptive Statistics"

Table 3.10: "OUTPUT SPSS: Independent-Samples Kruskal-Wallis Test –SR: independent variable – WTCGDO: dependent variable"

Table 3.11: "OUTPUT SPSS: Independent-Samples Kruskal-Wallis Test – Pairwise comparison of SR"

Table 3.12: "OUTPUT SPSS: PROCESS v.3.5 – Model Summary – WTCGDO: dependent variable – SR: independent variable – ECC: moderating variable – GenCat, AgeCat, EdCat: covariates"

Table 3.13: "OUTPUT SPSS: PROCESS v.3.5 – Regression Model –- WTCGDO: dependent variable – SR: independent variable – ECC: moderating variable – GenCat, AgeCat, EdCat: covariates"

Introduction

Today, e-commerce plays a key role. It has been developing in depth throughout the years, redefining the world's business activity. In particular, online shopping is one of the most popular online activities. In recent years, the global expansion of e-commerce has resulted in a dramatic increase in online sales, especially during the COVID-19 pandemic. Since consumers have started to shop more and more online, e-commerce offerings have changed in order to adapt to consumers' wants and needs. As a result, in addition to expanding the number of product categories offered on online platforms, companies have started differentiating their online sales services, including return and home delivery services. In particular, with regard to the latter, fast delivery has been added to the standard home delivery service; it was initially introduced by Amazon and then by all competitors operating in the online environment. This expansion of the offer arises from the need of ensuring an online shopping experience as close as possible to the traditional purchasing process, as well as attractive and advantageous.

Whilst one-day delivery is part of a competitive e-commerce strategy to gain both market share and a larger customer base, it requires an efficient management of logistics activities that undermine the company's profitability. Also, it has a considerable impact on the environment, in terms of greenhouse gas emissions caused by the increased freight transportations necessary to ensure such a timely service. In order to solve or minimise these problems, companies face the so-called "last-mile delivery challenge". Among all the possible solution alternatives, this study aims to analyse one in particular: the introduction of a green delivery option placed in the last step of the online purchase process. The implementation of this new delivery option would require online customers to wait a few extra days to get their purchased orders, thus reducing logistics efforts and the related environmental impact. In this regard, this research seeks to analyse the effect of a powerful and cost-effective strategy that would make final consumers choose sustainable delivery in their purchase process. This strategy relies on the principles of behavioural economics and applies the so-called nudging approach.

So far, past literature has proven the effectiveness of this approach in the field of environmental sustainability, with several experiments showing that the use of green nudges plays a key role in inducing consumers to make sustainable choices during the traditional purchase process. However, few studies analyse the effectiveness of green nudges in the online environment, in particular no research was found for what concerns the use of green nudges to promote a sustainable delivery service for online purchases. In this regard, this research focuses on the effect of four green nudges techniques (eco-label, green default, feedback and social norm) on the consumers' willingness to engage in a sustainable behaviour by choosing the green delivery option when purchase online. In addition, the role of environmental concern in this context will be explored, as a driver that potentially leads consumers to switch from choosing fast or standard delivery to choosing green delivery option.

The results of this research could potentially integrate the existing literature by confirming the power of nudging in influencing individuals' decision-making. Furthermore, logistics and e-commerce companies could

also be interested in this study, as using nudging approach to undertake a business strategy which promote sustainable delivery would lead to benefits in terms of logistics and profits.

In addition, the adoption of such a strategy would have positive effects on the environment, reducing the environmental impact of e-commerce activities, especially that of home delivery services.

What is more, ensuring a sustainable business would help e-commerce to meet the needs of environmentally concerned consumers looking for companies that share their polices, increasing their market share.

Finally, this study would be useful for policy makers and institutions, as it provides them with an additional tool, namely the principles of behavioural economics and nudging, to achieve the common goal of environmental protection.

The present work is articulated in 3 chapters: the first chapter deals with the growth of e-commerce and fast home delivery; it analyses the drivers underlying the last-mile delivery challenge and introduces the green delivery option as a feasible solution to meet the challenge.

In the second chapter, there is an extensive introduction to the principles on which behavioural economy is established, and then the concept of nudging and how it works in the environmental field is discussed (green nudging); furthermore, four green nudges that research focuses on are discussed in detail.

Finally, the third chapter shows the empirical analysis of the primary data collected. The analysis aims at measuring the effect of the four green nudges on the willingness to choose the green delivery option in the online purchase. It also measures the environmental concern of potential consumers who took part in the research. The results of the analysis reported that nudges have a statistically significant effect on the willingness to choose the green delivery option, verifying the main effect. However, environmental concern does not moderate such relationship, even though, as independent variable, it has a significant direct effect on the consumers' purchase behaviour.

CHAPTER 1

E-commerce,
its environmental impact and the opportunities for more sustainable deliveries

1.1 Fast-moving e-commerce

One of the most popular online activities worldwide is represented by online shopping through e-commerce. In more established markets, e-commerce is now the main channel for generating consumption.
Online shopping led e-commerce sales to triple between 2014 and 2019, from 1.3 up to 3.5 trillion U.S dollars (Figure 1.1)[1]. In 2019, e-retail sales represented 14.1% of total global retail sales (Figure 1.2)[2].

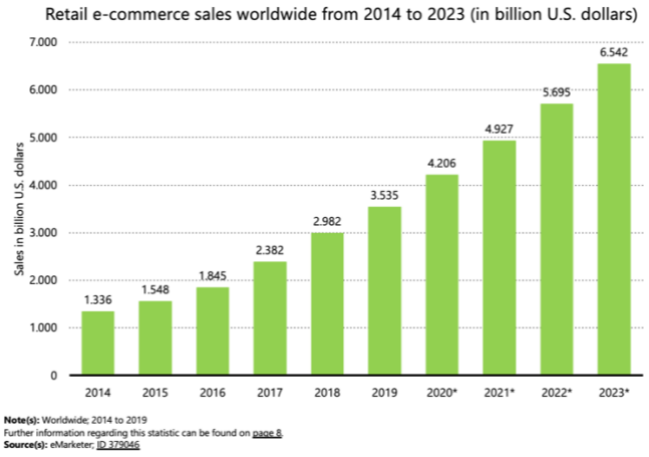


Figure 1.1: "Retail e-commerce sales worldwide (2014 – 2023)"

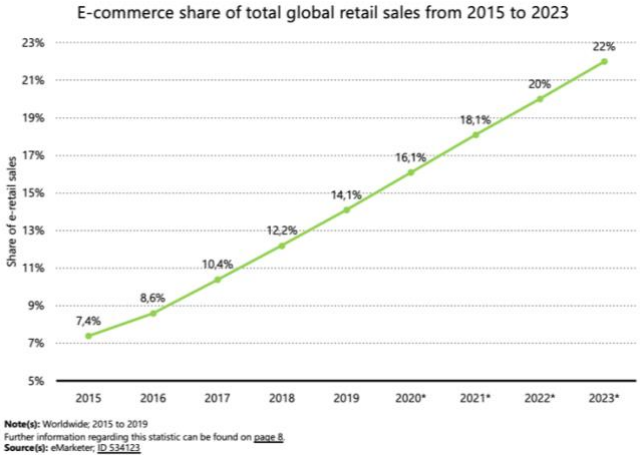


Figure 1.2: "E-commerce share of total global retail sales (2015 – 2023)"

According to the new study of the World Economic Forum, e-commerce has developed so much that, in January 2020, 82% of global consumers had made online purchases in the previous three months. The study forecasts that, between 2019 and 2023, e-commerce will grow by 17%, much more than offline retail, whose growth rate will be 4%[3].
In markets where supply is lagging behind, online is nonetheless taking over important areas of trade growth. Indeed, in Italy, although it represents a small part of overall online and offline purchases, with a penetration rate of 7.3%, e-commerce is now responsible for 65% of overall retail growth. Here, the value of the online purchases in 2019 grew by 15% up to 31.6 billion euros, and the increase in absolute value is the highest ever (4.1 billion euros)[4].

---

[1] eMarketer (2020). Retail e-commerce sales worldwide from 2014 to 2024, Statista.com. Retrieved from: https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/
[2] eMarketer & Vision Monday (2021). E-commerce share of total global retail sales from 2015 to 2023, Statista.com. Retrieved from: https://www.statista.com/statistics/534123/e-commerce-share-of-retail-sales-worldwide/
[3] World Economic Forum (2020). The Future of the Last-Mile Ecosystem. Retrieved from: http://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf, p. 7
[4] Osservatorio eCommerce B2c (2019). L'eCommerce B2c: il motore di crescita e innovazione del Retail!. Osservatori.net. Retrieved from: https://www.osservatori.net/it/ricerche/comunicati-stampa/continua-la-crescita-dellecommerce-b2c-in-italia-gli-acquisti-online-superano-i-31-mld-di-euro-e-il-40-provengono-da-smartphone, p.11

Part of this rapid e-commerce growth is the COVID-19 pandemic, which, besides the impact of lockdown periods, turned out to be a relevant trigger in accelerating the transition towards online purchase. Among the most important data from the Netcomm survey, the online purchase frequency in Italy has increased by 79%, meaning that more than three out of four online shoppers active in September 2020 say they have increased their frequency of online shopping as a result of the Coronavirus outbreak[5]. At the same time, online transactions increased by 15.4%[6]. As a result, in 2020 the online shopping experience in Italy affects 27.2 million individuals[7].

The four top online stores that share sales in the Italian market are represented by Amazon.it, the leading e-commerce, which in 2019 generated net sales of 2896 million U.S. dollars; the leader is followed by Zalando.it, which recorded net sales of 517 million U.S. dollars; third in the ranking is Apple.com, with revenues of 358 million U.S. dollars; finally, it is followed by Shein.com, the fourth biggest online store, with revenues of 296 million U.S. dollars[8]. According to the estimates of first-party net sales of 2020, esselungaacasa.it and unieuro.it outperformed Zalando.it net sales, ousting its second place and causing it to end up being the fourth online store[9].

The exponential growth of e-commerce worldwide has been driven by several factors: among them, we need to take into account the internet penetration, whose global rate is 59.5%, meaning that 4.66 billion people in the world are active internet users; 4.32 billion have access to the internet via mobile devices, with a mobile penetration rate of 92.6%[10]. The Global Ecommerce Overview provided by DataReportal states that 55.4% of internet users purchased a product online via mobile phone[11]. The most recent data about the Italian market have been collected in 2019 and show that 60% of Italian people use the smartphone to shop online[12] and that the value of online purchases from smartphones constitutes 40% of total e-commerce[13].

Moreover, other relevant factors for e-commerce growth are represented by the introduction of competitive prices, the wide range of products sold on online platforms and the increase in the customer base. For what concerns the wide range of product offerings, in addition to the traditional online categories, such as books,

[5] Netcomm (2020). Evoluzione degli acquisti online degli italiani ed effetto del Lockdown sui comportamenti di consumo omnicanale - versione LIGHT. Retrieved from: https://www.consorzionetcomm.it/download/netretail-ottobre-2020-versione-light/, p. 10

[6] Ibidem.

[7] Netcomm (2020). Evoluzione degli acquisti online degli italiani ed effetto del Lockdown sui comportamenti di consumo omnicanale - versione LIGHT. Retrieved from: https://www.consorzionetcomm.it/download/netretail-ottobre-2020-versione-light/, p.3

[8] EcommerceDB.com & Statista (2021). Top online stores in Italy in 2019, by e-commerce net sales", Statista.com. Retrieved from: https://www.statista.com/forecasts/871153/italy-top-online-stores-italy-ecommercedb

[9] Ecommercedb (n.d.). Store Ranking & Overview. Ecommercedb.com. Retrieved from:https://ecommercedb.com/en/ranking/it/all

[10] We Are Social et al. (2021). Global digital population as of January 2021. Statista.com. Retrieved from: https://www.statista.com/statistics/617136/digital-population-worldwide/

[11] Kemp, S. (2021). Global Ecommerce Overview January 2021. Datareportal.com. Retrieved from: https://datareportal.com/reports/digital-2021-global-overview-report

[12] Idealo (2020). Report annuale sull'e-commerce italiano: come si sta evolvendo il commercio digitale nel nostro Paese. Idealo.it. Retrieved from: https://www.idealo.it/dam/jcr:4a9dfdfb-6992-4af2-a23d-54fd0b39738e/2020_ebook_ecommerce_idealo_scarica_gratis_IT.pdf, p. 7

[13] Osservatorio eCommerce B2c (2019). L'eCommerce B2c: il motore di crescita e innovazione del Retail!. Osservatori.net. Retrieved from: https://www.osservatori.net/it/ricerche/comunicati-stampa/continua-la-crescita-dellecommerce-b2c-in-italia-gli-acquisti-online-superano-i-31-mld-di-euro-e-il-40-provengono-da-smartphone, p.13

clothing and electronics, also categories like car spare parts, pet supplies, furniture, baby care and gardening are rapidly entering the online market. According to the World Economic Forum estimates, the product categories are going to increase more and more so that, for instance, the e-grocery is expected to grow by 10% per year[14].

Furthermore, the customer base is expected to reach an amount of 2.1 billion people, in 2021[15]. This increase in the number of customers who are turning to e-commerce to make purchases led to new ways of selling and delivering products. This is due to the ever-changing and demanding consumer wants and needs. During the online decision-making process, consumers evaluate not only the purchasing experience, prices, and product reliability, but also the speed and variety of delivery services, that play an important role. For these reasons, e-commerce has started to develop services to increase the speed of delivery and implement innovative strategies for distribution processes. They are engaging in proposing more and more services with the intention to provide customers with the same support and convenience that they would experience when buying in the physical store. In other words, e-retailers have mainly focused on the last-mile delivery: "*in a product's journey from a warehouse shelf to the back of a truck, to a customer doorstep, the "last-mile" of delivery is the final step of the process — the point at which the package finally arrives at the buyer's door*"[16]. This step is now significant since improving the last-mile experience allows e-commerce to retain customers more effectively. Sure enough, three-quarters of customers are more willing to buy products online if they are provided with satisfying delivery services[17].

The B2C E-Commerce Observatory of the Politecnico di Milano conducted a study on a sample of 80 companies that sell products in Italy and analysed the service offerings in the last-mile delivery step: according to the results obtained, 50% of merchants offer options such as delivery in a given day, delivery to a specified floor or the collection of products by customers at one of the network's shop; 25% of companies deliver on Saturdays, use on-demand delivery dynamically managed by the customers, evening delivery or pick-up at post offices and newsagents; moreover, 8% of merchants, especially in the food industry, employ delivery by their own means; finally, 7% offers customers to pick up their order directly at the store[18].

Globally, in the last-mile environment, even though the standard delivery (from one to five days) continues to be the most used one, same-day and instant delivery are about to grow annually with rates respectively of 36% and 17%[19].

[14] World Economic Forum (2020). The Future of the Last-Mile Ecosystem. Retrieved from: http://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf, p.6
[15] Ibidem.
[16] Dolan. S.(2021). The challenges of last mile delivery logistics and the tech solutions cutting costs in the final mile. businessinsider.com. Retrieved from: https://www.businessinsider.com/last-mile-delivery-shipping-explained?IR=T
[17] Capgemini Research Institute (2019). The last-mile delivery challenge. Retrieved from: https://www.capgemini.com/wp-content/uploads/2019/01/Report-Digital-%E2%80%93-Last-Mile-Delivery-Challenge1.pdf, p. 3
[18] Pontiggia,V. (2018). Logistica eCommerce: l'importanza della consegna ultimo miglio, Blog.osservatori.net. Retrieved from: https://blog.osservatori.net/it_it/logistica-ecommerce-ultimo-miglio
[19] World Economic Forum (2020). The Future of the Last-Mile Ecosystem. Retrieved from: http://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf, p.8

The percentage of e-commerce that offers fast delivery is expected to grow because of the need to provide more convenience to customers. Thus, as e-commerce has started to raise, delivery time has decreased. This is because, according to McKinsey's study, about 46% of people abandoned a shopping cart because the delivery time was too long or not specified, whereas 35% of customers decided not to purchase an item because of a long shipping time.

Besides supporting the increasingly sophisticated demands of consumers, fast delivery resulted to provide e-commerce with a set of relevant benefits. Among them: loyalty increase, higher willingness to pay for faster delivery, an increase in the amount of expenditure and higher purchase frequency. In support of this, the Capgemini Research Institute carried out a detailed analysis of 2.874 consumers in five countries and 500 supply chain managers from large retail firms in nine countries: it turned out that, among customers who are satisfied with delivery service, 74% are going to increase the purchase level of their favoured e-retailer, and 53% are willing to pay a membership for the delivery service[20]. Moreover, 55% would increase their loyalty if provided with a two-hour delivery; this percentage rises up to 61% if consumers are allowed to choose same-day delivery[21].

It all began, when, one of the biggest online retailers, Amazon, in 2005, introduced into the mass market two-day shipping and then, same-day delivery, as a result of subscription of the annual Prime membership. Since then, in order to stay competitive, other e-commerce began to introduce fast delivery options as well (same-day, two-hours, one-hour shipping), which now has become nearly *"as commonplace as online shopping itself"*[22].

1.2 Evaluating the environmental impact of online vs offline purchase process

In recent years, especially during the COVID-19 pandemic, we have been involved into a rapid shift of purchase behaviour toward online stores, since they allow customers to purchase whatever they want, at any time of the day. The exponential growth of e-commerce has been analysed in terms of consequences, or externalities, generated by online shopping for the environment. The online purchase process brings so-called "environmental externalities", defines as the "*un-priced, unintentional and uncompensated side effect of one agents' action, that directly affects the welfare of another*"[23]. The most common environmental externalities are climate change, air pollution, noise pollution and traffic congestion. The persistence of such externalities impedes the development of a good quality of life and sustainable resource management. In the context of online purchase, these issues are stressed by the high rate of deliveries connected to the uptick in online sales.

[20] Capgemini Research Institute (2019). The last-mile delivery challenge. Retrieved from: https://www.capgemini.com/wp-content/uploads/2019/01/Report-Digital-%E2%80%93-Last-Mile-Delivery-Challenge1.pdf, p.13
[21] Id, p.14
[22] Jiang, E. (2016). Is e-commerce really better for the environment than traditional retail?. Businessoffashion.com. Retrieved from: https://www.businessoffashion.com/articles/sustainability/is-e-commerce-really-better-for-the-environment
[23] Manitoba Wildlands (2014). Environmental Externalities. Retrieved from: http://manitobawildlands.org/pdfs/2.6.1-EnvironmentalExternalities-Jan12.pdf, p. 2

The environmental impact of online shopping has been analysed by making a comparison with traditional shopping (also known as offline shopping). The research proposed below studied the worrying aspects of consumer purchase processes in terms of sustainability. In particular, the most relevant elements responsible for greenhouse gases (GHG) emissions are taken into consideration.

In the ProLogis Report of 2019, experts state that "*the key to greater sustainability in retail is reducing the transportation impact […]. Here, e-commerce is substantially more efficient*"[24]. This means that, in both online and offline shopping, parcels' transportation is the main responsible for environmental pollution, therefore the aspect that we should focus on. According to ProLogis, the amount of CO_2 emitted by online purchases is reduced by more than 50% with respect to offline shopping, even if we consider a higher return rate. This is because, when people purchase products online, the customers' orders are consolidated into trucks and vans, which travel along a single delivery route; for what concerns the in-store shopping, instead, we need to consider individual trips of customer's vehicles from their home to the stores and back (Figure 1.3). What is more, the saving in the carbon footprint of parcels' transportation that characterizes online shopping, can be further enhanced through the adoption of electric vehicles (EVs) by delivery companies; this can lead to a reduction in the environmental impact of 15% more than traditional shopping[25].

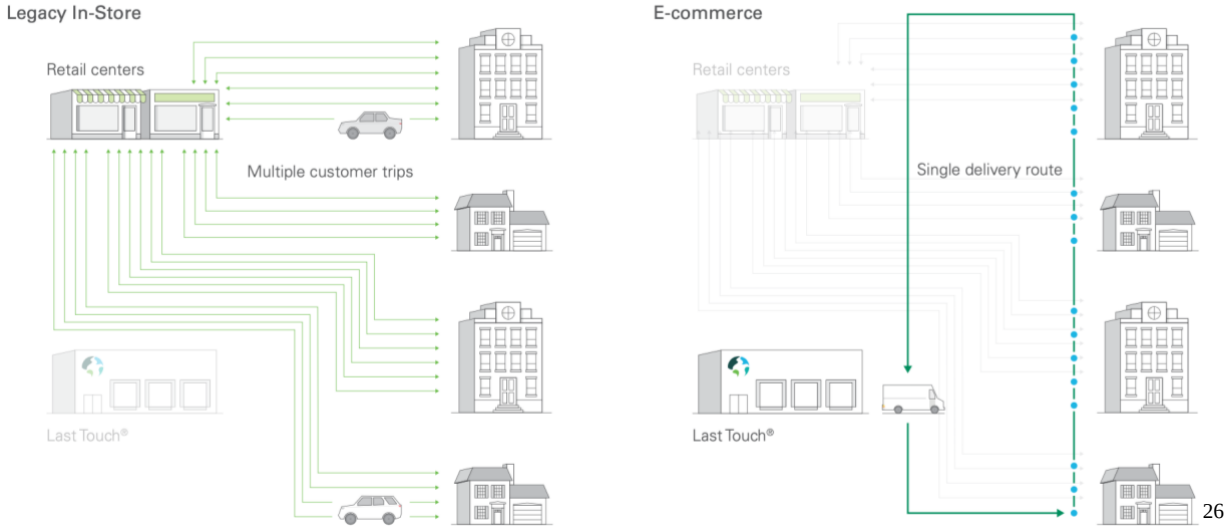


Figure 1.3: "Significant transportation savings from e-commerce network"

From the aforementioned research, it is possible to infer that buying online immediately seem to be a good way to reduce pollution caused by the individual trips of consumers. However, these results are influenced by several factors, such as the product sector of reference, the distance covered by the customer in the purchase process, the structure of the distribution network of reference, the number of deliveries made in a delivery round, the number of items in the shopping basket, and, finally, the rate of return. For what concerns the

[24] ProLogis research special report (2019). Logistics Real Estate and E-commerce Create Sustainability Advantages. Retrieved from: https://prologis.getbynder.com/m/59b2eafd08339273/original/Logistics-Real-Estate-and-E-commerce-Create-Sustainability-Advantages.pdf, p.1

[25] Ibidem.

[26] Id, p.2

product sector, in clothing, for example, the environmental impact of online purchases is around 20% lower than that generated by traditional sales, while in publishing and IT the saving would reach around 30%[27].

It is worth mentioning the results of other studies to have a complete view of the issue.

The B2C E-commerce Observatory of the Politecnico di Milano collaborated with the B2C Logistic Center to develop a model that quantifies the amount of CO_2 (kg CO_2e) emitted by online and offline purchases, specifically in apparel industry. The strength of this study is that it takes into account the entire purchasing processes and their environmental impact, rather than considering only specific phases, such as the last-mile delivery. First of all, the experts defined the main basic activities that compose both offline and online purchase processes. Concerning the online purchase, the following activities were identified: pre-sale and sale, order picking and assembly, delivery and post-sale. Instead, the offline purchase is composed of store replenishment, pre-sale and sale, delivery and post-sale.

Then, the study proposes a model to measure the environmental impact (in terms of CO_2e) of all the activities involved in both the purchasing processes. Lastly, this model is applied to the product industries such as apparel, large-scale retail, IT, publishing business and others. This accurate study returned that online purchase is on average more environmentally sustainable than offline purchase[28]. However, several parameters should be taken into account in the online case, in particular the location of the consumer's house and customer profile. If the consumer's house is inside the city centre, then the online purchase is more sustainable than the offline. The main reason is based on delivery density: if the courier has to deliver inside the city centre, he is able to make more drops in a given timeframe with shorter distances to be travelled between two consecutive stops; otherwise, in the extra-urban areas the distances increase, which means that the number of drops in the same timeframe decreases. This result highlights that logistic activities, such as the last-mile delivery, is the most critical step of the process from an environmental sustainability point of view.

The second parameter taken into account is the customer profile and its extra-activities in the post-sale phase, more specifically the ease of return of the product purchased: the easier is it for the customer to return a product that does not meet his/her needs, the higher the environmental impact of the online purchase process in terms of CO_2 emissions; the latter is a direct consequence of the increasing number of travels necessary to collect and redeliver the new order to the final customer.

In the offline case, the main variable is the distance between the consumer's house and the store, due to the impact of customer travel to and from the store. The offline purchase is more sustainable than the online purchase only when the consumer's house is very close to the store, meaning a distance less than 1 to 5 km[29].

To sum up, according to this study, the online purchase process has a lower environmental impact than the offline one when the consumer's house is inside the city centre, regardless of the distance between the

[27] D'Agostino, E. (2020). Acquisti online o in negozio? Il vero impatto dell'e-commerce sull'ambiente. Thegreenevolution.vaillant.it. Retrieved from: https://thegreenevolution.vaillant.it/acquisti-online-o-in-negozio-il-vero-impatto-delle-commerce-sullambiente/

[28] Mangiaracina, R., Perego, A., Perotti, S., & Tumino, A. (2016). Assessing the environmental impact of logistics in online and offline B2C purchasing processes in the apparel industry. International Journal of Logistics Systems and Management, 23(1), 98-124

[29] Id, pp.116,118.

consumer's home and the store. However, the online purchase is not always better than the offline, since the latter is preferred when the distance between the consumer's house and store is very small.

As we have seen, since each situation is unique, it is hard to tell that e-commerce is always more environmentally sustainable than a traditional purchase. Still, many other conditions have to be taken into account.

Previous studies have defined three several archetypes in order to study the environmental impact of different shopping behaviours: the Traditional shopper, the Cybernaut and the Modern shopper[30].

The "Traditional shopper" leads the shopping journey entirely offline, without ever turning to e-commerce; according to research from MIT's Center for Logistics and Transportation, this shopper's travel is responsible for more than 75% of greenhouse gas emissions in the offline purchase process, generating on average 3.1 kg of carbon dioxide per journey[31].

The "Cybernaut" leads his shopping journey entirely online, generating a reduction of greenhouse gas emissions and a carbon footprint 50% lower than the Traditional shopper[32].

Finally, the "Modern shopper" is a hybrid between the two previous categories, because it involves both physical and online stores: this shopper's category tends to check products in the physical store to end his shopping journey on an online purchase platform. Doing so, the modern shopper surges the environmental impact of his shopping behaviour, by increasing the carbon footprint of transportation. This makes the CO_2 emissions reduction related to the online final purchase to be useless. By making it clearer, the Modern shopper is responsible for the transport-related emissions of 1 kg of carbon dioxide (over a third of the shopper's total carbon footprint)[33].

Afterwards, P. Van Loon et al., by studying the variability of consumer shopping behaviour, confirm that online shopping is often not a substitute for consumers moving to physical stores. Most importantly, other critical variables related to shopping behaviour are considered: they study how the consumers' choice of basket size affects the sustainability of e-commerce[34]. Also, they address the environmental impact of e-fulfilment methods for different basket sizes. According to this, the emissions per item delivered are inversely related to the basket size, without considering the choice of e-fulfilment method: therefore, the best sustainable strategy could be to maximize the basket size[35]. In addition, the different fulfilment methods play an important role in the CO_2 emissions per item[36]. The study makes a distinction between, on the one side, parcel deliveries and van-based deliveries from local stores, and, on the other side, van-based deliveries from centralized warehouses. The former is a method more suitable to deliver items in a small basket because items can be

[30] Jiang, E. (2016). Is e-commerce really better for the environment than traditional retail?. Businessoffashion.com. Retrieved from: https://www.businessoffashion.com/articles/sustainability/is-e-commerce-really-better-for-the-environment
[31] Ibidem.
[32] Ibidem.
[33] Ibidem.
[34] Van Loon, P., Deketele, L., Dewaele, J., McKinnon, A. & Rutherford, C., 2015. A comparative analysis of carbon emissions from online retailing of fast moving consumer goods. Journal of Cleaner Production, 106, pp.478-486, p.478
[35] Id, p.483
[36] Ibidem.

combined and delivered in the same neighbourhood, travelling shorter distances[37]. This will allow minimizing the CO_2 emissions. If larger baskets were delivered by parcel-based fulfilment methods, they would be split into smaller deliveries as to increase the shipment speed, being more pollutant and less attractive than methods able to make delivery combinations. On the other side, van-based deliveries from centralized warehouses are more suitable for larger baskets because of the e-fulfilment centre efficiency that exceeds the increasing delivery distances[38].

Furthermore, M. Jaller and A. Pahwa study the environmental impact of e-commerce transportation in terms of vehicle miles travelled (VTM) and emissions[39]. They discuss the previous research assumptions regarding the potentiality of e-commerce to reduce the negative externalities that come from shopping. Firstly, they analyse the purchase behaviours of US consumers, considering online shopping in relation to the in-store one, that is, whether online shopping substitutes, complements or modifies traditional shopping. Online shopping substitutes the traditional one when it replaces purchases in the physical store; instead, the complementary effect occurs when the customer journey takes place partly online and partly in the physical store; then, it can also happen that online shopping modifies the mode, time and duration of the offline purchase process.

After analysing different shopping behaviour and the simulation of shopping-related travel, the research concludes that if all individuals chose to replace in-store shopping with online, then a potential 87% reduction in VMT is possible[40]. These results show that online shopping is able to reduce the negative externalities that characterize in-store shopping, such as VMT and emissions. This reduction is possible thanks to the orders' consolidation into trucks and vans, which reduce the number of deliveries to the final customer. However, the efficiencies of online shopping and logistic-related strategies are counteracted by the introduction of a relevant variable: fast delivery. The use of same-day delivery or services as two- and one-hour delivery dramatically reduces the consolidations levels, since more frequent shipments split occur; this leads to an increase in the number of deliveries per tour and, consequently, the vehicle miles travelled rise, augmenting the transportations' negative externalities.

Studies have clearly shown that, due to freight transportation, the logistics activities in online shopping, especially the last-mile delivery phase, are the most critical component of the purchase process, in terms of sustainability. Additionally, to speed up the transportation of orders through fast delivery, such as providing the same-day option, leads to an increase in extra emissions of carbon dioxide that account for 0.75 kg for each shopper[41]. This estimate exceeds more than double that of the emissions expected by non-expedited delivery methods; and thus, the use of fast delivery offsets the environmental benefits of not driving to the physical store.

[37] Ibidem.
[38] Ibidem.
[39] Jaller, M., & Pahwa, A. (2020). Evaluating the environmental impacts of online shopping: A behavioral and transportation approach. Transportation Research Part D: Transport and Environment, 80, 102223, p.2
[40] Id, p.14
[41] Jiang, E. (2016). Is e-commerce really better for the environment than traditional retail?. Businessoffashion.com. Retrieved from: https://www.businessoffashion.com/articles/sustainability/is-e-commerce-really-better-for-the-environment

Summing up, e-commerce is a more sustainable solution as long as standard delivery is preferred to fast delivery.

Finally, as it is clear that one of the most relevant factors that makes e-commerce unsustainable is same-day or fast delivery, a relevant issue needs to be considered: if, on the one side, it satisfies actual customers' needs, on the other side, it collides with the company's mission of being sustainable for the environment. That is why, henceforth, we will address this issue by referring to the so-called "last-mile delivery challenge", that is the struggle of e-commerce in trying to provide consumers with a satisfying purchase and delivery experience, being environmentally sustainable and, at the same time, ensuring profitability.

1.3 The last-mile delivery challenge: logistics in terms of financial and environmental costs

"The goal of last-mile delivery logistic is to deliver the packages as affordably, quickly and accurately as possible"[42]. Online companies aim at optimizing this logistic step in terms of both profitability and costs.

The e-commerce growth is shifting the market share from B2B to B2C[43]. For this reason, consumers' attitudes, preferences and purchase behaviours have become a relevant component to analyse in order to implement a successful business strategy, whose key differentiator is the last-mile.

The first aspect of the last-mile delivery challenge is related to the attempt to find a balance between customer satisfaction and delivery cost in the supply chain[44].

From the customer point of view, expectations related to the online purchase experience, are high and rising. Consumer demands concern not only product quality, product differentiation and the opportunity to compare several offerings in the online store; but, today, also delivery time is changed, since people ask for their purchases immediately.

According to the Capgemini Research Institute study already mentioned, 55% of consumers are more likely to switch to a competitor if it offers a faster delivery service[45]. The Net Promoter Score given to the delivery services analysed in the study was, on average, minus nine. The main reasons dissatisfaction reflected in a negative score, were the delivery price, the lack of same-day delivery and delivery delays. Then, the concept of satisfaction and service delivery is a sort of virtuous circle: the more consumers are satisfied with their shopping experience and delivery, the more they adopt new services, such as paid memberships. This uptick in consumers' satisfaction, i.e., the Net Promoter Score, in turn, results in an increase in average spending, purchase frequency, and subsequently, loyalty in the long-term[46]. Indeed, on the one hand, e-retailers have to make sure that online services are affordable and agile to be appreciated by customers. Therefore, to support

[42] OptimoRoute (2021). What Is Last Mile Delivery? Costs & How to Optimize. OptimoRoute.com. Retrieved from: https://optimoroute.com/last-mile-delivery/

[43] EyeforTransport Ltd (2020). Supply Chain Last Mile Report. Retrieved from: https://discover.3ds.com/supply-chain-last-mile-report-2020, p.3

[44] Id, p.4

[45] Capgemini Research Institute (2019). The last-mile delivery challenge. Retrieved from: https://www.capgemini.com/wp-content/uploads/2019/01/Report-Digital-%E2%80%93-Last-Mile-Delivery-Challenge1.pdf, p. 7

[46] Id, p.18

the increase in online sales and the consumers' expectations of delivery times, e-commerce companies need to improve their delivery logistics so that they can move more products at a faster pace.

On the other hand, e-retailers have to implement a successful logistics strategy in order to be profitable, while maintaining strong customer satisfaction. From the e-commerce point of view, one of the biggest challenges to be faced in the last-mile delivery is related to the reduction of logistics costs: today, the costs related to the last-mile delivery accounts for 53% of the total delivery costs[47]. Due to this, they represent the biggest cost driver in the supply chain.

As customers have increased the use of online stores, the expectation related to free and fast deliveries has increased, and the number of parcels delivered as well; the more the online orders are, the more stops drivers have to do, which means more complex routes and more time on the road. To face this issue, businesses have to increase the number of vehicles and drivers to deliver products purchased. Moreover, since fast delivery has become a "must-have" feature for online purchases, people are less willing to pay for that service so that companies have to bear the cost on their own. By doing so, they charge customers less than the amount they should pay to fulfil the orders. The Capgemini Report has broken down the last-mile delivery cost: according to the research, organizations spend on average 10.1 U.S. dollars, whereas the customers averagely are charged with 8.08 U.S. dollars[48].

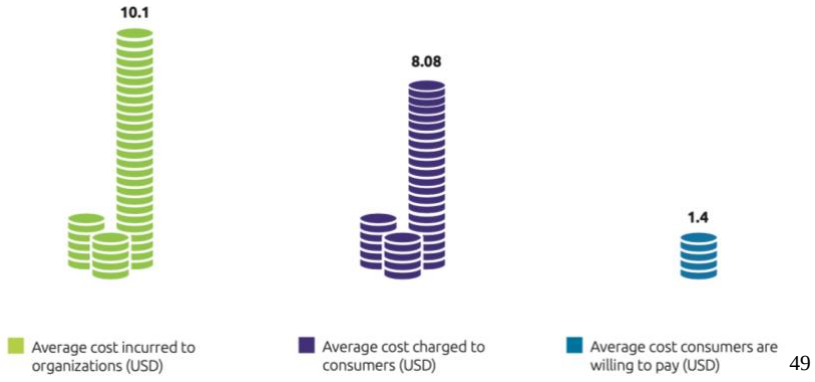


Figure 1.4: "The erosion of company profits by last-mile deliveries"

These estimates concern the most frequently transported parcels, i.e., the small ones. But for large parcels, the costs estimate rise to more than 50 U.S dollars per parcel[50]. Worse, by taking into account the average driver's salary, warehousing, fuel, and vehicle maintenance, it is easy to understand the extent of the delivery cost problem.

Since the company has to face these costs, for the business to be able to grow, it has to increase the average number of deliveries per hour for each driver. On the flip side, by boosting the number of packages delivered every day, the challenge becomes more complex, because of the increasing relevance of factors that contribute

[47] Dolan, S.(2021). The challenges of last mile delivery logistics and the tech solutions cutting costs in the final mile. Business Insider.com. Retrieved from: https://www.businessinsider.com/last-mile-delivery-shipping-explained?IR=T
[48] Capgemini Research Institute (2019). The last-mile delivery challenge. Retrieved from: https://www.capgemini.com/wp-content/uploads/2019/01/Report-Digital-%E2%80%93-Last-Mile-Delivery-Challenge1.pdf, p. 21
[49] Ibidem.
[50] Hochfelder, B. (2017). What retailers can do to make the last mile more efficient. Supplychaindive.com. Retrieved from: https://www.supplychaindive.com/news/last-mile-spotlight-retail-costs-fulfillment/443094/

to the overall last-mile delivery cost. Among them, the first is represented by the impact of both the average speed and the fuel efficiency: by delivering thousands of packages inside the city, the traffic congestion makes drivers spend a lot of time on the road, costing far more in fuel. Going on, the idling time represents another factor: traffic lights, various types of roads and other vehicles on the streets, unavoidably slow the driver's pace by consuming both fuel and time for which the driver has to be paid. The third relevant element to be considered is the failed delivery: according to PCA Predict research in UK, Germany and US, the average cost of a failed delivery to a retailer is about 17.78 U.S. dollars, and 5% of all last-mile deliveries fail[51]. This issue is related to several reasons: for instance, when, selecting same-day delivery, the package arrives late, there is no prior notification of the delivery, the customer does not expect the order, the address provided is wrong or when there is no delivery time window specified. In addition, out of planned route miles represent another cost for the last-mile delivery logistic, since they account for 3% to 10% of a driver's total mileage[52]. Also, the percentage of delivery return rate significantly influences the last-mile logistics costs. According to Statista, among the Europeans most used to returning orders, Germany and Netherlands rank first and second, recording a percentage of returns equal to 53% and 52%, respectively[53]. This means that, here, more than half of the population send at least one product purchased back to an online store. Unfortunately, Italy does not perform better, since, here, 43% of people return at least one delivered package. The three main reasons for consumers to return a product are faulty or damaged goods, products different described online and poor quality[54]. Worse, according to the data collected by Pitney Bowes Report, 41% of customers admit to *"bracketing"*, meaning that they buy multiple versions of a product online with the intent of returning the ones that do not work[55].

All the factors aforementioned contribute to the increase of the total last-mile delivery costs, representing a pressure on the budget of companies that are suffering from marginal profits.

Moving further, the second aspect of the last-mile delivery challenge faced by e-commerce is related to the attempt to reduce as much as possible the environmental impact of the last-mile logistics.

According to the World Economic Forum, as online sales are going to increase, the demand for last-mile deliveries is expected to grow by 78% globally by 2030[56].

[51] Retailweek (2018). Counting up the cost of failed deliveries. Retail-week.com. Paid for post by PCA Predict (2018). Retail-week.com. Retrieved from: https://www.retail-week.com/retail-voice/counting-up-the-cost-of-failed-deliveries/7028019.article?authent=1

[52] Hochfelder, B. (2017). What retailers can do to make the last mile more efficient. Supplychaindive.com. Retrieved from: https://www.supplychaindive.com/news/last-mile-spotlight-retail-costs-fulfillment/443094/

[53] Best, R. (2019). The Return of the Package [Digital image]. Statista.com. Retrieved from: https://www.statista.com/chart/16615/e-commerce-product-return-rate-in-europe/

[54] UPS. (2019). Reasons for returning online purchases according to online shoppers worldwide as of January 2019. Statista.com. Retrieved from: https://www.statista.com/statistics/348087/order-return-rates-worldwide/

[55] Pitney Bowes. (2019). "Pitney Bowes Online Shopping Study 2019". Retrieved from: https://www.pitneybowes.com/content/dam/pitneybowes/us/en/ecommerce/shopping-study/2019-global-ecommerce-report-v3-web.pdf, p. 19

[56] World Economic Forum (2020). The Future of the Last-Mile Ecosystem. Retrieved from: http://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf, p.6

The first element that contributes to the increase of this data is urbanization. The global population will reach 8.5 billion in 2030[57]. The more the global population increases, the more it is concentrated in the cities, by rising the urban density; the latter is responsible for traffic congestion and global emissions. Indeed, cities are deemed to account for 70% of global emissions. In this context, rising delivery vehicles disproportionately contribute to the amount of CO_2 emitted, if compared to individual passengers' cars[58]. Estimates of the World Economic Forum expect the number of vehicles to increase by 36% by 2030 in the top 100 cities. Consequently, the traffic congestion will rise by 21% and the emission from delivery traffic will increase by 32%[59].

Another factor with a relevant impact on the last-mile delivery demand is the increasing need for speed deliveries, which have been demonstrated to be critical in the environmental field. The increasing vehicles used by companies allows supporting the consistent demand for same-day and instant delivery, which grow by 36% and 17% annually, respectively[60].

As has already been explained, the advantage of online shopping, in terms of sustainability, disappears if the shopper selects fast delivery. This happens because, by considering a standard delivery, e-retailers are allowed to consolidate products on vans and trucks, that travel on a single route to deliver them to a bunch of final customers; but, if we consider a reduction in the delivery time and offer same-day delivery, the situation is different: here, e-retailers have to decrease the number of parcels to drop off per mile, because they need to manage deliveries in smaller time windows; this problem is faced by increasing the number of vehicles that, in order to deliver parcels as soon as possible, do not have time to fill up and therefore run half-empty. To give an example, available data shows that 39% of the delivery vans in London use just 25% of their maximum capacity[61]. Such condition involves the lack of optimization, in terms of both capacity and route travelled and therefore leads to higher greenhouse gas emissions. Thus, to clearly understand the impact of this kind of online business model, one only needs to think that Amazon, the leader of fast delivery, serves 72% of all customers within 24 hours and manages 20,000 delivery vans[62]. In 2019, the company released a report with details about its environmental impact: it showed that in 2018, it emitted 44 million metric tonnes of carbon dioxide equivalents into the atmosphere, which is approximately the annual emissions of Norway[63].

Moreover, the pressing need to deliver quickly combined with the inability to optimize routes let companies end up using air freight, which is highly more impactful than ships, trains and ground transportation: the

[57] Id, p.7
[58] Ibidem.
[59] Id, p.5
[60] Id, p.8
[61] Trimble Smartdelivery (2019). The Impact of Green Delivery on Customer Satisfaction. Smartdelivery.trimble.com. Retrieved from: https://smartdelivery.trimble.com/the-impact-of-green-delivery-on-customer-satisfaction/
[62] Ibidem.
[63] Reynodls, M. (2020). Jeff Bezos wants to fix climate change. He can start with Amazon. Wired.co.uk. Retrieved from: https://www.wired.co.uk/article/jeff-bezos-climate-change-amazon

logistic company UPS, in 2018, was responsible for increasing emissions by 6% up to 14.6 million tonnes, part of which was related to the increased use of aircraft[64].

We can therefore argue that accelerating delivery times not only results in a great strain on the budget but also, leads to an increase in greenhouse gas emissions from e-commerce and logistics companies that fulfil deliveries[65].

Besides the fast deliveries, also unsold or returned products surge the last-mile delivery environmental impact. On average, ecommerce return rates are 3 times higher than those of brick and mortar.[66] According to the logistics company Optoro, in 2020, e-commerce globally generated a value of 428 billion U.S dollars of inventory returned, which turned to almost 5.8B lbs. of returns ending up in landfills; in addition, the transportation of these returns is responsible for the emissions of 16 million metric tonnes of CO_2[67].

In light of these environmental issues, a new era of sustainability is rising. Recently, people have realized the need to face several big environmental problems such as climate change, plastic pollution, air pollution and so on. As a result, they have begun to express increased concern about the environmental impact of their daily activities. In 2019, 77% of people worldwide confessed to worrying about the impact of human activities on the planet[68]. This is then reflected in 68% who try to live eco-consciously[69]. Moreover, if we consider Italian people, according to a survey carried out by Statista, 90% of Italians agree about to the individual's real impact on the protection of the environment[70].

More specifically, for what concern sustainability of shopping habits, consumers have become more aware of the hidden environmental costs associated to the purchase processes: today, consumers are trying to adjust their shopping habits, by looking for companies that share their sustainability values. In a Nielsen survey, 81% of global consumers believe that firms should develop strategies to protect the environment[71]; they ask companies to be transparent in terms of goals and corporate policy, especially with regard to the environmental field[72].

Considering this, as e-commerce growth has been accentuated by the COVID-19 pandemic, the concern about the impact of last-mile delivery logistics is also becoming increasingly relevant in terms of sustainability. During their online decision-making process, consumers are gradually showing a growing interest in the use

[64] Abboud, L. and Hodgson, C. (2019). Climate costs mount as retailers compete on fast delivery". Ft.com. Retrieved from: https://www.ft.com/content/2f7203dc-1b63-11ea-97df-cc63de1d73f4

[65] EyeforTransport Ltd (2020). Supply Chain Last Mile Report. Retrieved from: https://discover.3ds.com/supply-chain-last-mile-report-2020, p.17

[66] Optoro (2021). Impact Report: Powering Resilient Retail 2020. Retrieved from: https://info.optoro.com/hubfs/The%20Optoro%202020%20Impact%20Report.pdf, p. 4

[67] Ibidem.

[68] Lampert, M., Metaal, S., Liu, S. & Gambarin, L. (2019). Global rise in environmental concern. Retrieved from: https://www.courthousenews.com/wp-content/uploads/2019/08/ClimateChangeGlocalities.pdf, p.4

[69] Id, p.9

[70] Statista (2020). Environment in Italy. Retrieved from: https://www.statista.com/study/47118/environment-in-italy/, p. 26

[71] CPG, FMCG & Retail (2018), Global Consumers Seek Companies That Care About Environmental Issues. Nielsen.com. Retrieved from: https://www.nielsen.com/eu/en/insights/article/2018/global-consumers-seek-companies-that-care-about-environmental-issues/

[72] Enright, T. (2019). The Need for Supply Chain Multispeed and Sustainability in Retail's Shipping Practices. Gartner.com. Retrieved from: https://www.gartner.com/en/documents/3975547/the-need-for-multispeed-and-sustainability-in-retail-s-l, p. 7

of plastics, paper and landfill-destined materials; therefore, they are increasingly concerned about packaging materials for orders purchased online, the delivery options and the related CO_2 emissions.

In the online market, e-retailers are becoming aware of environmental issues as well. According to the Supply Chain Last Mile Report 2020, 27% of retailer, eTailer and brand respondents consider the environmental impact of the logistics process as one of the three main priorities of 2020[73]; the 29% established targets to reduce their environmental impact[74], and the 10% use their business' sustainable attitude as a key differentiation element in the related market[75]. However, 34% of firms have no internal target other than the ones set by the law[76].

These data show the e-commerce's positive attitude toward the attempt to make the online purchase process more sustainable. Hence, this is where the real challenge comes in: indeed, to reduce the environmental impact and optimize the last-mile logistics, e-commerce are going to rethink their delivery strategies by implementing innovative profitable solutions that offer sustainability-related fulfilment services.

1.3.1 Feasible solutions that address the last-mile delivery challenge

The main goal of e-retailers consists of cutting down the delivery costs, in order to implement profitable rapid fulfilment methods: this improvement will enable them to compete with the main leaders of speed delivery, among which is the well-known Amazon. In this regard, according to Gartner, cost optimization is one of the top five priorities that retailers want to focus on. In addition, in order to gain a competitive advantage and guarantee a flawless customer experience, retailers aim also at revenues and business growth, digital initiatives and operational challenge[77].

On the other hand, customers are waking up to the urgency of the environmental crisis and, due to the increasing impact of online stores deliveries, they are modifying their habits by engaging in more sustainable shopping behaviours. Therefore, they are moving towards companies that share sustainable policies and help them to behave eco-consciously. As a result, besides profitability, e-retailers aim at being sustainable, while meeting customers' demands. In order to accomplish this goal, online companies have started to implement last-mile innovations. More specifically, the literature review defines three main categories of last-mile innovations: organizational, technology-enabled, and data-technique-enabled[78]. The mentioned innovations can be developed to mitigate the negative externalities and contribute to improving not only profitability but also to the environmental sustainability of the last-mile delivery step in the online purchase process.

[73] EyeforTransport Ltd (2020). Supply Chain Last Mile Report. Retrieved from: https://discover.3ds.com/supply-chain-last-mile-report-2020, p.6
[74] Ibidem.
[75] Ibidem.
[76] Ibidem.
[77] Gartner.com (2019). Retrieved from: https://www.gartner.com/en/supply-chain/insights/retail-supply-chain-management
[78] Viu-Roig, M., & Alvarez-Palau, E. J. (2020). The Impact of E-Commerce-Related Last-Mile Logistics on Cities: A Systematic Literature Review. Sustainability, 12(16), 6492, p. 3.

Among the organizational innovations, we find the urban consolidation centres; the technological innovations concern innovative vehicles, automated lockers, and robots; instead, examples of data techniques refer to data mining, data analytics, big data, which allow improving efficiency and effectiveness of the last-mile logistics[79]. The above categories of innovations will be broadly explored; then, an additional option, which has not yet been studied in-depth, will be proposed, that is the green delivery option.

The first category analysed is the organizational one, which focuses on the Urban Consolidation Centres (UCC). This term refers to *"a logistics facility that is situated in relatively close proximity to the geographic area that it serves be that a city centre, an entire town or a specific site (e.g., shopping centre), from which consolidated deliveries are carried out within that area"*[80]. UCC can be considered as intermediate distribution points and enable companies to consolidate parcels and distribute them jointly with the shortest routing distances[81]. This alternative is both economic and environmentally sustainable: it aims at preventing vehicles to make deliveries in urban areas not fully loaded, therefore it maximizes the utilization of vehicles capacity thanks to the consolidation of orders; what is more, it reduces truck trips, vehicle traffic, the miles travelled and therefore energy consumption and emissions[82].

The second category analysed is the technological one, which includes innovative vehicles. Among them: electric vehicles (EV), hybrid vehicles, Fuel Cell Electric Vehicles (FCEVs) and Electric L-category Vehicles (EL-Vs), such as mopeds, motorbikes and quad; in addition, we consider also autonomous, semiautonomous and Unmanned Aircraft Vehicles (UAVs), also called drones. All the aforementioned technological innovations are able to drive a reduction in environmental externalities, meaning that represents a decrease in the carbon footprint. Firstly, by replacing the conventional internal combustion engine (ICE) with electric vehicles (EVs), it is possible to immediately eliminate all toxic emissions of nitrogen oxides (NOx), carbon monoxide (CO) and hydrocarbons (HC)[83]. The main drawback of the EVs is battery autonomy, which is lower than 150 km, and the charging time[84]. However, according to the ProLogis Report, over 90% of the trips per parcel delivered are within a 100-mile range: thus, it is a feasible distance for such sustainable vehicles, which increases the potential to significantly reduce the environmental impact of transportation for e-commerce[85]. Moreover, studies show that autonomous vehicles (AV) are expected to reduce greenhouse gas emissions approximately by 40-60%[86]. However, in terms of profitability, the study of McKinsey and Company found

[79] Id, pp.3,4
[80] Browne M., Sweet M., Woodburn A., Allen J. (2005). Urban freight consolidation centers- final report. Prepared for the Department for Transport London by Transport Studies Group. University of Westminster, London, p. 4
[81] Lin, J., Chen, Q., & Kawamura, K. (2016). Sustainability SI: logistics cost and environmental impact analyses of urban delivery consolidation strategies. Networks and Spatial Economics, 16(1), 227-253, p. 231
[82] Id, p.250
[83] Krajinska, A. (2021). Electric vehicles are far better than combustion engine cars when it comes to air pollution. Here's why. Transportenvironment.org. Retrieved from: https://www.transportenvironment.org/newsroom/blog/electric-vehicles-are-far-better-combustion-engine-cars-when-it-comes-air-pollution
[84] Ranieri, L., Digiesi, S., Silvestri, B., & Roccotelli, M. (2018). A review of last mile logistics innovations in an externalities cost reduction vision. Sustainability, 10(3), 782, p. 7
[85] ProLogis research special report (2019). Logistics Real Estate and E-commerce Create Sustainability Advantages. Retreived from: https://prologis.getbynder.com/m/59b2eafd08339273/original/Logistics-Real-Estate-and-E-commerce-Create-Sustainability-Advantages.pdf,p.3
[86] Igliński, H., & Babiak, M. (2017). Analysis of the potential of autonomous vehicles in reducing the emissions of greenhouse gases in road transport. Procedia engineering, 192, 353-358, p. 357.

that, whilst EVs do not allow for significant cost savings, AVs allow for delivery costs reduction of about 10-40%[87].

Another technological innovation is represented by proximity stations or points**.** They are defined as a *"depot station where goods can be stored when the customers are not at home until they can pick them up"*[88]. They are similar to the parcel lockers that can be implemented as points where customers pick the parcel and pay for the order simultaneously; they can be especially automated lockers that can be opened with a code sent to customers by email. This strategy is efficient and effective in economic and environmental terms since the parcel can be delivered during the night, when there is no traffic, the travel distances can be minimized, and the problem of failed deliveries is avoided[89].

Moreover, the challenge of last-mile delivery is also being met by the introduction of robots. Even here, the advantage is twofold: investing in robots, that perform repetitive tasks, allows companies to save the cost of human labour, being more profitable; robots also are able to perform a green delivery thanks to the implementation of electric robotic vehicles[90].

To mitigate the carbon footprint and the costs generated by last-mile delivery, we need also to take into account the third category of innovations, namely the data technique. Using and sharing data is fundamental to develop and implement effective interventions. Therefore, it is necessary to shift towards software solutions that analyse the data collected and enable the use of real-time routing and solutions related to tour planning[91]. As a result, the route optimization software could be implemented for this purpose.

"Route optimization is the process of finding the shortest and most cost-efficient route to handle a list of deliveries"[92]. The success of this process depends on several factors, such as the customers' locations, total stops, the time windows, the customer wants to be served, the driver or vehicle capacity that delivers the parcel and the traffic congestions on the roads[93].

Since considering all these constraints manually is extremely time-consuming, implementing route optimization software could help the e-commerce or logistic company to improve the business efficiency. Therefore, the software helps to speed up the delivery rate, increasing productivity and ensuring the shipment of packages on-time to final customers; this, in turn, will yield a higher customer satisfaction[94]. In addition,

[87] McKinsey & Company (2018). Fast forwarding last-mile delivery - implications for the ecosystem. Retrieved from: https://www.mckinsey.com/~/media/mckinsey/industries/travel%20logistics%20and%20infrastructure/our%20insights/technology%20delivered%20implications%20for%20cost%20customers%20and%20competition%20in%20the%20last%20mile%20ecosystem/fast-forwarding-last-mile-delivery-implications-for-the-ecosystem.pdf, p.8

[88] Ranieri, L., Digiesi, S., Silvestri, B., & Roccotelli, M. (2018). A review of last mile logistics innovations in an externalities cost reduction vision. Sustainability, 10(3), 782, p. 8

[89] Ibidem.

[90] Elogii (2020). 11 New Trends in 2020 for the Next 11 Years in Delivery. Elogii.com. Retrieved from: https://elogii.com/blog/delivery-management-trends/

[91] World Economic Forum (2020). The Future of the Last-Mile Ecosystem. Retrieved from: http://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf, p.24

[92] OptimoRoute (2020). What Is Last Mile Delivery? Costs & How to Optimize. Optimoroute.com. Retrieved from: https://optimoroute.com/last-mile-delivery/

[93] Ibidem.

[94] Sarma, S. (2019). Last Mile Delivery Route Optimization and the Changing Logistics of Grocery Stores. Suppluchain.com. Retrieved from: https://www.supplychain247.com/article/last_mile_delivery_route_optimization_and_the_changing_logistics_of_grocery/locus

the software ensures efficiency in terms of sustainability, since, by strategically planning the routes to be travelled, it reduces the time wasted on the road, consequently, leads to improvements in traffic congestions, miles driven and fuel consumption. This leads not only to CO_2 emissions significantly reduced but also to great cost savings[95].

Over the last few years, e-commerce decided to implement some of these innovations to reduce the damage their activities cause to the planet: definitely, Amazon is the one that stands out the most among all the competitors in the related market. Over time, it launched several sustainable delivery programs. In 2008, it started with the Frustration-Free Packaging (FFP) program, through which it began to commit reducing waste by shipping 100% recyclable packaging, without additional boxes[96]. In 2019, the company founded the Climate Pledge, its commitment to fighting climate change with the objective to be net-zero carbon, by significantly reducing the emissions related to their online business by 2040. Among the projects launched to achieve this goal, we find the rollout of the electric robotic carrier: its name is Scout, and it has been tested to deliver goods to customers who are Prime Members and choose Same-Day, One-Day, and Two-Day delivery[97]. In addition, in 2020 the company began using electric vehicles to make deliveries, starting from Los Angeles. The plan is to expand the vehicles to 15 cities in 2021, to introduce 10,000 vehicles by 2022 that will become 100,000 by 2030[98].

1.3.2 The green delivery option

So far we have considered solution strategies that can help companies meet the challenge of the last-mile, i.e., lowering delivery cost pressure on the budget and reducing the environmental impact of delivery.

The innovations mentioned above require the implementation of significant upfront investments that in the long run turn into competitive advantages for those who decide to implement them. If, on the one hand, these innovations can be adopted at the discretion of the company, here we propose a further alternative whose adoption is mainly by choice of the online consumer. Such alternative concerns the introduction of the so-called *"green delivery option"*, placed at the final stage of the online purchase process.

The green delivery option consists of a sustainable method of shipping products purchased on an online platform. This alternative requires the online consumer to choose a delivery option that will take at least three or four days to deliver the order to the customer's doorstep. It can represent a huge change with respect of the one and two-hours delivery or same-day delivery.

---

[95] Dista (n.d.). 5 ways to make your last mile delivery sustainable. Dista.ai. Retrieved from: https://www.dista.ai/blog/how-to-make-your-last-mile-delivery-sustainable/

[96] Amazon.com (n.d.) Retrieved from: https://sustainability.aboutamazon.com/environment/packaging-and-products/packaging

[97] Brown, D. (2020). "Meet Scout: Amazon is taking its Prime Delivery Robots to the South". Usatoday.com. Retrieved from: https://eu.usatoday.com/story/tech/2020/07/22/amazon-taking-its-scout-delivery-robots-south/5485106002/

[98] Meisenzahl, M. (2021). Amazon's first electric delivery vans are now making deliveries — see how they were designed. Businessinsider.com. Retrieved from: https://www.businessinsider.com/amazon-creating-fleet-of-electric-delivery-vehicles-rivian-2020-2?IR=T#according-to-amazon-the-team-spent-18-months-considering-available-electric-vehicle-options-before-deciding-to-make-its-own-1

More specifically, green shipping attempts to solve the problem of vehicles that travel even when they have not reached their maximum capacity in order to deliver parcels quickly. To let vans and trucks not use their maximum filling capacity means an increase in the carbon footprint and logistics costs. Thus, e-commerce is asking their customers to wait a few days more for package delivery, in order to employ greener service delivery systems.

Amazon, to additionally implement its strong commitment to climate change, introduced a delivery option that can be considered eco-friendly: the Amazon Day option.

The Amazon Day option allows customers, that are Prime members, to group up deliveries by choosing a day of the week (except Sunday) on which to receive all their orders. This alternative enables the company to get several advantages that have benefits in terms of both costs and sustainability: it allows to increase the orders' consolidation, to reduce the number of package waste and the number of stops made by Amazon drivers; thus, it also saves fuel, drivers' salaries and carbon emissions[99]. Moreover, this option requires the consumer to plan ahead the day they will receive the orders, avoiding the risk of failed deliveries[100].

There are other retailers worldwide offering such a green delivery option. In particular, Ocado, a UK food delivery brand, which group up deliveries by areas and ask consumers to choose a delivery time in specific time slots. These latter have been already scheduled in the same locations and are called *"greener delivery slots*" [101]. This allows, on the one hand, customers to choose a sustainable option and, on the other hand, retailers to manage fewer and fuller trucks. Same works for Sainsbury's, another UK delivery brand[102].

Clearly, the proposed delivery option is more sustainable than instant delivery, but it requires consumers to wait a little bit longer for their orders in order to protect the environment.

In this regard, recent studies ensure the consumers' willingness to wait few more days for home deliveries if this reduces the environmental impact of the purchase process. Research conducted in Mexico, showed that 70% of people are willing to wait longer when the economic incentive is provided; this percentage increases up to 71% when environmental impact information is provided[103].

To analyse the advantages of the green delivery option in the environmental field, we take into consideration the MIT Sustainable Logistics Initiative study. It built a model to support a greener delivery system. Such a model is more flexible and capable of managing both same-day and slower but sustainable deliveries and is based on the customers' preferences. This analysis has been made on data collected about last-mile delivery of Coppel, a retail company in Mexico. The model is based on a new algorithm for deliveries: it combines the customers' demands and the distances travelled, in order to exploit the maximum capacity of the trucks and

[99] Day, M. (2020). Amazon Nixed 'Green' Shipping Proposal to Avoid Alienating Shoppers. Bloomberg.com. Retrieved from: https://www.bloomberg.com/news/articles/2020-03-05/amazon-nixed-green-shipping-proposal-to-avoid-alienating-shoppers

[100] Chen, C. & Saril,S. (2020). Amazon Day is a Prime member perk that lets you schedule your package deliveries — here's how it works. Businessinsider.com .Retrieved from: https://www.businessinsider.com/what-is-amazon-day-schedule-deliveries-prime-benefit?IR=T

[101] Trimble smartdelivery (2019). The Impact of Green Delivery on Customer Satisfaction. Smartdelivery.trimble.com. Retrieved from: https://smartdelivery.trimble.com/the-impact-of-green-delivery-on-customer-satisfaction/

[102] Ibidem.

[103] Fu, A. J., & Saito, M. (2018). "Would You Be Willing to Wait?": Consumer Preference for Green Last Mile Home Deliver., p.19

minimize the number of stops. Customers that took part in the study were allowed to postpone the home delivery up to four days. The results showed that the model proposed reduced the distance travelled by trucks by 46% and the delivery time by 43% with respect to the Coppel existing delivery system[104]. In addition, the number of vehicles used was reduced by 57%, whereas the drop size was improved by 126%[105]. Moreover, the total costs have been lowered by 29%; in particular, the model achieved costs savings related to the delivery labour, fuel and fleet of 22%, 39% and 57% respectively[106].

These results show that, providing customers with multiple choices of delivery options, including a green one, allows companies to differentiate the logistic efforts in order to be both more sustainable and satisfy customers' needs. Thus, this will allow them to gain a competitive advantage in the market.

In light of the literature review collected, the green shipping option could be a powerful solution for the company's budget strain and for environmental pollution, but only if a significant number of consumers adopt it.

To benefit from the introduction of green shipping, it is necessary to implement a strategy that influences people to engage in a more pro-environmental behaviour by selecting this option at the end of the online purchasing process. This strategy could be successful because of the opportunity to change customer behaviour by educating shoppers on the importance of choosing a sustainable service.

Here, in order to accomplish this goal, the approach suggested is based on behavioural science. In particular, the technique to be used is the so-called *nudging*, which will be further explored in the next chapter.

[104] Martínez, J.V. & Cottrill, K. (2020). E-commerce retailers should put more value on green delivery options. Greenbiz.com. Retrieved from: https://www.greenbiz.com/article/e-commerce-retailers-should-put-more-value-green-delivery-options
[105] Ibidem.
[106] Ibidem.

CHAPTER 2

Behavioural economics and nudging approach to drive a sustainable online purchase

2.1 Behavioural economics

For the time being, we have seen that purchase processes, both online and offline, have significant environmental impact and pressure on companies' budget. A distinction between offline and online purchases in terms of costs and sustainability has been drawn. To this effect, on average, online shopping is more sustainable than the traditional one. However, the introduction of fast delivery reduces the e-retailers' marginal profits and increases air pollutions (and emission of greenhouse gas). Thus, the last-mile delivery challenge. Among the innovative solutions suggested to cope with this challenge, green delivery is the one we will focus on. To get the advantages of introducing a sustainable delivery, it is necessary to alter consumers' behaviour so that they can adopt it, without avoiding or forbidding any other option. In this context, the nudging approach seemed to be suitable to accomplish this goal. Nudging is an application of insights from behavioural economics used to influence individuals' decisions. Before exploring the nudging theory, it is worthwhile to mention the key concepts of behavioural economics.

"Behavioural Economics is the study of psychology as it relates to the economic decision-making processes of individuals and institutions"[107]. In other words, it is a branch of economics that, through experimental analysis and psychology, develops alternative models of behaviour to those formulated by traditional economics[108].

While human behaviour and the decision-making process used to be studied in areas such as sociology, psychology and anthropology, things have changed. Behavioural economics emerged from the interaction of achievements in economics, as well as other social sciences. Thanks to the development of economics, the perception of the economic man's behaviours and consumer choices has also changed in neoclassical and behavioural economic models[109]. It is necessary to start from classical and neoclassical economic theories, so that to comprehend the reasons that led behavioural economics to emerge.

In this chapter, the main theories about the decision-making process of individuals will be retraced, starting from the model of homo economicus, followed by the rational man of expected utility theory, up to the birth of behavioural economics that addresses the concepts of bounded rationality, heuristics and biases. The latter underly the nudge theory that will be discussed in depth.

[107] Kenton, W. (2020). Behavioral Economics. Investopedia.com. Retrieved from: https://www.investopedia.com/terms/b/behavioraleconomics.asp

[108] Belloc, M. (2012). Economia comportamentale. Treccani.com. Retrieved from: https://www.treccani.it/enciclopedia/economia-comportamentale_%28Dizionario-di-Economia-e-Finanza%29/

[109] Zalega, T. (2014). Consumer and Consumer Behaviour in the Neoclassical and Behavioural Economic Approach. konsumpcja i rozwój, (4 (9)), 64-79, p. 64

2.1.1 The concept of "homo economicus" in classical economics theories

The first evidence of economic man is traced to one of the founders of classical economy, that is Adam Smith, a Scottish philosopher of the late 18th century. His works show that the economic man is "*a creature who chooses from among scarce alternative resources those which are best suited to produce certain accepted ends*"[110]. According to this, Smith's economic man is a self-interested creature who considers the best way to arrange his means in order to obtain the best benefits, in terms of wealth, prestige, ostentation and power[111].
In the early 19th century, the classical economist John Stuart Mill extended the ideas proposed by Adam Smith. Mill is considered the creator of the concept of *homo economicus* even if he never actually used this definition inside his own works. The term appeared later in works of his contemporaries, such as John Kells Ingram and John Neville Keynes, who disparaged the Mill's political economy, using the term *"economic man"* with a negative connotation. Ingram in *"A History of Political Economy"* (1888) defined Mill's economic men as *"money-making animals"*[112], while Keynes painted the subject as a man *"whose activities are determined solely by the desire for wealth"*[113].
However, to understand the concept of economic man or *homo economicus*, we need to turn to Mill's essay *"On the Definition of Political Economy; and on the Method of Investigation Proper to It"* (1836). Here, Mill defines Political Economy as an abstract science and, at the same time, presents the deductive reasoning as the most suitable approach to conducting economic research. In his opinion, Political Economy, as any other abstract science, is based on *a priori* assumptions or hypothesis; among them, Mill recognized the assumption related to the aspiration of the economic man. He presupposes the economic man as *"a being who desires to possess wealth, and who is capable of judging of the comparative efficacy of means for obtaining that end. It predicts only such of the phenomena of the social state as take place in consequence of the pursuit of wealth"*[114]. Continuing, Mill states that such economic agents tend to ignore other human passions or motives, except those which do not prevent him from the achievement of the main goal, namely those which are not an impediment for the pursuit of wealth[115]. In this regard, Mill's man has only four interests: accumulation, leisure, luxury and procreation; the latter reported as *"principle of population"*[116]. In addition, Mill stated that mankind is only interested in *"acquiring and consuming wealth*", whereas all the other operations that occur in the economic life, such as production and distribution, only derive from the desire of wealth[117].
The economic agent model built by Mill is considered an example of theoretical isolation method through which human economic activity is assumed to be isolated from the social context[118]. Indeed, going on, Mill

[110] Grampp, W. (1948). Adam Smith and the Economic Man. Journal of Political Economy, 56(4), 315-336, p. 315
[111] Id, p. 335
[112] Persky, J. (1995). The ethology of homo economicus. Journal of Economic Perspectives, 9(2), 221-231, p.222
[113] Ibidem.
[114] Mill, J. S. (1836). On the definition and method of political economy. The philosophy of economics, 41-58, p.41
[115] Id, pp. 41,42
[116] Persky, J. (1995). The ethology of homo economicus. Journal of Economic Perspectives, 9(2), 221-231, p.223
[117] Mill, J. S. (1836). On the definition and method of political economy. The philosophy of economics, 41-58, p.42
[118] Dzionek-Kozłowska, J. (2017). The early stages in the evolution of Economic Man. Millian and marginal approaches. Annales. Etyka w życiu gospodarczym, 20(6), 33-51, p.35

summarizes "*the arbitrary definition of a man as a being who invariably does that by which he may obtain the greatest amount of necessaries, conveniences, and luxuries, with the smallest quantity of labour and physical self-denial with which they can be obtained in the existing state of knowledge*"[119]. According to this last definition, the economic agent can be thought as a rational being who considers only the economic reasons for his actions, getting rid of all irrationality that affect his decisions, without being influenced by the surrounding environment[120]. While we may discuss whether rationality is a component of the model of *homo economicus*, it must be specified that Mill did not explicitly assume the rationality of actions of economic man. One can only assume a rationality in an instrumental sense. That is, since wealth maximization is the main goal of the economic agent, one may include the implicit assumption that, when choosing his actions, the economic agent is perfectly able to assess which one will lead to the highest level of wealth[121].

The concept of rationality and wealth maximisation as the main aspiration of the economic man was later revised and extended by neoclassical economists.

2.1.2 Individual's rational choice in neoclassical economics theories

In the second half of 1800s, the marginal revolution began. The three, independent, marginal economic schools of W.S. Jevons, C. Menger and L. Walras were based on the Mill's *homo economicus* model. In particular, they accepted the Mill's postulate about the distinction of the economic aspect of human activity as a dimension on which to focus. They also accepted that there are rules of behaviour followed by economic agents, that allow the formulation of economic laws about humans' actions. Yet they replace the wealth maximization with utility maximization as the main goal of economic activity. Here, utility is the representation of a broader category that includes pleasure, satisfaction and benefit. More specifically, utility is considered as an abstract property of goods and services, which is instrumental to the satisfaction of needs. Maximizing utility means reaching pleasure, benefit or happiness, being protected from pain, evil or misfortune[122].

In both Mill and marginal economists' *homo economicus* there is the belief that the economic agent is able to maximize wealth or utility. Even marginal economists do not explicitly claim the full rationality of men but assume in a tacit manner that human economic activities are rational[123].

From the three independent marginal schools emerged neoclassical economics, whose main precursors were W. S. Jevons, A. Marshall and J. B. Clark. Henceforth, the concept of rationality becomes more explicit. To this effect, neoclassical economics is based on three basic assumptions: firstly, it assumes people's rational

[119] Mill, J. S. (1836). On the definition and method of political economy. The philosophy of economics, 41-58, p.45
[120] Dizionario Di Economia E Finanza (2012). Homo Oeconomicus In Treccani.it. Retrieved from: https://www.treccani.it/enciclopedia/homo-oeconomicus_%28Dizionario-di-Economia-e-Finanza%29/
[121] Dzionek-Kozłowska, J. (2017). The early stages in the evolution of Economic Man. Millian and marginal approaches. Annales. Etyka w życiu gospodarczym, 20(6), 33-51, p.37
[122] Id, pp.38,39
[123] Id, p.40

preferences between outcomes; secondly, while individuals maximize their utility, firms maximize their profits; finally, people's actions are based on full and relevant information.

Likewise, neoclassical approach to consumers used to explain economic man's behaviour, is based on a similar but broader set of assumptions. First of all, consumers are assumed to be fully rational when making choices that maximize utility. Moreover, consumers have full and effortless access to complete knowledge about products and all market possibilities, and they also have the full capacity to process such information in making decisions. Finally, markets resemble a perfect competition model, removing monopoly profits and income's competitive distribution[124].

For what concerns the consumer behaviour theory, neoclassical economics applies the utility theory based on the *homo economicus* developed by Mill. It refers to the consumer as a rational individual, regardless of the group or community of which it is part. That is, consumers are able to define their specific needs, prioritise them, and make choices that maximize the satisfaction of these needs[125].

The neoclassical theory of decision making is also based on the expected utility theory of J.von Neumann and O. Morgenstern, which aims at analysing human behaviour, both as individuals and consumers[126]. This theory considers man both as a rational and predictable being and studies his preferences. According to this, the individual knows the available alternatives, evaluates them, and chooses the one that provide him the greatest utility. When individuals or consumers are faced with uncertain alternatives, whose probability distributions are known, they choose, among the various possibilities, the one with the highest expected utility, based on the available resources. In other words, the theory of expected utility is a criterion allowing for the consumer to select a choice even in uncertain or risky conditions. Here, the term *"utility"* identifies an index of consumer preferences in risk conditions, that is, it defines the degree of enjoyment that the subject derives from the satisfaction of needs.

This theory provides us with a function of expected utility which identifies the set of preferences that maximize the consumers' utility. To this effect, the function associates to each possible choice a corresponding measure of utility, respecting the order of preferences; indeed, it can be used to order the risky alternatives. Thus, the function denotes exactly the preferences of the consumer since it assigns a numerical value to each preference. The consumer, who has as main goal the maximization of expected utility, considers each possible outcome of an alternative (e.g., combinations of goods) and measures its utility level; then, he will obtain the expected utility of the alternative, summing the utilities of each outcome weighted with their degree of probability.

The theory is based on a deductive method that starts from axioms that define the requisites of rationality[127]:

1. Completeness of preferences. Each individual or consumer is able to order the alternatives according to an order of preferences. One must be able to make a comparison and obtain a relation between

[124] Zalega, T. (2014). Consumer and Consumer Behaviour in the Neoclassical and Behavioural Economic Approach. konsumpcja i rozwój, (4 (9)), 64-79, p. 69

[125] Id, p.70

[126] Donadi, E. (2013). Dalla teoria dell'utilità attesa alle teorie alternative: analisi del comportamento degli individui nelle scelte di portafoglio in laboratorio. Università Ca' Foscari Venezia. Retrieved from: http://dspace.unive.it/bitstream/handle/10579/3136/811552-1164411.pdf?sequence=2, p.11

[127] Id, p.13

preferences. This is an important property because it prevents the possibility of not being able to rank the preferences.

2. Continuity of preferences. Each individual or consumer, faced with an alternative with a probability distribution with a better and a worse event, is always able to indicate a probability that makes him indifferent to the alternative with a certain result.
3. Independence of alternatives. If the individual prefers the alternative A with respect to alternative B, whenever a third alternative C is detected, this does not change the preferences previously assigned.
4. Transitivity of alternatives. Individual or consumer preference for alternative A over B and B over C implies a preference for A over C. If this does not happen, a circularity would be created, and the individual would not be able to make a decision.
5. Insatiability of preferences. The consumer is never satiated, a greater quantity will always be preferred over a lesser quantity, hence the consumer prefers alternatives that provide more satisfaction to less satisfactory alternatives.

The basic idea underlying this theory, also contained in the axioms, is that individuals behave rationally and therefore are always able to make decisions based on their preferences.

The above rules, on the one hand, allow consumers to make choices that maximize their utility and, on the other hand, define the underlying reasoning behind decision-making behaviour.

In recent years, critics have identified several limitations in the capacity of neoclassical theories to explain and analyse the human behaviour. In particular, the expected utility theory has been charged with inconsistency between the actual behaviour adopted by individuals and the theoretical behaviour predicted[128].

Among other general criticisms of neoclassical theories, modern economists complain the rejection of the social factor, meaning that the decision-maker individually makes decisions and assigns a rational value to the available alternatives; they also disagree with the assumption of individuals access to a complete information; in addition, they disapprove of the failure to consider the psychological factors that can influence an individual's behaviour, which would make the assumption more realistic[129].

To conclude, the model of rational behaviour, from Mill's *homo economicus* to the von Neumann and Morgenstern's expected utility theory, explained only apparently economic individuals' behaviour and decision-making. The rationality criterion is now considered relative, if we pay attention to the expansion of scientific knowledge.

In light of this, economists try to create new theories through the violation or weakening of the axioms proposed by von Neumann and Morgenstern, which are the requirements that determine rationality.

Thus, the argument arises between accepting expected utility theory for evaluating the choices of individuals or creating alternative theories.

[128] Id, p.5

[129] Zalega, T. (2014). Consumer and Consumer Behaviour in the Neoclassical and Behavioural Economic Approach. konsumpcja i rozwój, (4 (9)), 64-79, p. 71

Therefore, exactly where neoclassical economics fails to answer to the critical questions, behavioural economics comes into play.

2.1.3 Individual's choice in the light of behavioural economics

Behavioural economics is a science that combines the attainments of economics and the achievements of psychology, sociology and neurobiology.

Traditional economics deals with knowledge-based rational individual's choices, without considering psychological factors. On the other side, insights from psychology are embedded into behavioural economics. Therefore, the combination of both economic and psychological factors allows achieving more realistic results about human behaviour, their decision-making and the reason behind it.

More specifically, *"Behavioural economics uses variants of traditional economic assumptions (often with a psychological motivation) to explain and predict behaviour, and to provide policy prescriptions"*[130].

Moreover, behavioural economics aims at fulfilling the gaps stemmed from the traditional economic theories, including neoclassical economy. In particular, it questions the assumption about rationality of human actions, to drop the *homo economicus* model; recourses to psychology to explain the human behaviour in its complexity; and, finally, strays from the simplified economic models, to examine anomalies in traditional economic theories[131]. The first to address this challenge was Herbert Simon.

Simon, an American economist, political scientist and cognitive psychologist, defined the ideas behind behavioural economics, by challenging the traditional economy assumptions of rationality and self-interest.[132] In 1950, he coined the term *"bounded rationality"* which "*is used to designate rational choice that takes into account the cognitive limitations of the decision-maker – limitations of both knowledge and computational capacity.*"[133]

It is a deviation from Savage's subjective expected utility (SEU) theory based on neoclassic economy. Savage revaluated expected utility theory by replacing the concept of expected utility with one of subjective expected utility. The latter is based on a new idea of probability, i.e., the *"subjective probability"*, introduced by the probabilist statistician Bruno de Finetti[134].

Initially, the expected utility theory of von Neumann and Morgenstern considered probability in objective terms, without considering the beliefs and preferences of an individual. Then, according to De Finetti, the probability was defined as the degree of confidence that a subject attaches to the event considered; thus, the

[130] Laibson, D., & List, J. A. (2015). Principles of (behavioral) economics. American Economic Review, 105(5), 385-90, p.385

[131] Zalega, T. (2014). Consumer and Consumer Behaviour in the Neoclassical and Behavioural Economic Approach. konsumpcja i rozwój, (4 (9)), 64-79, p. 73

[132] Tomer, J. F. (2007). What is behavioral economics?. The Journal of Socio-Economics, 36(3), 463-479, p.469

[133] Simon H.A. (1990). Bounded Rationality. In: Eatwell J., Milgate M., Newman P. (eds). Utility and Probability. The New Palgrave. Palgrave Macmillan, London, p. 15

[134] Donadi, E. (2013). Dalla teoria dell'utilità attesa alle teorie alternative: analisi del comportamento degli individui nelle scelte di portafoglio in laboratorio. Università Ca' Foscari Venezia, p.48. Retrieved from: http://dspace.unive.it/bitstream/handle/10579/3136/811552-1164411.pdf?sequence=2

probability is assigned by the individual and it is the individual who attributes a value to the occurrence of an event[135].

To summarize, for what concerns objective probability, the probability distribution is the actual distribution of events. On the other hand, subjective provability means that the probability distribution reflects individual beliefs about a particular event.

Starting from the expected utility theory, Savage introduced the degree of confidence attributed by individuals to a specific event and defined the subjective expected utility (SEU) theory. According to this, *"choices are made: (1) among a given, fixed set of alternatives; (2) with (subjectively) known probability distributions of outcomes for each; and (3) in such a way as to maximize the expected value of a given utility function."*[136]

Simon considered these postulates as not able to fit the real-world situations in which economic choices are made by human beings. Thus, he substituted the set of alternatives among which the solution is selected, with a process of alternative generation; he did not assume the known probability distributions of outcomes for each set but considered strategies that enable decision-maker to cope with the outcome's uncertainty, whose probability distribution is unknown; finally, he assumed a satisfying strategy, not the maximization one proposed in the SEU theory.

These deviations are supported by the empirical knowledge about the human decision-making and the cognitive limits involved in the lengthy and costly process of generating the alternatives and evaluating their consequences (outcomes uncertainty). Therefore, defining the concept of bounded rationality, Simon highlighted constraints in the human decision-making process. According to the author, decision-makers are not able to obtain all the relevant information to make a final decision by the time it has to be made; they are not able to perceive and evaluate accurately all the information accessed; they also have cognitive limits in processing information[137]. To be clear, the constraints are represented by the amount of information provided, the timeframe in which the decision must be met and internal cognitive limits. These constraints prevent decision-makers from maximizing the expected value of the solution chosen. As a result, individuals *"satisfice"*, meaning that they look for satisficing solutions rather than optimal ones, since the latter, due to uncertain and ambiguous circumstances, cannot be obtained.

Simon explained the *"satisficing"* concept with heuristics: he noted that the best way to come up with a satisfactory solution was through the use of shortcuts and rules of thumb or heuristics, defined as "*any principle or device that contributes to the reduction in the average search to a solution*"[138]. Heuristics will be better discussed further ahead.

Rejecting the substantial theory of rationality supported by neoclassical economic models, Simon embraces the procedural rationality supported by behavioural theories. Due to limitations in terms of information, time

[135] Ibidem.

[136] Simon H.A. (1990). Bounded Rationality. In: Eatwell J., Milgate M., Newman P. (eds). Utility and Probability. The New Palgrave". Palgrave Macmillan, London, p. 15

[137] Schwartz, H. (2002). Herbert Simon and behavioral economics. The Journal of Socio-Economics, 31(3), 181-189, p. 182

[138] Newell, A., Shaw, J. C., & Simon, H. A. (1962). The processes of creative thinking. In Contemporary Approaches to Creative Thinking, 1958, University of Colorado, CO, US. In Schwartz, H. (2002). In: Herbert Simon and behavioral economics. The Journal of Socio-Economics, 31(3), 181-189, p. 182

and computational capability, substantial rationality is not assured[139]. Specifically, on the one side, SEU theory aims at predicting people's choices, assuming them to be objectively optimal and maximising subjective expected utility. On the other side, by using empirical knowledge, theories of bounded rationality are more demanding, seeking to detect the actual decision-making process as well as the substance of the final decision itself, which, according to the cognitive limitations, makes use of heuristics[140].

In his research, Simon focused on descriptive analyses to formulate suggestions useful for improved decision-making, yet he did not provide an alternative normative theory, which is why he was not given too much importance.

However, because of the introduction of bounded rationality, the rational choice model, based on *homo economicus* and expected utility, was weakened.

Twenty years later, from early 1970s, two psychologists, Daniel Kahneman and Amos Tversky began to run experiments to test how far people stick to predictions about rational choices. They confirmed that humans do not match the *homo economicus* model as well as the so-called *"Econ"*. The term *"Econ"* as opposed to *"Humans"* has been used by Richard H. Thaler and Cass R. Sunstein. They refer to *"Econs"* as imaginary, analytical and fully rational decision-makers, who always make the best choice; the *"Econ"* is considered an imaginary and theoretical decision-making model. However, according to the authors, people in real-world *"are not homo economicus; they are homo sapiens"*[141] and therefore they refer to real species of individuals as *"Humans"* whose decision-making is flawed and error prone.

Thanks to their contributions Kahneman and Tversky, and the economist Thaler, are considered the founders of behavioural economics. To this effect, Kahneman and Tversky's research in experimental psychology identified several ways in which Humans moves away from Econs.

In 1979, they developed one of the most important concepts in behavioural economics, namely prospect theory. It aims at being an alternative to expected utility theory as a theory of decision under conditions of risk. It replaces the utility function with a function whereby gains and losses are attributed their perceived value[142]. According to this theory, people think in terms of expected utility or gains and losses relative to a reference point (i.e., current wealth) rather than absolute outcomes. Hence, *"the carriers of value or utility are changes of wealth, rather than final asset positions that include current wealth"*[143].

In this context, the authors show that human attitudes toward gains and losses depends on the perspective from which they are considered: they tend to be risk averse when it comes to gains, and risk-seeking with respect to losses.

---

[139] Schwartz, H. (2002). Herbert Simon and behavioral economics. The Journal of Socio-Economics, 31(3), 181-189, p. 182

[140] Simon H.A. (1990). Bounded Rationality. In: Eatwell J., Milgate M., Newman P. (eds) "Utility and Probability. The New Palgrave". Palgrave Macmillan, London, p. 17

[141] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.7

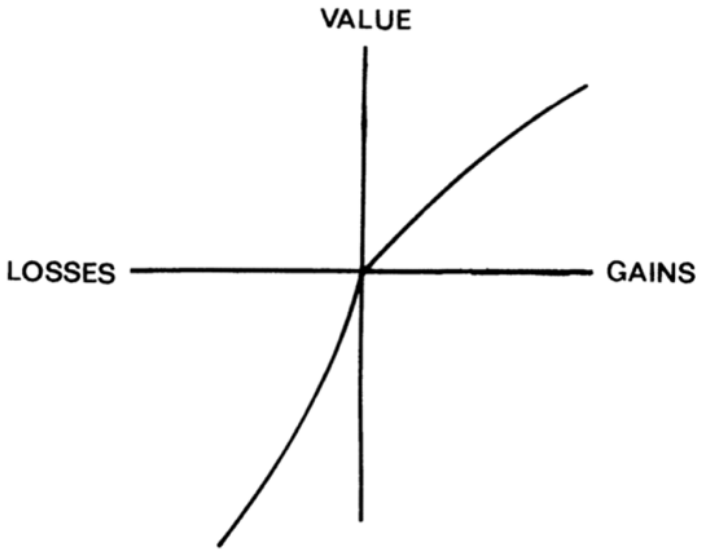
[142] Zalega, T. (2014). Consumer and Consumer Behaviour in the Neoclassical and Behavioural Economic Approach. konsumpcja i rozwój, (4 (9)), 64-79, p. 71

[143] Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. Econometrica, 47(2), 263-291. p.273

For what concerns gains, people underweight the results when they are probable compared to situation in which the results are certain. This is what they call *"certainty effect"* and explains why people are risk averse, meaning that humans prefer a certain gain over gambles, even when gambles have higher expected utility[144]; for what concern losses, the reflection effect occurs, meaning that humans are risk seeking preferring to take the risk of a large loss that is merely probable, rather than accept the certainty of a smaller loss[145].

To explain this effect, Kahneman and Tversky showed an experiment where 80% of respondents chose a certain outcome of $3000 when compared to a probability of 80% to get $4000 and a probability of 20% to get nothing. On the other side, when asked to choose a probability of 80% of losing $4000 and a 20% of losing nothing compared to a certain loss of $3000, 92% of respondents chose the first option.

As a result, the two psychologists represent the individual utility function: it is defined on deviations from the reference point; also, it is concave for gains and convex for losses, representing the reflection effect around the reference point[146].



147

Figure 2.1: "The individual utility function"

The curve pattern reflects a decreasing sensitivity to changes in utility as moving away from the reference point, both for gains and losses.

Prospect theory demonstrates that gains are treated differently than losses, as "*losses loom larger than gains*"[148]. This attitude is defined as loss aversion: for instance, "*the aggravation that one experiences in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount*"[149].

As it is shown in the figure above, the curve results to be steeper for losses than for gains.

[144] Id, p.265
[145] Id, p.268
[146] Levy, J. (1992). An Introduction to Prospect Theory. Political Psychology, 13(2), 171-186, p.174
[147] Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. Econometrica, 47(2), 263-291. p.279
[148] Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. Econometrica, 47(2), 263-291. p.279
[149] Ibidem.

The shape of this utility function implies that people value what they have more than what they do not have in the same amount. To this effect, the tendency of people to overweight anything in current possession is called endowment effect[150].

The impact of loss aversion and endowment effect on an individual's choice is easily observed in the experiment by Kahneman, Knetsch, and Thaler. Students at Cornell University were divided into two groups and shown identical coffee mugs. Then, each member of a random group was given one of these mugs. Finally, all those who received a mug were asked the minimum amount they would accept to sell it (the willingness to accept or WTA), while all those who did not receive a mug were asked the minimum amount they would pay to buy one (the willingness to pay or WTP). The results showed that the mug owners were willing to accept a price that was twice as high as the one the nonowners were willing to pay to buy one mug. According to this experiment, people are hurt more when they have to give something up than they are pleased if they have to acquire it. This is because, due to the endowment effect, people value what they already have much more than what they do not have[151].

Since people view gains and losses according to a reference point and due to differential treatment of both, Kahneman and Tversky focused on the framing of a choice as a critical element, namely the framing effect. It occurs when the way information is presented is able to influence individuals' decisions. Thus, "*equivalent information can be more or less attractive depending on what features are highlighted*"[152].

To explain this issue, they illustrate an experiment conducted in 1981[153]. After selecting two groups of candidates, participants are asked what they would do when faced with a new disease from Asia that put the lives of 600 people at risk. The first group was provided with a choice between program A, 200 people would be saved, and program B, one-third probability to save everyone and two-thirds probability that that none would be saved.

In contrast, the programs for the second group were as follows: program C, where 400 people would die, and program D, where one-third probability that nobody would die whereas two-thirds probability that everybody would die. From a content point of view, programs A and B are respectively equivalent to programs C and D. Yet the responses of the two groups were differently framed: in the first group, where the choice outcomes are framed positively in terms of lives saved, 72% of respondents chose program A (survival frame); in the second group, where choice outcomes are framed negatively in terms of lives lost, 78% chose program D (mortality frame). Thus, this experiment shows us that the way in which the issue is framed, in terms of gains or losses, influences the individual's choices.

Prospect theory represents part of the cognitive tendencies underlying the field of behavioural economics and also notes the practical and theoretical limitations of neoclassical economic theory, in particular expected utility theory.

---

[150] Levy, J. (1992). An Introduction to Prospect Theory. Political Psychology, 13(2), 171-186, p.175

[151] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.33

[152] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/framing-effect/

[153] Kahneman, D. (2002). Maps of bounded rationality: A perspective on intuitive judgment and choice. Nobel prize lecture, 8, 351-401, p.457

So far, we have introduced some cognitive biases that affect humans reasoning preventing them from making fully rational choices. Dilip Soman properly defines the cognitive bias as *"any systematic deviations from a response or decision that would expect a decision maker to make"*[154]. Till now, the three biases discussed are loss aversion, endowment effect and framing effect.

Moreover, to better understand the limits to human judgments, we need to delve into the prevailing model of human cognition. In order to describe how humans make decisions, Kahneman, in *"Thinking, fast and slow"* (2011), presented the dual process theory, a model of human cognition based on two modes or "systems" of thinking that influence our behaviour: System 1 and System 2[155].

System 1, also known as *"intuitive thinking"*, is emotional, impulsive and automatic, operates quickly, with little or no effort and, as it is an involuntarily system, individuals have no control on it. On the other side, System 2, also known as *"slow thinking"*, is distinguished because it is slower, serial, deliberate and allocates attention to effortful mental activities that require it in order to evaluate the alternatives.

While System 2 represents the conscious, which controls thoughts, has beliefs and make choices, System 1 originates easily impressions and feeling, underlying beliefs and choices of System 2.

Among the activities associated to the System 1 we can consider the following: detect hostility in a voice, answer to a simple mathematical operation, such as 2+2, read words on large billboards or drive a car on an empty road[156].

Instead, here are some of the activities that require attention to be successfully completed, associated to the System 2: look for a woman with specific characteristics, such as white hair, compare two washing machines for overall value, fill out a tax form, check the validity of a complex logical argument[157]. When it comes to these activities, it is necessary to pay proper attention, otherwise the individual will mis perform.

Similarly, Thaler and Sunstein explain human behaviour through the two kinds of thinking, but they refer to them as Automatic System, which is uncontrolled, effortless and associative, and Reflective System, which is controlled, effortful and deductive[158].

Furthermore, in his book, Kahneman stresses the interaction between the two systems. That is, System 2 is able to change the workflow of System 1, for instance individuals can actively ask themselves to look for men wearing a hat. In general, interaction between the two systems means that, System 1 generates impressions, intuition, intentions and feelings, whereby impressions and intuitions are used by System 2 as main source to create beliefs, and intentions that turn into actions. *"You generally believe your impressions and act on your desires, and that is fine—usually"*[159]. To this effect, most of the things that the individual does come from System 1, but there are situations in which System 2 comes to its aid: it may happen that the individual is asked a question to which System 1 is not able to answer automatically; it can also occur an event that violates

[154] Soman, D. (2015). The last mile: Creating social and economic value from behavioral insights. University of Toronto Press, p.156
[155] Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux, p.22
[156] Id, p.23
[157] Id, p.25
[158] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.20
[159] Id, p.26

the model created by System 1, for instance when a situation surprises the individual. Still, System 2 has also the task to monitor the individual's behaviour by making him to increase the attention and the cognitive effort when he is about to make an error: for instance, System 2 helps maintaining calm in unrest situations or increasing the attention when driving at night.

That said, most of the time, the two systems share the work efficiently in a way that minimizes the effort and optimizes the performance. Yet, sometimes, even though Systems 1 has fairly accurate models of familiar situations and appropriate short-term predictions or initial reactions to challenges, it makes systematic errors, namely biases. Moreover, the main limitation is that, since the intuitive thinking is out of the individual's control, it cannot be turned off at will, to avoid such biases[160].

Due to this, according to Kahneman, System 2 has *"to monitor and control thoughts and actions "suggested" by System 1, allowing some to be expressed directly in behaviour and suppressing or modifying others"*[161]. Yet, System 2 operates through processes that are slow or may also never be triggered due to the mental effort required, therefore it is defined as a *"lazy controller"* [162]. To this effect, the author refers to the *"law of least effort"* which applies to cognitive strain. According to this, people achieve their goals by investing the least amount of mental effort[163]. This sometimes leads individuals to make wrong decisions.

To better explain System 2 laziness, and to implicitly see how intuitive thinking works, the following example is given. An individual is asked the following question:

A baseball and a bat cost $1.10.The bat costs $1.00 more than the ball. The bat costs $1 more than the ball. How much does the ball cost?[164].

The quick and intuitive answer given by System 1 is most likely $0.10, but it is the wrong answer. Indeed, if the ball costs 10 cents and the bat costs one dollar more than the ball ($1.10), then together they will cost $1.20[165]. Only after telling the individual that his intuitive answer is wrong does he consult his System 2 to give the right answer, which is $0.05. As a matter of fact, slow thinking laziness can get individuals into trouble by making mistakes like this. Due to this laziness, System 2 is reluctant to invest mental effort in voluntary and analytical activities for which it is required, leaving thoughts and actions to be often guided by System 1.

As a result, as System 1 is struggling under a work overload, it relies on simplifying heuristics or rules of thumb that reduce the mental effort required to make difficult choices. Finally, this leads intuitive preferences to systematically violate the rules of rational choice, resulting in biased decisions.

[160] Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux, p.27
[161] Id, p.44
[162] Id, p.40
[163] Id, p.37
[164] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.21
[165] Ibidem.

2.1.4 Heuristics and biases

So far, the findings from behavioural economics highlights that the dual process model of thinking leads humans to shift away from the rational decision-making process because biases and heuristics influenced their choices.

In this section we will explain how some heuristics and biases work in practical contexts.

Kahneman and Tversky clearly stated that individuals' decisions are based on the assessment of probability of uncertain alternatives' outcome, that could be an event or a quantity. Due to the complexity of these assessments, people rely on heuristics rules that process limited information or data of limited validity but make actual judgments and decisions simpler. These heuristics are generally useful, although they can sometimes result in systematic errors (cognitive biases)[166].

Kahneman and Tversky noted that people are not aware of the rules that influence their impressions. Moreover, since they stemmed from System 1, people are not able to control their impressions. Yet it is possible to recognize the situations in which biased impressions occur in order to correct them[167].

Heuristics are properly defined as "*simple procedure that helps find adequate, though often imperfect, answers to difficult questions*"[168].

Kahneman and Tversky presented their findings about the shortcuts of intuitive thinking (System 1) in the article "*Judgment Under Uncertainty: Heuristics and Biases"*. They described the shortcuts of intuitive thinking and the manifestation of the related biases in order to demonstrate the role of heuristics in individuals' judgment. This research program is known as *"heuristics and biases"* approach. According to them, there are three main heuristics that affect human judgement: representativeness, availability and anchoring[169].

The representativeness heuristics occur when individuals assess the degree to which an object or event A is similar to or representative of B. The individual develops certain methods, often stereotypes, to categorize information, which is necessary for its rapid indexing and recall to memory[170]. More specifically, individuals, especially in the intuitive thinking system (System 1), evaluate the likelihood that an object or event A belongs to category or process B, by judging whether A is similar to the image or stereotype of B[171]. The more representative is A of B, the more likely that A comes from or belongs to B.

Thaler and Sunstein, in order to make this heuristic clearer, report the example of Linda: she is a thirty-one years old, single, and intelligent woman with a degree in philosophy and, when she was a student, deeply interested in social justice issues. People were asked to rank eight possible features for Linda, according to the degree of probability, and generally people considered that Linda was more likely to be similar to the

[166] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[167] Ibidem.
[168] Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux, p.97
[169] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[170] Nava, G. (2018). Organizzare il cambiamento – razionalità limitata & mental biases (1/3). Madeforexport.it. Retrieved from: https://www.madeforexport.it/innovazione/razionalita-limitata-ed-organizzazione-parte-i/
[171] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.26

stereotype of a "bank teller and feminist activist" than "bank teller". This is obviously a logic mistake because it is much more likely that only one event will occur, as opposed to two events combined[172].

When people use representativeness heuristic, they ignore several factors that should influence probability. First of all, people are insensitive to the prior probability of outcomes[173]: as a result of some people use heuristic representativeness, they will dismiss preliminary probability information. In the example proposed by Kahneman and Tversky, subjects were provided with a description of Steve as a stereotyped representation of a librarian; then, they were questioned if Steve is more probable to be a farmer or a librarian. To correctly answer to the question, subjects should have considered that there are more farmers than librarians in the population; however, the prior probability or base-rate frequency did not influence the subjects' judgment about similarity of Steve to the stereotype of a librarian. This bias is also called base rate fallacy or base rate neglect, and refers to when an individual, provided with both a specific information about a certain person or event, and a base rate information, which is an objective statistical information, assigns more value to the specific information without considering the base rate information[174].

As the example of Kahneman and Tversky showed, people selected the occupation of librarian (outcome) that mostly represented the Steve's description (input). The degree of representativeness, namely how much the outcome fits the input, influences the confidence people have in predicting the outcome, regardless its predictive accuracy. In the example above, people are confident in predicting that Steve is librarian, since his description fits the stereotype of the librarian, though the description is unreliable. Such *"unwarranted confidence"* is called illusion of validity[175]. *"The illusion of validity is a cognitive bias that describes our tendency to be overconfident in the accuracy of our judgements, specifically in our interpretations and predictions regarding a given data set."*[176] The more the input variables are independent of each other, the higher the prediction accuracy; the more such variables are redundant and correlated, the more they appear internally consistent, the higher is the similarity to the stereotype, hence the confidence in the prediction. For instance, people may be more confident in predicting the final average grade of a student whose records consist in all Bs than they were both As and Cs[177].

Another bias connected to this heuristic is the insensitivity to sample size: people assess the probability of a particular result in a sample, for instance the average height in a random sample, by its similarity to the corresponding parameter in the population, that is, the average height in the population. In this way the intuitive assessment of a sample statistic is independent from the sample size[178].

[172] Ibidem.
[173] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[174] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/base-rate-fallacy/
[175] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[176] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/illusion-of-validity/
[177] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[178] Ibidem.

Then, the use of representativeness heuristics can cause the misconception of choice[179]. According to this, individuals assume that a sequence of events, generated by a random process, is a representative characteristic of such process even in a short sequence. Considering a coin tossed 6 times, people expect
the resulting sequence of head and tails to be representative of what they perceive as a randomized sequence. *"Unfortunately, people do not have accurate perceptions of what random sequence look like"*[180].Therefore, in their opinion, the sequence H T H T T H is more probable than H H H T T T, which *"does not appear random"* even though it actually is.

Similarly, the well-known Gambler's fallacy works: "*it describes our belief that the probability of a random event occurring in the future is influenced by previous instances of that type of event*"[181]. According to this, when a chance-generated event deviates from the average, the opposite event is judged more probable, i.e., after seeing a series of four reds in roulette, people expect to see black, because the occurrence of black is considered an essential characteristic of a more representative sequence than the occurrence of an additional red[182].

Furthermore, it may happen that people make predictions by representativeness, being insensitive to prediction accuracy: suppose one is asked to make a prediction of a company's profitability in the future, after giving a description of the company. Such future prediction can be related to the favourability of its description, rather than to its reliability or the degree to which it allows for an accurate prediction. For instance, a very favourable description will correspond to a higher profit prediction so that to appear as representative as possible of that description[183].

The second cognitive shortcut taken into account is the availability heuristic. It occurs when people assess the likelihood of an event by the ease with which the event comes to mind[184]. Individuals tend to assign greater probability to the information that they remember more vividly, because they have recently learned it and therefore it is available in a direct and ready way to his memory[185]. For instance, an individual may assume that the risk of heart attack among middle-aged people is high because he remembers such an event among his acquaintances[186]. Another example is represented by the individual's belief that more people die from homicide, simply because homicides are more available than suicides. What's more, due to availability heuristics, people's purchase of insurance for natural disaster is affected by recent experiences[187].

People's reliance on availability prevents them to consider factors as frequency and probability, leading to systematic cognitive biases. Among them, biases due to the retrievability of instances are considered: to this effect, familiarity, accessibility and salience are related to availability, meaning that they increase the ease

[179] Ibidem.
[180] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.27
[181] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/gamblers-fallacy/
[182] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[183] Ibidem.
[184] Ibidem.
[185] Nava, G. (2018). Organizzare il cambiamento – razionalità limitata & mental biases (1/3). Madeforexport.it. Retrieved from: https://www.madeforexport.it/innovazione/razionalita-limitata-ed-organizzazione-parte-i/
[186] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[187] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.25

with which information or instances are retrieved from memory. In this regard, Kahneman and Tversky demonstrated this effect by reading a group of subjects a list of well-known personalities of both sexes and asking them to assess whether the list contained a majority of men or women. Different groups of subjects heard different lists; in some lists the men were more famous than the women, whereas in other lists it was the opposite. According to the subjects' judgment, in each list, the most numerous category was the one including the most famous personalities, and therefore more salient, familiar, and easily retrieved than the other category[188].

Afterwards, availability heuristics are related to biases concerned with the effectiveness of a search set. People answer to a problem on the basis of the ease of search information, rather than the effectiveness of the search: for instance, if the question is *"Is it more likely that the word starts with R or that R is the third letter?"*[189], people will recall both words that begin with R and words in which R is in the third position and, then, they will assess the relative frequency of the respective groups of words that come to mind. Finally, they will find that words starting with *"R"* are more numerous than the words that have *"R"* in the third position, simply because it is much easier to search for words that begin with the given letter[190].

Another predictive bias is the imaginability one: it occurs when individuals have to judge the frequency or probability of instances of an event, which are not stored in memory, therefore have to be generated, namely imagined. The ease with which instances may be imagined in mind will suggest such frequency.

Suppose to assess the risks involved in an expedition, especially the contingencies that are difficult to cope with: where difficulties are vividly portrayed, they may seem more likely to happen and so the expedition may appear extremely dangerous, even if the actual probability is different from that imagined. Conversely, some risks may be underestimated, if they are difficult to imagine they simply do not come to mind[191].

The last bias related to the availability heuristic is the illusory correlation. It occurs "*when we see an association between two variables (events, actions, ideas, etc.) when they aren't actually associated*"[192].

According to this, if two events are strongly associated they are assumed to frequently occur together. A simple example is the illusory correlation between suspiciousness and particular eye drawing, since the former is frequently associated with the eyes rather than any other part of the body[193].

Another type of heuristic is represented by anchoring and adjustment. It occurs when the individual does not have relevant information on a situation to be evaluated, so he tends to decide on the basis of a *"close"* available information, even if this can lead to have a completely arbitrary reference in the judgment[194]. In other words, people make estimates by starting from an initial available value, or starting point, which will be then adjusted to get to the final value. Regardless of the source of the initial value, individual's judgments are biased

[188] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[189] Ibidem.
[190] Ibidem.
[191] Ibidem.
[192] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/illusory-correlation/
[193] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[194] Nava, G. (2018). Organizzare il cambiamento – razionalità limitata & mental biases (1/3). Madeforexport.it. Retrieved from: https://www.madeforexport.it/innovazione/razionalita-limitata-ed-organizzazione-parte-i/

since the adjustments are usually insufficient. *"That is, different starting points yield different estimates, which are biased toward the initial values"*[195]. An illustrative example is an experiment in which individuals are asked to guess how many inhabitants the city of Milwaukee has: if individuals take the city of Chicago as a reference, they will assume that Milwaukee is quite large and could be about one third of Chicago (which has three million inhabitants), so it should have about one million inhabitants. If, on the other hand, individuals take the city of Green Bay (which has one hundred thousand inhabitants) as a reference, they will assume that Milwaukee is large and could be about three times as large as Green Bay. therefore, they will infer that Milwaukee has about three hundred thousand inhabitants, a result that is completely different from the first[196].
Furthermore, the reliance on anchoring heuristic causes predictable biases in the evaluation of conjunctive and disjunctive events. More specifically, people tend to overestimate probability of conjunctive events and underestimate probability of disjunctive events. Biases in the evaluation of conjunctive events are common in the context of business planning: even when the success of project is very likely, the overall probability can be low. However, the likelihood of conjunctive events tends to be overestimated by people, leading to losses in terms of time and costs of the related project. On the other side, biases in the evaluation of conjunctive events are common in the context of risk evaluation: for instance, consider a system where the functioning of each component is crucial to the overall successful performance. Even if the probability of failure of one component is low, the overall probability of some negative event is high if the system involves many components. However, people generally tend to underestimate the probability of disjunctive events, namely the failure of complex systems[197].
Finally, another type of heuristic is the affect heuristic, "*which specifically refers to how we can rely on our emotions when making decisions, which allows us to reach a conclusion quickly and without much effortful thought*" [198]. According to this, people's judgment about risks and benefits of alternatives is highly influenced by emotions. When people have a positive emotional attitude toward an option, namely experience a positive affect, they are more likely to perceive that option as having high benefits and low risks. Conversely, when they experience a negative affect, the option will be perceived as having high risks and low benefits.[199]
In light of this, individuals' decision-making process is not rational since they rely on these heuristics which may lead to cognitive biases.
It is fundamental to specify that these and other heuristics are not applied only to naïve people, but also to experts who are aware of them[200].
Beside the biases discussed so far, there are others that deserve to be mentioned due to their influence on the human intuitive system. Among them, the optimism bias. It refers to the *"tendency to overestimate our likelihood of experiencing positive events and underestimate our likelihood of experiencing negative*

[195] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[196] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.24
[197] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131
[198] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/affect-heuristic/
[199] Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The affect heuristic in judgments of risks and benefits. Journal of behavioral decision making, 13(1), 1-17.
[200] Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131

events"[201]. The unreasonably optimism of people occurs even when the stakes are high[202]. This bias explains human tendency to take risks. Just think of smokers, who even though they are aware of the statistical risks, they believe that they are less likely to suffer from cancer. Even lotteries, which are successful in part because people are unreasonably optimistic[203].

Another bias that characterizes the limited human rationality is dubbed the status quo bias, i.e., the tendency to prefer the current state of affairs, which results in resistance to change[204]. A simple example is given by a classroom, in which teachers know that students will tend to occupy the same seat; the same thing applies to magazine subscriptions, which, although they represent a cost, are unlikely to be abandoned by their readers, even if not consulted. It is the case experienced by Sunstein, who years ago, was informed about the possibility to choose the option of a three-months subscription to five magazines. He did not realize that, at the end of the three months, the subscription would be automatically renewed for a fee. For years, Sunstein continued receiving the magazines and, although he intended to cancel the subscription, in the end each time he did not complete the operation[205].

Other biases are the ones related to the framing effect, loss aversion and endowment effect already discussed above.

In the following sections, we will explain the importance of choice architecture to understand individuals' behaviour and how nudging uses heuristics and biases that affect human intuitive thinking to change such behaviour and the choices individuals or consumers make.

2.2 Nudge theory and choice architecture

The economist Richard H. Thaler is considered one of the pioneers of behavioural economics. On the basis of findings regarding the irrational reasoning of people, the shortcuts used during decision-making and the biased decisions they come up with, Thaler began to look into this in more detail, ending up evolving behavioural economics theories. Thaler together with the American legal scholar Sunstein developed the *"Choice architecture"* or *"Nudge theory"* which has been deeply explained in the book entitled "*Nudge: Improving decisions about health, wealth, and happiness*".

They start from the assumption that individuals' choices depend on a large extent, on the context in which choices are made. Our choices are not made in isolation. We choose within places, environments and architectures. The way these environments are designed has a major influence on our decisions and it can push us in one direction rather than another[206]. Hence, the concept of choice architecture explains the practice of

[201] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/optimism-bias/
[202] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.32
[203] Ibidem.
[204] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/status-quo-bias/
[205] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.35
[206] Pelligra, V. (2019). «Nudging», quella spinta gentile che vale una vita. Ilsole24ore.com. Retrieved from: https://www.ilsole24ore.com/art/nudging-quella-spinta-gentile-che-vale-vita-AC9LmOt?refresh_ce=1

influencing the choices of the individuals designing the physical and social environment in which they make decisions. The authors state that many people are choice architects, and many are not even aware that they are. A doctor who has to describe the alternative therapies to a patient, a parent who explain the educational options to his son, a salesperson; all of them are choice architects[207]. On the basis of the doctor's presentation of the drugs, the patient will decide which ones to buy from the pharmacy because in the doctor's opinion they are most suitable for the necessary therapy. Similarly, the parent classifies high schools according to the son's future job prospects. More in general, a choice architect is the one who *"has the responsibility to organize the context in which people make decisions"* in order to influence their final choices[208].

Once again, the principle of full rationality is undermined by admitting the ability to influence the choices of the decision-maker by changing the ways in which options are presented to them, in terms of design, sequence, and number of options available. Therefore, the development of behavioural theories in this sense provides further support for the assumption of bounded rationality concerning human beings[209].

Nudge theory uses bounded rationality to prompt behavioural change, influencing people to make better decisions. In this light, Dilip Soman defines the practice of choice architecture as *"a process for designing nudges to steer people toward a particular choice"*[210].

A nudge is defined as "*any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options, or significantly changing their economic incentives. To count as a mere nudge the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not."*[211]

There are some relevant aspects of nudge to be highlighted: first of all, it leverages heuristics to steer individuals toward defined directions and to help them to overcome their cognitive biases; then, in order to be considered a nudge, it should be a gentle indirect suggestion that do not limit other options; in addition, it should be easy to be avoid as well as easy to be followed, influencing biased humans' decisions without them even realizing.

In accordance with the distinction between Humans and Econs, nudge is going to alter the behaviour of the former, being completely ignored by the latter [212].

Some types of nudges are presented here together with illustrative examples.

First of all, there are some nudges that involve a slight modification of the physical environment to influence consumers' behaviour. The following example involves comparing the nudging approach with other approaches to better identify its distinctive features. Consider two cafeterias, A and B, that want to influence consumers' decisions, to let them eat less junk food. Cafeteria A implements an incentive or banning approach,

[207] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.3
[208] Ibidem.
[209] Cecchini, G. (2020). Nudging in COVID-19 era. Università Luiss Guido Carli. Retrieved from: http://tesi.luiss.it/28030/1/710201_CECCHINI_GIACOMO.pdf, p.27
[210] Soman, D. (2015). The last mile: Creating social and economic value from behavioral insights. University of Toronto Press, p.21
[211] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.6
[212] Id, p.8

respectively increasing the price of junk food or forbidding the sale of junk food. On the other side, cafeteria B uses the choice architecture (or nudging) approach: it consists in changing their food display so that junk food will less likely be chosen. In particular, junk food will be placed on higher, harder-to-reach shelves, so that it is more difficult to pick them, while healthy food will be placed at eye level and easy to pick up. Both cafeterias have the same goal, namely trying to influence the consumers' purchase of junk food but use two completely different methods[213]. As the example shows, the director of the cafeteria A is the choice architect that is enabled to design the physical environment in which consumer decisions have to be made, implementing the nudging approach. Through such nudges the director exploits the individual's reliance on intuitive and automatic System 1 to help them make better choices, i.e., eating healthy food.

Another example of similar nudge is represented by use of image of houseflies on the inside of urinals in the bathrooms of Schiphol Airport in Amsterdam. This trick was used to improve the bathroom cleanliness, reducing the *"spillage"* around urinals. The idea was to give people something to aim at. The Airport's manager, namely the choice architect, decided to use the image of housefly especially because it is small, annoying, and *"nobody feels guilty aiming at it"*[214]. This intervention was so effective that it reduced the urinal spillage of about 80%[215].

Afterwards, there are nudges that are based on framing. Often, since people are busy and rely on heuristics, they directly answer questions or solve problems as they are posed, without thinking about how the answers might vary if different formulations were given or different options were proposed. Due to this, on the one side, the reliance on automatic system leads to biased choices, whereas, on the other side, make people "nudge-able"[216].

In accordance with this, one of the most frequent systematic bias in the decision-making process of individuals is due to the framing effect already explained above, according to which choices depend how the related problems are presented. Besides the famous example regarding the Asian disease problem already discussed, there are other circumstances that show how nudges can leverage this bias to help people conform to better behaviour, for instance, in public policy. Let us consider two information campaigns between which the government has to choose to encourage citizens' energy conservation:

a) If you use energy conservation methods, you will save $350 per year (positive frame).
b) If you do not use energy conservation methods, you will lose $350 per year (negative frame).

Due to individuals' loss aversion, option B framed in term of losses, will be more effective than option A[217]. Loss aversion might lead to inertia and consequently to the phenomenon of the status quo bias. This bias can be easily exploited through the opportunity to design a default choice as a nudge. Default option is a powerful

[213] Soman, D. (2015). The last mile: Creating social and economic value from behavioral insights. University of Toronto Press, p.29
[214] Ingraham , C. (2017). What's a urinal fly, and what does it have to with winning a Nobel Prize?. Washingtonpost.com. Retrieved from: https://www.washingtonpost.com/news/wonk/wp/2017/10/09/whats-a-urinal-fly-and-what-does-it-have-to-with-winning-a-nobel-prize/
[215] Ibidem.
[216] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.37
[217] Ibidem.

nudge since even when no action is taken, the initial situation remains unchanged. The simplest example concerns the companies' option provided to customers for magazine subscriptions, as explained above: after a free subscription for a limited period, customers are required to actively cancel the subscription, otherwise, as default, they continue to pay for the service. In addition, organ donation provides a particularly interesting and well-known example of default option. Two researches at Columbia University in 2003 showed that the percentage of people who were willing to donate their organs was very high in countries such as France and very low in Denmark. The difference in these data depended on the default option. In countries where the percentage was low, *explicit consent* (opt-in) was in place, namely people who want to donate organs have to actively say that they want to be organ donors. Conversely, in countries where the percentage of donators was high, *implicit consent* (opt-out) was applied: here, unless people do not explicitly say that they do not want to be organ donors, they result to be willing to donate organs. The difference in the data showed by the researches lied in the stickiness to the default option provided by the country of origin[218].

This nudge will be further discussed particularly because of its relevance in the following discussion about influencing a sustainable behaviour of online consumers.

Nudging is especially effective, when it is applied to collective behaviours, and it comes in the form of social influences. Econs are *"unsociable creatures"*, they only communicate with others if such communication allows gaining something useful, whereas Humans are influenced by others. Such social influences can lead people to learn from each other, but also create misconceptions; therefore, social influences allow to create biased belief, for better or for worse[219].

Social influences act through information and peer pressure[220]. In the first case, on the basis of what many people do or think, they provide the individual with information about what might be the best thing to do or think. In the second case, the one of group pressure, when an individual cares about what people think of him/her, then he/she might align him/herself with the crowd to not face their disapproval.

As a matter of fact, the source of social influence is the individual's desire to imitate, coordinate with or be accepted by people that are more influential or more knowledgeable[221].

In accordance with this, "*humans are frequently nudged by other humans*"[222], due to their tendency to conform. Here choice architects exploit the sources of social influences using nudges to encourage a proper and socially beneficial behaviour and discourage behaviour that is harmful to the community[223].

Few examples show the power of social nudges: all other things being equal, teenage girls who see other peers become mothers are more likely to also get pregnant at a young age; obesity is contagious, since individuals with fat friends are more likely to gain weight; again, college students' academic engagement is influenced by their peer group, to the point that their grades depend on the roommates randomly assigned in housing.

[218] Id, p.14
[219] Id, p.54
[220] Ibidem.
[221] Bicchieri, C., & Dimant, E. (2019). Nudging with care: The risks and benefits of social information. Public choice, 1-22, p.22
[222] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.53
[223] Id, p.54

These problems can be addressed by considering the social context in which the choice architecture must be developed. Hence, social norm nudges represent a powerful tool to change targeted behaviour, by exploiting Humans' tendency to conform and evoking their social identity.

An example of how social influences are exploited by norm nudges is the *"Don't mess with Texas"* social advertising campaign initiated in 1986. This campaign was created to convince people to stop littering, as being a civic duty. Most of the litterers where men between 18 and 24 years old, therefore, in order to convince the litterers to change behaviour, Texas officers enrolled popular football players to participate in television advertisements in which they collect litters repeating the slogan *"Don't mess with Texas"*.

The slogan appealed to people's sense of social identity and community pride, representing littering as an unacceptable behaviour of Texans and making people to internalize a social norm.[224]

This example shows how the choice architect, that is, Texas officers, gently pushed individuals in directions they would not have taken on their own by leveraging the power of social influence connected to social norms. Social norms nudges will be further discussed as a tool to influence a sustainable behaviour of online consumers.

2.2.1 Libertarian paternalism

Nudge theory is based on the idea that the choice architect influences the decisions of individuals by changing the context in which those decisions are made without limiting freedom of choice. If these conditions are satisfied, then the intervention can be qualified as nudge. Therefore, the choice architect works according to the paradigm of *"libertarian paternalism"*[225]. Thaler and Sunstein argue that "*libertarian paternalism is a relatively weak, soft, and nonintrusive type of paternalism because choices are not blocked, fenced off, or significantly burdened.*"[226]

Choice architects, both private companies and public government, try to move people toward better choices, leaving them free to make the decisions they want.

According to Sunstein, nudging people involves practicing a paternalism of means rather than a paternalism of ends and using "soft" rather than "hard" means of intervention to implement it[227].

An intervention or a choice architect is defined as paternalistic if it limits individual freedom by *"banning, regulating or influencing behaviour or choices"* to achieve the choice architect's goals, without harming others[228]. On the basis of the degree of costs entailed in the intervention for individuals, two kinds of paternalism are distinguished: hard and soft paternalism.

[224] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.62
[225] Id, p.13
[226] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.5
[227] Franzini, M. (2014). Il paternalismo liberale, i nudge e la politica economica. Meridiana, 71-84, p.78
[228] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.14

Hard paternalism imposes high costs, both materials and otherwise, on individuals. A tax on cigarettes could be considered a case of hard paternalism because it represents a regulatory policy intervention that introduces sanctions to induce behavioural change, so that people must choose to stop buying cigarettes or give up more of their income[229].

In contrast, soft paternalism involves negligible costs to individuals. An example of soft paternalism is the five-cent tax on grocery bags[230].

In this context, the concept of libertarian paternalism defined by Thaler and Sunstein is a particular form of soft paternalism that does not involve any material costs[231]. The authors fully explain the two concepts, apparently contradictory, involved in the nudge strategy.

The libertarian aspect of this strategy lies in the principle that individuals should be free to do as they will, and free not to participate in situations they find undesirable. To this effect, libertarian paternalists want to make it easier for people to exercise that freedom[232].

The paternalistic aspect of the strategy lies in the legitimization of the choice architect to influence the individuals' behaviour so that they make decisions that improve their lives[233].

In concordance to this, the authors give a definition of paternalistic policy or intervention as the one that seeks to influence choices in a way that improves the well-being of those who choose, "*as judged by themselves*"[234].

Paternalistic intervention can be means-based or ends-based. The means-based paternalism applies nudges that attempt to influence individuals' behaviour toward ends that are in their interest, *"as judged by themselves"*[235]. According to Thaler and Sunstein, human cognitive limits allow to intervene not on the ends of the individuals but on the means used to pursue them, without limiting, with explicit prohibitions, the set of choices to which each person has access[236]. Here, pro-self-nudges are suitable to steer people away from irrational behaviour (bounded rationality), preventing them from making bad decisions for themselves[237].

A basic example of pro-self-nudges is the one of cafeteria, in which, on the basis of how food is displayed, individuals can choose between healthy food and junk food. This kind of intervention helps consumers to avoid irrational behaviour in order to maximize their good in the long run. These pro-self-nudges fit well into the paradigm of libertarian paternalism, which aims to push individuals to maximize their well-being, but still allows individuals to ignore the nudge at little or negligible cost[238].

---

[229] Ibidem.
[230] Ibidem.
[231] Ibidem.
[232] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.5
[233] Ibidem.
[234] Ibidem.
[235] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.15
[236] Franzini, M. (2014). Il paternalismo liberale, i nudge e la politica economica. Meridiana, 71-84, p.78
[237] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.15
[238] Hagman, W., Andersson, D., Västfjäll, D., & Tinghög, G. (2015). Public views on policies involving nudges. Review of philosophy and psychology, 6(3), 439-453

Conversely, the ends-based paternalism involves nudges that guide individuals toward predetermined ends, regardless of the interest of the individuals themselves, but beneficial to social welfare. Pro-social nudges belong to ends-based paternalism, that is the ones that prevent people from harming society or the environment. An example of pro-social nudge is the introduction of default choices that induce people to opt-out of giving money to charitable causes. Another example consists in making it easier for people to recycle in order to achieve environmental goals (i.e., green nudges). Use nudge as a policy tool to push people toward a more sustainable behaviour is good for society, since it leads to a reduction in greenhouse gas emissions responsible for climate change. Yet, environmental protection is not in the personal interest of every individual[239].

Thus, Thaler and Sunstein's definition of nudging as a libertarian paternalistic intervention based on means does not seem to include pro-social nudges; therefore, it may be a too limited concept due to the uncertainty of the degree to which individuals decide their own ends.

In this framework, the literature is divided into two ways of thought: on the one side, some claim that nudging and libertarian paternalism are conflated; therefore, they have to be considered as conceptually separated. In accordance with this, sometimes many nudges are not paternalistic even if they are labelled as such: for example, information campaigns highlighting the harms of smoking aim to protect a population from harm, respecting rights and leaving complete autonomy to individuals, hence they cannot be paternalistic[240]. Conversely, the other branch of literature, namely Thaler and Sunstein, claim that "*all nudges are a form of libertarian paternalism and defensible as such*"[241].

However, the remainder of the thesis does not concern libertarian paternalism but aims at evaluating nudging as an environmental policy tool that is suitable to influence an online consumer's sustainable behaviour. Therefore, the next section, will explain green nudging and the ways in which it can be implemented to pursue environmental ends.

2.3 Green nudging

Green nudges aim at pushing people toward an "*environmentally responsible behaviour*"[242]. Green nudging is introduced as an environmental policy tool that can better address the human bounded rationality than conventional regulatory policy interventions. The following section will discuss the environmental problems and the main barriers to sustainable behaviour. Further on, the conventional environmental policy instruments that have been used to tackle such problems will be discussed. Finally, the nudging approach will be flanked

[239] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.15
[240] Ibidem.
[241] Id, p.16
[242] Schubert, Christian (2016).Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg, p.4

to the traditional methods, therefore, some important green nudges for overcoming these obstacles will be analysed.

2.3.1 Environmental problems and ecological behaviour barriers

The negative impacts of human behaviour and consumption on the environment have some distinctive characteristics compared to other policy areas. According to Per Mickwitz, environmental problems can be very complex, due to both the natural resources extraction process and human, social, technical and economics interaction involved in such process[243]. Environmental problems concern geographically remote regions connected through economy: the negative impact of an activity in a region such as the emissions of sulphur dioxide from an electricity plant in the UK, become noticeable in another region, like the reduction in fish populations in a small lake in Scandinavia[244].

Moreover, often the consequences of an activity that is not sustainable in environmental terms will not be observed for a very long time[245].

Furthermore, the causes and the consequences of the environmental problems are unequally distributed, that is, developing countries are often more affected by climate change than developed countries, due to their increased dependence on natural resources and reduced means of coping with negative environmental consequences[246].

Finally, global environmental protection and natural resources are referred to as *"commons"*. The term *"commons"* is used for both public goods and common-pool resources (CPR henceforth). Both types of goods are non-excludable, that is, it is impossible or very expensive to prevent someone from access the good (i.e., the air we breathe). A distinctive feature of public goods is that they are non-rival, that is, the use of a public good by one does not exclude access by others (i.e., order and national defence). In contrast, CPR are rival, as the access to the resource prevents others to access some amount of such resource or future use of it. These common-pool resources are in fact largely environmental assets. "*Examples of environmental common-pool resources are grazing areas, fisheries, forests, water quantity and quality, the air quality. They [CPR] are available in limited amounts: hence utilizing them in a non-exclusive way can make their use excessive*."[247]

Some claim that the feature of non-excludability leads these resources to be defined as *"open access"*, but this is not always the case. Open access happens when there is no owner of the resources and therefore there is no formal responsibility to the resource; thus, the likelihood of depletion of the resource stock is very high. Others refer to common-pool resources as *"common property resources"*[248]. However, the CPR may be owned and

[243] Mickwitz, P. (2003). A framework for evaluating environmental policy instruments: context and key concepts. Evaluation, 9(4), 415-436, pp.416,417
[244] Id, p.417
[245] Ibidem.
[246] Ibidem.
[247] Musu, I. (2013). Economic Analysis, Sustainability and Environmental Commons, p.1
[248] Id, p.2

managed as public, private, or common property. Because consumption of the common good is rival, one individual's use of the good has negative externalities on other consumers and on the environment.

To better explain the organization process of CPR, Elinor Ostrom distinguishes between resource system and the flow of resource units produced by the system[249].

The resource systems are considered as stocks of the resource that are capable, under favourable conditions, of producing a quantity of flows of the resource without damaging the stock or the resource system itself; examples of stocks of the resource are fishing areas, grazing areas, irrigation canals.

Flow of resource units are what individuals use and consume as inputs from resource systems to further production processes; examples of resource units are represented by the fish harvested from a fishing ground, the feed consumed by animals from a grazing area and the biological waste absorbed by streams.

While the stock of the resource may be jointly supplied and/or produced by multiple entities, resource units are what individuals appropriate, and consequently are not subject to joint use by multiple entities; hence, for instance, the fish harvested by one boat is not there for someone else[250].

For what concerns the environment, it is not only a matter of preventing others from access common good by taking something away from it, but also of introducing something into it, i.e., in the water, chemical and radioactive waste, residual energy; in the air, dangerous and noxious fumes; and unpleasant and disturbing advertising signs in our visual horizon[251].

Studies have focused on environmental goods defined as common-pool resources as well as the unobservable relation between the environmental goods-related activities and their consequences on the environment that lead to individuals' unsustainable behaviour. This phenomenon is better explained by the theory of the common goods developed by Garret Hardin in 1968. According to the theory, when it comes to the use of common goods, individuals prioritize their own self-interest over the interests of the group[252]. As a result, shared environmental resources are overused, abused and ultimately exhausted, which poses risks for all concerned. It happens because, as already said, environmental goods are considered as common property resources, therefore people do not feel directly responsible for the good, and no one can be denied access to it. Furthermore, the harmful consequences of private activities may not have a direct or immediate impact on the polluter, but rather are dispersed across society. Therefore, the opportunity to benefit from common goods and natural resources without risking being excluded and without contributing to survival of such resources explains opportunistic human behaviour, called free-riding, that results in an excessive use of the flows and not enough action to raise the stock at least[253].

Unlike Hardin's theory, which assumes rational and self-interested individuals without considering behavioural aspects of decision-making, Ostrom proposes the utility of behavioural factors in assisting people,

[249] Ostrom E., (1990). Governing the Commons. Cambridge: Cambridge University Press. Retrieved from: https://wtf.tw/ref/ostrom_1990.pdf, p.30
[250] Id, p.31
[251] Hardin, G., & Coccoli, L. (2009). La tragedia dei beni comuni. Bollettino telematico di filosofia politica.
[252] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.18
[253] Ibidem.

defined as *"prisoners"*, to avoid the conflict between private and social interests. That is why, for instance, social norms are assumed to both "*facilitate or hinder collective action*"[254]. This powerful tool will be further analysed.

Besides the general problems associated with common resources, the implementation of ecological behaviours is hindered by other financial, material and psychological obstacles[255]. Ecological behavioural barriers are augmented by material factors, that is, infrastructures such as recycling system or public transportation. The better they are implemented, the more they are able to foster ecological human habits.

As explained above, another reason is that, in the area of environmental policy, complexity factors, long periods of time and vague cause-consequences relations result in policy interventions such that people perceive more widely the immediate negative outcomes, including the costs (i.e., restriction or payment), rather than the positive outcomes for society in the long run. Since environmental damages are not always immediately evident, no sustainable behavioural change is perceived to be necessary; for instance, the advantages of mitigation by means of emission reductions are temporarily extended, while costs currently occur.

Another barrier is represented by the attitude-behaviour gap also referred to as intention-action gap. It is the discrepancy between "*what people think they would like to do* [change environmentally harmful behaviour] *and what they actually end up doing*"[256].

Because general economic theories have shifted from the neoclassical model of rational economic man (*homo economicus*) to a model based on a more realistic human economic behaviour, this change has also affected the environmental field. As a result, to solve the environmental problems and overcome ecological barriers, behavioural insights have been incorporated into the set of environmental policy interventions. In this framework, green nudges could become a powerful tool for tackling environmental issues. The goal of green nudging is to leverage individual cognitive biases to improve promoting behaviours for people that are more concerned with the environmental sustainability[257]. Before concentrating on the four kinds of this policy tools, a brief overview of the conventional environmental policy instrument will be provided in the next section.

2.3.2 Traditional environmental policy instruments

Mickwitz defines environmental policy instruments as *"the set of techniques by which governmental authorities wield their power in attempting to affect society - in terms of values and beliefs, action and organization - in such a way as to improve, or to prevent the deterioration of, the quality of the natural environment.[258]"*

[254] Ibidem.
[255] Id, pp.19,20
[256] Soman, D. (2015). The last mile: Creating social and economic value from behavioral insights. University of Toronto Press, p.18
[257] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.20
[258] Mickwitz, P. (2003). A framework for evaluating environmental policy instruments: context and key concepts. Evaluation, 9(4), 415-436, p.419

Environmental policy instruments (and policy instruments in general) may be classified according to both the degree of authoritative force involved or the instrument's target.

Considering the former criterion three categories are distinguished: regulatory, economic and information instruments.

According to the latter criterion, environmental issues typically arise as a result of how natural resources are produced and the quantity extracted for utilization, how they are utilized in the manufacture of goods and services, and the quantity and mode of use of goods and services. Environmental policy tools may thus be classified according to one of these processes they target. But these processes are interdependent and therefore they are all impacted, regardless of the instrument's primary goal.[259].

The aim of regulatory instruments (also known as command-and-control) is to influence human behaviour by changing the range of options available[260]. Standards, bans, permissions, planning, and restrictions are some of the tools used. Evert Vedung clearly defined regulations as *"measures undertaken by governmental units to influence people by means of formulated rules and directives which mandate receivers to act in accordance with what is ordered in these rules and directives"*[261]. Environmental legislation has been widely used in most industrialized countries to interfere and eliminate environmental damage. Regulations can be mandatory, such as an upper limit on pollution threshold for coal-fired power plants in the US Clean Power Plan; also, regulations can be standards, such as banning vehicles without a green carbon tag from entering the city centre[262].

Furthermore, economic environmental policy instruments alter the gains and/or the expense of the agents[263]. They are properly defined as *"involving the handing out or the taking away of material resources while the addressees are not obligated to take the measures involved"*[264]. In the environmental field, economic instruments do not *"formally restrict"* individuals' decision-making but influence their choices toward the regulator goals, that is environmental sustainability[265]. The difference with the regulations lies in leaving individuals in deciding whether or not to take action on their own. Examples of economic incentives are grants and subsidies, taxes and charges. They can be monetary such as the European Emissions Trading System (EU ETS); or non-monetary such as awards provided to best practice firms which, in contrast with their competition, provide the smallest amount of annual waste[266].

---

[259] Ibidem.
[260] Ibidem.
[261] Vedung, E., Bemelmans-Videc, M., & Rist, R. (1998). Policy instruments: typologies and theories. Carrots, sticks, and sermons: Policy instruments and their evaluation, 5, 21-58, p.10
[262] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.22
[263] Mickwitz, P. (2003). A framework for evaluating environmental policy instruments: context and key concepts. Evaluation, 9(4), 415-436, p.419
[264] Vedung, E., Bemelmans-Videc, M., & Rist, R. (1998). Policy instruments: typologies and theories. Carrots, sticks, and sermons: Policy instruments and their evaluation, 5, 21-58, p.11
[265] Michalek, G., Meran, G., Schwarze, R., & Yildiz, Ö. No 21–October 2015. Nudging as a new "soft" tool in environmental policy. An analysis based on insights from cognitive and social psychology, p.10
[266] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.22

Finally, information measures *"influence addressees through the transfer of knowledge, communication of reasoned argument, persuasion, advice, moral appeals, and so on"*[267]. Information is a policy tool aims to change people's perception of environmental issues and the importance attached to them[268]. This can be done through persuasion, exhortation and public communication. It is a powerful instrument that influences agents to engage in a particular behaviour by providing them with affirmative information, for instance encouraging people to travel by bike in designated week of the year; otherwise, agents can be provided with negative information that dissuade them from performing an ecologically unconscious behaviour, for instance convincing people to reduce paper waste by explaining the negative impact of deforestation[269].

Economic and information instruments are distinguished from regulations because of their *"softness"*. That is, the choice in a given set available to a decision-maker is not prohibited through restrictions, but is discarded through budget constraints, emphasized or blurred.

Despite their differences, the traditional environmental policy instruments assume full human rationality in making choices that maximize their utility. Here the decision-making is carried out by the conscious and reflective System 2.

However, since most human choices are driven by the automatic and reflective System 1, it is necessary to address it through nudges, in particular the ecological or green nudges[270]. Therefore, green nudging is introduced as a *"soft, non-regulatory extension of the environmental policy toolkit. […] potentially non-intrusive way of pursuing environmental ends"*[271].

2.4 Typologies of green nudges

Given the increasing body of literature on current or potential green nudges, we will focus on four types of these soft policy instruments that seem to be distinctive examples of the overall approach to public policy-making. Specifically, we will distinguish between four green nudges: eco-labelling, green default, feedback, and green social norms.

[267] Vedung, E., Bemelmans-Videc, M., & Rist, R. (1998). Policy instruments: typologies and theories. Carrots, sticks, and sermons: Policy instruments and their evaluation, 5, 21-58, p.48

[268] Mickwitz, P. (2003). A framework for evaluating environmental policy instruments: context and key concepts. Evaluation, 9(4), 415-436, p.419

[269] Vedung, E., Bemelmans-Videc, M., & Rist, R. (1998). Policy instruments: typologies and theories. Carrots, sticks, and sermons: Policy instruments and their evaluation, 5, 21-58, p.48

[270] Michalek, G., Meran, G., Schwarze, R., & Yildiz, Ö. No 21–October 2015. Nudging as a new "soft" tool in environmental policy. An analysis based on insights from cognitive and social psychology, pp.10,11

[271] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.24

2.4.1 Eco-labelling

Eco-labels can be messages that simplify product or service information or can be organic markers to make some characteristics more salient, so that to appeal consumers' desire to maintain a positive self-image[272]. That is, choice architects are able to foster a pro-environmental behaviour by motivating people to "*cultivate a positive self-image as considerate "pro-environmental consumers""*[273].

Providing information can be useful to foster green behaviours, but it has to be simplified to reduce individuals' cognitive effort. As said above, real-world individuals process information differently from the neoclassical *homo economicus*, that is they ignore part of information provided, or absorb it in a biased way due to their cognitive limits. Hence, framing effect plays a relevant role as it takes into account how the information has to be presented to final consumers in order to encourage them engaging in an ecological behaviour[274].

Eco-labels represent a suitable tool to provide consumers with product or service information that are essential for an environmentally friendly behaviour. However, eco-labels not only provide information to consumers but also affects them during their purchase process, being a basic element of the choice architecture[275]. To this effect, eco-labels exploit the salience bias, namely "*the people tendency to focus on items or information that are more noteworthy while ignoring those that do not grab their attention"*[276].

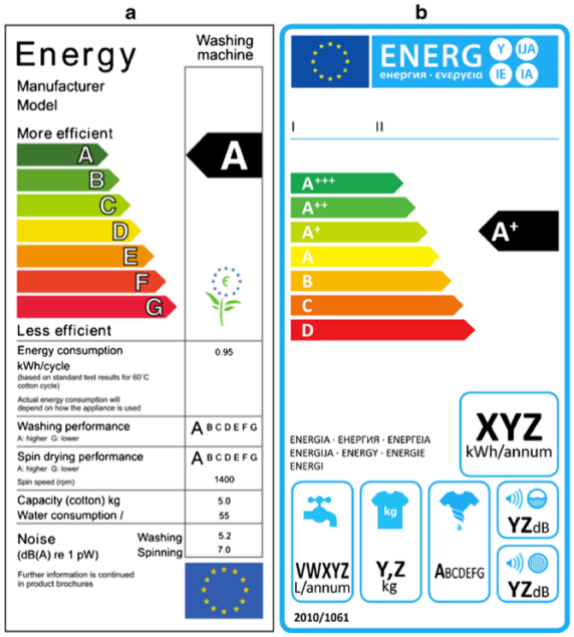
In other words, eco-labels are used to increase the salience of some environmental aspects of certain choices, making customers more aware of them.

Moreover, this nudge is not only effective through framing effects and salience; due to the extent to which a sustainable behaviour is socially acceptable in the socio-cultural context, eco-labels are used to confer social significance on the enhanced aspects. In other words, they appeal to a consumer's self-image and desire to belong to an ecologically-conscious society[277].

An example that explains how salience eco-labelling impact consumer choices is represented by the European Union (EU) scheme for electronic appliance energy labelling, implemented in 1995[278]. In the original design, appliances scored on a seven-point coloured scale varying from class A (green), the most energy-efficient, to G (red), the least energy-efficient in terms of energy consumption. It has been such a successful strategy that it has positively influenced consumers to purchase more energy-efficient appliances. In turn, it has also had a positive impact on producers: by 2003, 90 % of refrigerators, dishwashers and washing machines reached class

[272] Schubert, Christian (2016). Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg, p.7
[273] Ibidem.
[274] Ibidem.
[275] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.28
[276] Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/salience-bias/
[277] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.28
[278] Ölander, F., & Thøgersen, J. (2014). Informing versus nudging in environmental policy. Journal of Consumer Policy, 37(3), 341-356, p.345

A. As a result, a revision of the scale and criteria defining labels was needed. To allow consumers to identify appliances more efficient than A, additional classes were added on top of class A, up to get the class A+++ beyond the former A category. The scale is then cut off at the opposite end, while maintaining the seven-point scale format and colour code[279].



280

Figure 2.2: "EU energy label for washing machines, old (a) and new (b) design"

A completely rational man would not have changed the way such labels are interpreted. However, since real-world individuals are not fully rational, the results were different from those expected. Thus, the increase in energy efficiency achieved when moving to classes beyond A (from A+ to A++) was perceived to be smaller than the increase in relative efficiency achieved when moving between categories with different letters. That is why, consumers took the class A as the current reference point or anchor, perceiving all groups of class A (A+, A++, A+++) as somewhat similar. Consequently, an energy class below A was regarded as a loss, whereas one above class A was regarded as a win. Therefore, since losses loom greater than gains, increases in energy class above A will be priced lower than a comparable increase below class A. As a result, customers were less likely to use energy-saving appliances[281].

2.4.2 Green defaults

It is possible to encourage pro-environmental actions by carefully determining the default, that is, set a predefined option that prevails when people do not make an active decision[282]. Before making examples

[279] Ibidem.
[280] Id, p.346
[281] Ibidem.
[282] Schubert, Christian (2016). Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg, p.17

concerning the benefits of such green nudge, it is necessary to analyse the psychological factors on which rely the effectiveness of defaults, namely inertia, loss aversion and implicit endorsement[283].

First of all, opt-in and opt-out defaults are nudges that exploit the status quo bias and loss aversion, already discussed. Active decision-making requires costs in terms of money, time and cognitive effort. Sometimes people are unwilling to focus on complex trade-offs, such as sustainable solution and monetary savings, because it leads them to incur costs in terms of cognitive effort[284]. As a result, the avoidance of taking active decisions, prevents people from incurring these costs.. Therefore, people tend not to choose, recognizing the effects of their inertia rather than taking the responsibility of an active choice[285]. The source of this resistance to active choice, or inertia, is loss aversion. The default option is set as a reference point that is considered as an endowment, therefore opting out the default option is perceived as a loss of the endowment[286]. Due to their loss aversion, people will be more averse to the results that arise from action (for which they are responsible) than to results coming from inaction[287].

Furthermore, people perceive the default option as an implicit recommendation or endorsement by a superior authority. Especially when they lack expertise or when the decision-making becomes complex, due their bounded rationality, people think that the given default has been set for a superior good reason[288].

There are several examples that show how the status quo bias and the other biases mentioned above can be exploited by setting an environmentally friendly choice as default. One of the main applications fields of this nudge is that of energy: studies have shown that when consumers are asked to choose between different home electricity contracts, setting the default choice to the sustainable energy option, steer people towards an increasing purchase of renewable energy[289].

Another experiment was conducted on the printers of Rutgers University (New Brunswick, NJ): default setting was switched from "single-sided" printing to "double-sided" printing. As a result, a saving of 7 million pages, or about 620 trees has been recorded[290].

2.4.3 Feedback

Giving people feedback on the effects of their decisions (i.e., the amount of electricity they consume) is another way to nudge them toward greener choices. On the basis of the type of feedback individuals get, the decision context is influenced as well as individuals' decisions and behaviours[291].

---

[283] Id, p. 18
[284] Ibidem.
[285] Bonini, N., Hadjichristidis, C., & Graffeo, M. (2018). Green nudging. Acta Psychologica Sinica, 50(8), 814-826, p.821
[286] Schubert, Christian (2016). Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg, p.19
[287] Bonini, N., Hadjichristidis, C., & Graffeo, M. (2018). Green nudging. Acta Psychologica Sinica, 50(8), 814-826, p.821
[288] Schubert, Christian (2016). Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg, p.19
[289] Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument, p.27
[290] Bonini, N., Hadjichristidis, C., & Graffeo, M. (2018). Green nudging. Acta Psychologica Sinica, 50(8), 814-826, p.821
[291] Ibidem.

Feedback is a simple but effective strategy to help people to improve their performance and correct wrong behaviour. Doing so, this tool has to be well-designed[292]. *"This strategy can improve the operation of the markets and government alike, and are also far less expensive, and less intrusive, than command-and-control approaches that national legislatures have so often favoured"*[293].

Carl Fischer's study show how feedback on electric energy consumption help customer to control their consumption more accurately and, as a result, save electric energy. The success of this nudge lies in the following elements: the feedback makes people aware of the problem, of their behaviour related relevance and of the opportunity of their behaviour to solve the problem (people become aware of their high electricity consumption and consider how to reduce it); the feedback also specifies the actions needed to solve the problem (the installation of electronic display at each appliance to provide information about the relative consumption)[294].

According to Fisher, there are three ways to improve the effectiveness of the feedback message. First of all, in order to create a direct relation between cause and effect of customers' actions so to increase the customer awareness of their electric energy consumption, the feedback has to immediately follow the action. Moreover, increasing the frequency of feedback for a long time period can help to foster the generation of habits, such as the habit of not leaving the lights on when leaving the room. Finally, the more specific and precise (energy costs per room, time of day and so on) the feedback is, the higher its effectiveness[295].

An additional example of an effective green feedback has been developed by Southern California Edison which tried to encourage customer to save energy through the Ambient Orb, a ball that changes colours on the basis of energy consumption: it becomes red when a customer is using much energy and green when he is moderate in energy consumption. This tool helped customers to reduce their use of energy up to 40%[296].

2.4.4 Norm-nudges: descriptive and social norms

As said above, although nudging generally focuses on individual behaviour change, it is also applied to collective behaviours.

Such nudges rely on the assumption that targeted behaviours are interdependent, as individuals' social preferences are influenced by social expectations.

Cristina Bicchieri defines preferences as *"dispositions to act in a particular way in a specific situation"*[297]. More specifically social preferences are influenced by behaviours, beliefs and outcomes of other people; therefore, they might take into account social comparison or social expectations. Social preferences based on

[292] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.92
[293] Id, p.191
[294] Bonini, N., Hadjichristidis, C., & Graffeo, M. (2018). Green nudging. Acta Psychologica Sinica, 50(8), 814-826, p.821
[295] Ibidem.
[296] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin, p.196
[297] Bicchieri, C. (2016). Norms in the wild: How to diagnose, measure, and change social norms. Oxford: Oxford University Press, p. 7

social comparison can be unconditional, as they do not take into account "*how others act in similar situations or what they approve/disapprove of*"[298]. Conversely, they could be conditional, as based on others' actions and beliefs.

Expectations are beliefs. Social expectations, in turn, are beliefs that individuals have about other's behaviours and beliefs[299]. If people's preferences depend on how other people will act, we refer to empirical social expectations[300]: for instance, a tourist's left-side driving in England is influenced by the expectation that people in that country expect to drive on the left side.

On the other hand, normative social expectations occur when people's preferences are influenced by their beliefs that other people have beliefs about how they should act. A suitable example is made by Bicchieri: *"I believe that women in my village believe a good mother should abstain from nursing her newborn baby"*[301].

In both cases, the group of people whose beliefs and behaviours are taken into account by individuals when making decision is called *"reference network"*[302].

Depending on which kind of expectations individuals' choices rely, two different norms are distinguished, descriptive and social norms.

"A descriptive norm is a pattern of behaviour such that individuals prefer to conform to a condition that they believe that most people in their reference network conform to it (empirical condition)"[303].

On the other side, *"a social norm is a rule of behaviour such that individuals prefer to conform to it on condition that they believe that a) most people in their reference network conform to it (empirical condition) and b) that most people in their reference network believe they ought to conform to it (normative condition)"*[304].

Social norms are also defined injunctive norms: they express what people believe ought to be done, therefore what they think is socially approved or disapproved of[305]. The additional characteristic of social norms is the strong normative influence that is crucial in shaping behaviours and driving compliance. The latter is motivated by the pressure to conform involved. Indeed, not respecting the social norm means suffering consequences in terms of disapproval by the social group or punishment[306].

In this framework, nudging is effective in changing collective behaviours by exploiting the power of descriptive and social norms. In this regard, we henceforth will refer to norm-nudging. Norm-nudging consists in conveying information about how *"most people"* behave and what they approve/disapprove of. Norm-nudging elicits social expectations to induce a behavioural change, assuming that preferences of individual's targeted behaviour are conditional, namely influenced by social expectations[307].

---

[298] Ibidem.
[299] Id, p.11
[300] Id, p.12
[301] Ibidem.
[302] Id, p.14
[303] Id, p.19
[304] Id, p. 35
[305] Id, p. 31
[306] Id, p. 35
[307] Bicchieri, C., & Dimant, E. (2019). Nudging with care: The risks and benefits of social information. Public choice, 1-22, p. 8

Norm-nudging exploits social influence which, as said above, act through information and peer pressure: by giving information about what other people do, making comparison with their peer, neighbours, or friends can have a powerful influence on individuals targeted behaviour[308].

Below we will explain the reasons why using nudges that rely on green descriptive and social norms is effective to change collective behaviours towards more pro-environmental ones.

Syon Bhanot conducted a natural field experiment examining the water conservation behaviour of over 40,000 households in California. These households are used to receiving Home Water Reports (HWRs) via emails, regarding social information on water use and advice on how to update the home's fixtures to be more energy friendly[309]. The households were assigned to one of four groups (or conditions): Control group, No Drop, Drop; and Injunctive Drop. The Control group receive the email HWR with no peer information; the No Drop group received the email with the HWR and peer information, but no visual cue or injunctive norms message; the Drop group received the email HWR and a basic visual cue (a simple water droplet); the Injunctive Drop group received the email HWR and a visual cue as injunctive norm massage. More specifically, the water droplet was either happy, neutral, or a scowling face on the basis of the household's water consumption compared to similar homes[310].

The results show that inclusion of injunctive condition in the use of social norms was a crucial element in the reduction of water consumption[311].

Another well-known study was conducted by Noah J. Goldstein and colleagues to show how descriptive norms are able to enhance pro-environmental behaviour in hotel[312]. The experimenters elicited hotel's guest to participate to the towel reuse program proposed to increase indirect water conservation. Hotel guests were divided in groups (or conditions) and exposed to two messages, respectively: the first message highlighted the importance of the environment with no descriptive norm mentioned; the second message use descriptive norms, informing guests that the majority of other clients reuse their towels. As a result, descriptive norms increase the towel reuse rate from 35.1% (environmental protection condition) to 44.1%[313].

Sometimes providing empirical information about people's behaviour is not enough to induce a significant behavioural change[314]. To this effect, is necessary to specify the reference network of the norm followers taken into account when both descriptive and social norms are used in the nudging approach. There are several factors that influence the likelihood that people follow the norms of a specific reference network; in particular the concept of similarity and social identity are considered. The norm compliance increases when individuals perceived the reference network mentioned as similar to them. This is due to the social comparison theory,

[308] Ibidem.
[309] Bhanot, S. P. (2018). Isolating the effect of injunctive norms on conservation behavior: New evidence from a field experiment in California. Organizational Behavior and Human Decision Processes, p.13
[310] Id, p.14
[311] Id, p.21
[312] Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. Journal of consumer Research, 35(3), 472-482
[313] Id, p. 474,474
[314] Bicchieri, C., & Dimant, E. (2019). Nudging with care: The risks and benefits of social information. Public choice, 1-22, p. 8

according to which *"people often evaluate themselves by comparing themselves to others—especially to others with whom they share similar personal characteristics"*[315]. Therefore, people are more likely to behave like people that are similar in terms of features such as age, personality attributes, gender and attitudes.[316]
Afterwards, people tend to adhere to norms followed by the reference groups they identify with; according to social identity theory, when people identify themselves with a group they tend to conform with it since it is perceived as appropriate[317].
To this effect, in their study Goldstein and colleagues show that better specifying the reference group as *"other hotel guests who stayed in the same room"* resulted to sharply increase the compliance rate with respect to the case in which the reference group was just "the other hotel guests"[318].

2.5 Research gap and research question

So far, we have deeply discussed the nudging approach as a powerful policy tool to induce individuals' behavioural change. More specifically, the introduction of this tool in the environmental field (green nudges) has been discussed. Several studies have been mentioned to clarify the effectiveness of green nudges in eliciting pro-environmental behaviours, in both public and private areas. It may seem that green nudges, as innovative policy instruments, are better able to solve environmental issues and could be more successful in certain circumstances than traditional policy instruments.
Several laboratory studies, field experiments and surveys have studied the impact of nudging on customer choice. Some have begun to investigate the effect of green nudges on customers' attitudes, habits, behaviours and consumption, as well as traditional and online purchase processes. However, the influence of green nudges on sustainable decision-making in the online environment is largely unknown. This thesis aims at bridging a gap in the literature concerning the influence of green nudges on online purchase environment and sustainable consumer choice, in particular the choice of delivery service.
In this regard, the increasing use of e-commerce, fostered by the COVID-19 pandemic, has been followed by environmentally devastating consequences in terms of greenhouse gas emissions. One of the main reasons for these consequences lies in the last-mile delivery stage of the supply chain. As online customer demand rises, the need for fast delivery of orders purchased online increases as well.
Given the significant management costs incurred by the company who implement fast delivery and the related impact on the environment, a new more sustainable delivery option is proposed to face the last-mile delivery challenge, i.e., the green delivery option. It could be a suitable solution to significantly reduce the environmental impact of online purchase, especially of the last-mile delivery of orders to customers' houses.

[315] Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. Journal of consumer Research, 35(3), 472-482, p. 475
[316] Ibidem.
[317] Bicchieri, C., & Dimant, E. (2019). Nudging with care: The risks and benefits of social information. Public choice, 1-22, p. 16
[318] Id, p. 9

As the first chapter already explained, the green delivery option has been introduced by several e-commerce in different ways, such as the "Amazon Day" option.

Here, the goal is to investigate whether green nudging theory can have a significant influence on the online consumers' adoption of a sustainable purchase behaviour, namely the choice of green delivery option.

The answer to this question will be provided by conducting a study that will analyse the different impact of four fundamental effective green nudges thoroughly described above, namely eco-labelling, default option, feedback and norm-nudges. By comparing the impact of the four nudges on the online customers' choice, the study will define the most effective green nudge in inducing customer to behave more ecologically.

In addition, due to the growing relevance of environmental issues, an increase in individuals' environmental concern has occurred. Several studies, such as the one conducted in Mexico by Andrew J. Fu and Mina Saito, explored customers' willingness to behave in a more sustainable way during online purchase process, waiting few more days for the home delivery of their online orders if it reduces the environmental impact of their purchase. Indeed, the study showed that 50% of people are willing to wait longer without receiving incentives or information; 70% of people are willing to wait longer when the economic incentive is provided; this percentage increases up to 71% when environmental impact information is provided[319]. In light of this, the study will include also an analysis of the key role of consumers' environmental concern. Hence, it could be interesting to analyse whether the environmental concern of online consumers can play a role in the influence of green nudges toward the activation of sustainable purchasing behaviour. In other words , the thesis aims to understand the influential power of green nudges in influencing online purchase of both consumers that are not interest in the environmental issue and those who are increasingly concerned with problem.

[319] Fu, A. J., & Saito, M. (2018). ""Would You Be Willing to Wait?": Consumer Preference for Green Last Mile Home Deliver.", p.19

CHAPTER 3

An experimental analysis on green nudging:
exploring the moderating role of environmental concern on the relationship between different green nudges and sustainable online purchase behaviour

3.1 The conceptual model and hypothesis development

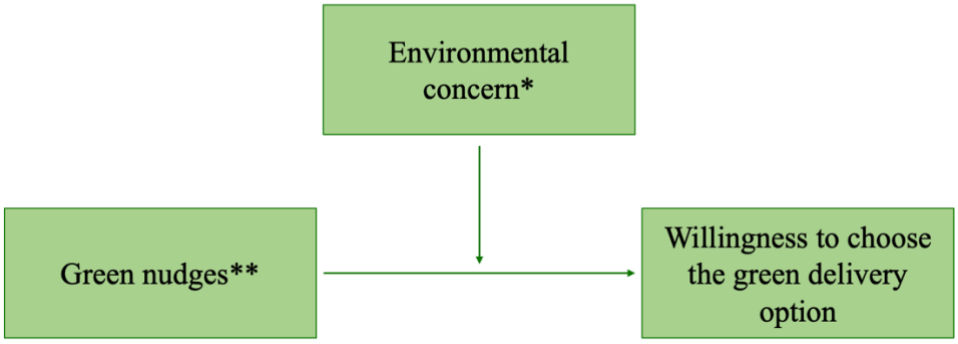
Until now, we have discussed the theory of nudging and its application in the environmental field. The aim of this thesis is to enhance literature about the influence of green nudging on individuals' decision-making. In particular, the literature about green nudging in the online environment is scarce.

To narrow the search field, the study will focus on the influence of green nudging on the individual's choice of a sustainable delivery service when purchasing online. In this framework, the role of the consumers' environmental concern is also explored.

To properly design a conceptual model, the main research questions are repeated in a clearer and more complete way.

Research Question 1: Do and to what extent different green nudges stimulate consumers to choose the green delivery option in their online purchase behaviour?

Research Question 2: Does the role of environmental concern affects the direction and the strength of the relationship between different green nudges and the willingness to choose the green delivery option in online purchase behaviour?



*Customers environmentally concerned VS customers non environmentally concerned

**Green nudges: eco-label, default option, feedback, social norm

Figure 3.1: "Conceptual model"

In order to fill the research gap and answer the questions above, a moderation model is set, the elements of which are the following: the different green nudges (eco-label, default option, feedback and social norm), represent the independent variable; the willingness to choose the green delivery option is the dependent variable; finally, the environmental concern represents the moderator, as illustrated above.

This conceptual framework aims to shed light on whether and to what extent green nudging induces pro-environmental behaviour in the online environment; it also focuses on the potential role of the rising environmental concern in influencing the above-mentioned relationship.

Hence, this chapter is going to review the literature involving the role of green nudging in influencing consumers' online decision-making; moreover, it takes into account past research that examines whether eco-friendly attitudes influence the willingness to behave in an ecological way. In this regard, past research is involved to present the hypotheses that will be tested in the experiment. Testing the hypotheses will be functional for understanding more deeply the relations between the variables of the conceptual framework. The experiment is made through an online questionnaire. In order to explain how the experiment is conducted, the research methodology and design will be discussed. Then, there will be a presentation of results followed by a discussion that allows us to interpret and understand data collected.

Findings of the research will give us the opportunity to comprehend in detail whether an influence of green nudges regarding online purchasing choices exists, and which interactions characterize it. Thereby, the research will provide theoretical contributions and managerial implications concerning the topic of interest.

3.1.1 The effect of different green nudges on sustainable online purchase behaviour

The literature of last decades demonstrated that green nudging is an effective policy tool when used for environmental ends. More specifically, among all the available green nudges, eco-labels are enticing tools that remind customers of the effect of their purchasing choices on the environment and, at the same time, provide companies with a mean to extract market place preferences, thus increasing market share[320].

As previously discussed, eco-labels represent instruments that facilitate customers' identification and location of green products[321]. To solve the difficulties in finding green offerings, eco-labels provide customers with salient information about environmental characteristics of the products to make customers more aware of the opportunity to engage in a more environmentally friendly behaviour.

In other words, eco-labels aim at offering consumers accurate information and increasing the demand for pro-environmental products[322].

The example about the electronic appliance energy labelling introduced by the European Union (EU) clearly shows the role of such nudges to push people towards ecological behaviour[323]. Moreover, another stream of

[320] Tullani, H., Dahiya, R., (2017). A Turn In Green Purchase Intentions Through Eco-Labelling, International Journal Of Engineering Research & Technology (Ijert) Ncietm - 2017 (Volume 5 - Number 11), p. 3

[321] Ibidem

[322] Thidell, Å. (2009). Influences, effects and changes from interventions by eco-labelling schemes-What a Swan can do? (Vol. 2009, No. 5). Lund University, p.16

[323] Ölander, F., & Thøgersen, J. (2014). Informing versus nudging in environmental policy. Journal of Consumer Policy, 37(3), 341-356

research has studied the effectiveness of eco-labels in improving the eco-friendliness of customers' food choices in a cafeteria setting[324].

Given these results, it seems reasonable to use eco-labels in the online purchase process in order to promote a sustainable delivery service, by making green delivery option more salient. Therefore, it is hypothesized that:

H1a. *Online customers are more likely to engage in sustainable purchase behaviour by selecting the green delivery option when provided with an eco-label as a green nudge rather than in the case where no green nudge is used.*

In addition, another nudge that turned out to be an effective mean of influencing consumers to buy in a sustainable way is the green default option.

Indeed, when consumers are provided with sustainable option as default they are more likely to make sustainable choices than in the case in which the unsustainable alternative is set as default[325]. The default option defines the reference point, or, in case of purchases, the reference product category. Generally, the reference product category is represented by unsustainable products, and all other alternatives offered, in addition to the reference one, are perceived as a loss. Because of loss aversion, a perceived loss has a greater impact on consumer preferences than a proportionate gain. Consequently, if the reference category is represented by traditional unsustainable products, consumers will be less likely to make a choice different from their reference point due to a negative attitude toward the sustainable alternative, perceived as a loss[326].

Moreover, as explained in the previous chapter, people tend to stick to the default choice, because it allows them to save time and it is also seen as an implicit recommendation of the provider, therefore the best option to choose.

The well-known experiment conducted by Katharina Momsen and Thomas Stoerk showed how green default nudge is able to increase the likelihood of consumers choosing renewable energy when entering into a home electricity contract. According to this study, the share of consumers who adopt renewable energy increased by 44.6%[327].

Furthermore, Gerrit Antonides and Michelle Welvaarts in 2020 studied the power of defaults in online choice environment considering the customers' purchase of make-up products. The research showed that when the sustainable product was set as default option, it was 8% more likely to be selected than if the default was an unsustainable product[328].

[324] Slapø, H. B., & Karevold, K. I. (2019). Simple Eco-Labels to Nudge Customers Toward the Most Environmentally Friendly Warm Dishes: An Empirical Study in a Cafeteria Setting. Frontiers in Sustainable Food Systems, 3, 40.
[325] Antonides, G., & Welvaarts, M. (2020). Effects of default option and lateral presentation on consumer choice of the sustainable option in an online choice task. Sustainability, 12(13), 5484, p.1
[326] Id, p.3
[327] Momsen, K., & Stoerk, T. (2014). From intention to action: Can nudges help consumers to choose renewable energy?. Energy Policy, 74, 376-382.
[328] Id, p.11

The same concept applies to the customers' choice of the delivery service in the online purchase process; therefore, it is hypothesized that:

H1b. *Online customers are more likely to engage in sustainable purchase behaviour by selecting the green delivery option when provided with a default option as a green nudge rather than in the case where no green nudge is used.*

The third nudge taken into account in this thesis is feedback. It is considered an important mean which is able to influence consumers to engage in an eco-friendly behaviour. Through feedback, it is possible to convey information concerning the performance related to a task or behaviour carried out[329].

Research shows that, in order to be effective, feedback has to be provided over a long period of time, in real-time and in a specific and clear way[330]. Moreover, by providing consumers with relevant information that is salient and easy to glance, it can help them to make a better decision overcoming cognitive limitations such as the salience bias. In this regard, the intention-action gap in the environmental field is fostered by the consumers' tendency to consider only the vivid aspect of a choice without considering those that are difficult to quantify during decision-making. This leads people to make suboptimal decisions especially when the immediate benefits of a behaviour are more noticeable than the long-term costs[331]. When it comes to resource consumption, this bias becomes more evident. For instance, this applies to energy and water, since their use provides consumers with immediate benefits (the pleasure of a warm shower), whereas the negative consequences in terms of costs for the environment are difficult to evaluate[332]. Due to this, even though people are willing to use efficiently natural resources or purchase sustainable products to protect the environment, the inability to perceive immediate benefits from their ecological behaviour makes it difficult to follow their intentions[333].

Studies showed that a salient real-time feedback is an efficient tool to reduce the lack of salience of resource use. According to a research on feedback mechanisms by Fischer, providing customers with feedback on their energy usage results in energy savings from 1.1% to 20%[334]. In addition, Verena Tiefenbeck et al. conducted an experiment to show the power of a real-time feedback in the reduction of energy and water consumption[335]. According to them, real-time feedback provided in a simple and intuitive way, allows individuals to adapt their behaviour on the basis of the feedback itself. Due to this, the experiment recorded a 22% reduction in

[329] White, K., Habib, R., & Hardisty, D. J. (2019). How to SHIFT consumer behaviors to be more sustainable: A literature review and guiding framework. Journal of Marketing, 83(3), 22-49, pp.26-27
[330] Id, p.27
[331] Tiefenbeck, V., Goette, L., Degen, K., Tasic, V., Fleisch, E., Lalive, R., & Staake, T. (2018). Overcoming salience bias: How real-time feedback fosters resource conservation. Management science, 64(3), 1458-1476, p.1459
[332] Ibidem.
[333] Ibidem.
[334] Fischer, C. (2008). Feedback on household electricity consumption: a tool for saving energy?. Energy efficiency, 1(1), 79-104, p.87
[335] Tiefenbeck, V., Goette, L., Degen, K., Tasic, V., Fleisch, E., Lalive, R., & Staake, T. (2018). Overcoming salience bias: How real-time feedback fosters resource conservation. Management science, 64(3), 1458-1476, p.1461

water and energy consumption[336]. In addition, real-time and specific feedback resulted to be more effective than broader feedback, i.e., past electricity consumption or water usage[337].
Starting from the findings above, it seems reasonable to apply feedback to nudge pro-environmental online purchase behaviour, by making benefits of eco-friendly delivery choice more salient. Therefore, the following hypothesis has been developed:

H1c. *Online customers are more likely to engage in sustainable purchase behaviour by selecting the green delivery option when provided with a feedback as a green nudge rather than in the case where no green nudge is used.*

Finally, we investigated the power of norm-nudging to influence environmentally responsible behaviour, i.e., the choice of green delivery service. Social psychology has shown that norms are an important source of social influence. Several studies have focused on the role of norms in influencing pro-environmental behaviours. More specifically, an interesting insight comes from the research of Christophe Demarque et al., that has proven the effectiveness of descriptive norms in promoting the purchase of a sustainable product within the online environment[338].
What is more, main research showed that social norms should act more effectively than descriptive norms, also in light of the fact that the former are supported by both empirical and normative condition, rather than only the empirical one as in the case of descriptive norms. Accordingly, P. Wesley Schultz et al., in 2007, and later Syon Bhanot, in 2018, proved that descriptive norms have a weaker role in influencing pro-environmental behaviour than social injunctive norms, respectively within the field of energy use and water consumption[339]. In both experiments the superior efficacy of a social norm message is related to the use of a visual cue, namely a smiley, neutral or frowny face, next to a peer's behaviour description (absent in the descriptive norm condition) that emphasizes social expectations, introducing the idea of being socially approved[340]. From these insights, we aim at understanding if the employment of social norms may be an effective nudge in purchasing decisions within the online environment. Thus, it is hypothesized that:

H1d. *Online customers are more likely to engage in a sustainable purchase behaviour by selecting the green delivery option when provided with a social norm as green nudge rather than in the case where no green nudge is used.*

[336] Id, p.1471
[337] Ibidem.
[338] Demarque, C., Charalambides, L., Hilton, D. J., & Waroquier, L. (2015). Nudging sustainable consumption: The use of descriptive norms to promote a minority behavior in a realistic online shopping environment. Journal of Environmental Psychology, 43, 166-174.
[339] Bhanot, S. P. (2018). Isolating the effect of injunctive norms on conservation behavior: New evidence from a field experiment in California. Organizational Behavior and Human Decision Processes.
[340] Id, p.4

3.1.2 The moderating effect of environmental concern in online purchase behaviour

This study explores the moderating role of environmental concern in the context of the relationship between green nudges and sustainable online purchase behaviour.

The growing environmental problems, such as the increase in greenhouse gas emissions and the consequent climate change, increased plastic pollution and exhaustion of natural sources, led individuals to become more aware of the ecological crisis[341]. This made people start paying closer attention to their activities and the related impact on the environment. As a result, there is a global rise in environmental concern.

In 2019, 77% of people globally became concerned about the effect of human activities on the environment[342]. This is translated in the 68% of people who try to live eco-consciously[343].

The environmental concern is defined as an individual's attitude towards the environment. It is based cognitively on a person's understanding of the consequences of human activities on the environment[344]. Affectively, it is a feature that may reflect a person's worries, likes, and dislikes about the environment[345].

Such a great attention to environmental and sustainability concerns has begun to be integrated in the individuals' purchase behaviour. That is, consumers' purchase decision-making is based on the evaluation of how products and services taken into consideration could impact the overall natural environment's well-being[346].

In order to explain the sustainable purchase behaviour, several theories tried to describe the consumers' attitudes and intentions that drive an ecological behaviour. Among them, the theory of planned behaviour (TPB) of Icek Ajzen[347]. According to him, intentions are the central factor that leads the individual to engage in a given behaviour[348]. Intentions are *"indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour. As a general rule, the stronger the intention to engage in a behaviour, the more likely should be its performance"*[349]. Volitional control represents the necessary condition for an intention to become behaviour.

[341] Losito. C (2020). Analyzing the Trade-off between Healthiness & Sustainability in Food-Related Behaviors: The Role of Environmental Concern in Food Packaging Choices, Università LUISS Guido Carli. Retrieved from: http://tesi.luiss.it/28041/1/708321_LOSITO_CRISTOFORO.pdf, p. 31

[342] Lampert, M., Metaal, S., Liu, S. & Gambarin, L. (2019). Global rise in environmental concern. Retrieved from: https://www.courthousenews.com/wp-content/uploads/2019/08/ClimateChangeGlocalities.pdf, p.4

[343] Id, p.9

[344] Yeung, S. P. M. (2004). Teaching approaches in geography and students' environmental attitudes. Environmentalist, 24(2), 101-117, p.101

[345] Ibidem.

[346] Mendleson, N., & Polonsky, M. J. (1995). Using strategic alliances to develop credible green marketing. Journal of consumer marketing, p.4

[347] Joshi, Y., & Rahman, Z. (2017). Investigating the determinants of consumers' sustainable purchase behaviour. Sustainable Production and consumption, 10, 110-120, p.112

[348] Ajzen, I. (1991). The theory of planned behavior. Organizational behavior and human decision processes, 50(2), 179-211, p.181

[349] Ibidem.

Another factor that influences individual's behaviour is the actual control over it, namely the disposal of requisite opportunities and resources such as time and money. If opportunities, resources and intentions occur, individuals should be able to perform the behaviour[350].

Whilst the people's actual control on behaviour is evident in terms of resources and opportunities available, another element of psychological interest is the perceived behavioural control (PBC)[351]. *"Perceived behavioural control refers to people's perception of the ease or difficulty of performing the behaviour of interest"*[352].

If PBC is considered together with intention, it can be used directly to predict the individual's behaviour.

In addition, according to the theory of planned behaviour there are three antecedents of intention[353]: the attitude toward behaviour, the subjective norm and the perceived behavioural control, explained above.

The first element refers to the individual evaluation of the given behaviour; the second element refers to the social factor, namely the group pressure to perform the behaviour.

"As a general rule, the more favourable the attitude and subjective norm with respect to a behaviour, and the greater the perceived behavioural control, the stronger an individual's intention should be to perform the behaviour under consideration.[354]*"*

On the basis of this theoretical framework, prior studies have showed environmental concern as an evaluation of environmental issues and therefore, being an attitude, is an antecedent to environmental purchase intention[355]. In other words, consumers' environmental beliefs form attitudes that generate intentions to purchase eco-friendly products[356].

Indeed, consumers environmentally concerned are more likely to be intrinsically motivated to choose and consume sustainable products, namely, to look for them in specific stores and pay higher prices to purchase them[357].

The key role of environmental concern in shaping people's behaviour is well-established not only when they buy ecological products or services, but also in other environmentally related domains like recycling and energy saving[358].

The past research has thoroughly proven that environmental concern plays a relevant role in affecting consumers' decision-making. To this effect, it influences consumers' green consumption intention during the purchase process[359].

---

[350] Id, p.182
[351] Id, p.183
[352] Ibidem.
[353] Id, p.188
[354] Ibidem.
[355] Newton, J. D., Tsarenko, Y., Ferraro, C., & Sands, S. (2015). Environmental concern and environmental purchase intentions: The mediating role of learning strategy. Journal of Business Research, 68(9), 1974-1981, p.1974
[356] Davari, A., & Strutton, D. (2014). Marketing mix strategies for closing the gap between green consumers' pro-environmental beliefs and behaviors. Journal of Strategic Marketing, 22(7), 563-586, p.571
[357] Ibidem.
[358] Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. Journal of environmental psychology, 23(1), 21-32, p.21
[359] Yue, B., Sheng, G., She, S., & Xu, J. (2020). Impact of consumer environmental responsibility on green consumption behavior in china: The role of environmental concern and price sensitivity. Sustainability, 12(5), 2074.

This work extends this acknowledgement to the context of choice of sustainable delivery service in the online purchase process. In this regard, the role of environmental concern may also be proved in the online environment, if we consider that the activities involved in the online purchase process, especially the last-mile delivery step, have a negative impact on the environment.

In this context, A. J. Fu and M. Saito proved an increase in online consumers' interest in sustainable offerings, more specifically, their willingness to wait few more days to receive their orders with a more sustainable delivery service. Research conducted in Mexico, showed that 50% of people are willing to wait for their orders on average 4.3 days (vs one day delivery) without receiving incentives or information; 70% of people are willing to wait on average 5.5 days, when economic incentive is provided; finally, up to 71% of people are willing to wait 4.7 days when environmental impact information is provided[360].

Indeed, it is reasonable to say that consumers environmental concern may moderate the impact of green nudging strategy on the consumers' intention to engage in a sustainable online purchase behaviour, by selecting the green delivery option. As a result, hypotheses on all four declinations of the presented nudging approach follow:

H2a. *Environmental concern moderates the relationship between the eco-label as green nudge and consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of eco-label on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

H2b. *Environmental concern moderates the relationship between the default option as green nudge and consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of default option on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

H2c. *Environmental concern moderates the relationship between the feedback as green nudge and consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of feedback on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

H2d. *Environmental concern moderates the relationship between the social norm as green nudge and a consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of social norm on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

[360] Fu, A. J., & Saito, M. (2018). "Would You Be Willing to Wait?": Consumer Preference for Green Last Mile Home Deliver.

3.2 Research Methodology

The objective of this empirical analysis is twofold. First of all, it aims to determine whether and to what extent different green nudges influence willingness to choose a green delivery option. Then, it has the purpose to estimate whether and how strongly the environmental concern affects the relationship between green nudges and the consumers' intention to behave in a sustainable way by choosing the green delivery when purchasing online.

To test the hypotheses developed, a conclusive causal research design was chosen. More specifically, the study used a 5x2 between-subjects experimental design (Green Nudge: no green nudge or control condition (CC), eco-label (GN1), green default (GN2), feedback (GN3), social norm (GN4); environmental concern: high vs low).

To test H1a to H1d, the independent variable (X) is represented by green nudge/no green nudge adoption; in the case of green nudge adoption, four different alternatives are provided: eco-label, default option, feedback and social norm. In addition, the dependent variable (Y) is the willingness to choose the green delivery option.

To test H2a to H2d, the presented conceptual model, implies the use of a moderation model to analyse data. Here, environmental concern is used as moderating variable (W) (Figure 3.1).

In this framework, green nudge is a nonmetric variable while the willingness to choose the green delivery option is a metric variable. Moreover, environmental concern is a metric variable which has been studied as dichotomous one (coded as 1 = high and 0 = low) by using the method of Median Split.

Using experimental conditions, the study manipulated different green nudges in consumers' online purchase process. Specifically, the current research conducted an online experiment in which participants have been randomly assigned to one of five different conditions and then asked to fill out a questionnaire. The following section will explain how this questionnaire has been developed.

3.2.1 Designing a Scenario-Based Questionnaire

The study has been conducted through an online questionnaire (see Appendix), developed on Qualtrics XM. The survey was divided into 5 sections: in the first section, respondents are advised that they are dealing with a research survey without specifying the priorities of such research, namely the sustainability of online purchase.

Afterwards, the second section involves the evaluation of the environmental concern. It has been measured through a 7-point Likert scale (1 = Totally disagree; 7 = Totally agree) of 5 items developed by Haws et al. in 2014[361].

[361] Haws, K. L., Winterich, K. P., & Naylor, R. W. (2014). Seeing the world through GREEN-tinted glasses: Green consumption values and responses to environmentally friendly products. Journal of Consumer Psychology, 24(3), 336-354, p. 339

Then, in the third section, the respondent is asked to imagine that he/she needs to make an online purchase from an e-commerce website; then, he/she is asked to choose a product category that he/she would like to purchase and to specify the name of the product within that category. The questions of this section do not involve aspects that will be taken into account in the data analysis; however, they have been included in the survey to allow respondents identifying themselves with the experience of an online purchase in order to make subsequent answers as close as possible to a realistic decision-making process.

Thereafter, in the fourth section, after choosing the product the respondent would be interested in buying, he/she is asked to choose a delivery option among the following three: a same-day delivery, a standard delivery (4-6 working days) and a green delivery (7-10 working days). Here, the respondent is presented with a randomly assigned stimulus/scenario, one out of five, which shows the green delivery option in different ways i.e., applying a specific type of green nudge.

- The first scenario shows the control condition, namely a green delivery option with no nudge involved.
- The second scenario shows the green delivery option flanked by an eco-label as green nudge.
- The third scenario shows the green delivery option preselected by default as green nudge.
- The fourth scenario shows the green delivery option followed by a feedback as green nudge: it consists of a sentence that explains the positive environmental impact of choosing the green delivery *("For your information, choosing this delivery option results in the saving of 45 tree seedlings grown for 10 years"*).
- The fifth scenario shows the green delivery option followed by a social norm as green nudge: it presents the behavioural norm concerning the shopping habits of Italian people *("For your information, almost 75% of Italian online consumers choose this green option to protect the environment"*); the reference network is represented by Italian people, since most of the survey's respondents are Italian or live in Italy. In addition, the empirical information is supported by a visual cue that signals the normative information: it shows to online shoppers whether they are above, below or around the norm. The visual cue consists of an emoticon alongside each deliver option: a sad face flanked the same-day delivery, a neutral face next to the standard delivery, and a smiley face beside the green delivery.

Each scenario is followed by two questions aimed at analysing the willingness to choose the same-day, standard or green delivery option. Even this variable is measured through a self-made 7-point Likert scale (1 = Totally disagree; 7 = Totally agree). Since the analysis does not focus on the willingness to choose the first two options (same-day and standard delivery), they are merged and measured together.

To conclude, the survey ended with a socio-demographic section, which consisted of 5 questions involving gender, age, professional occupation, level of education and nationality. Such questions are useful to gain background information about respondents and providing a context for better analysing the collected data.

Table 3.1 shows the scales and the related items used to measure the variables analysed in this research, together with their source of adoption.

Measurement items	Scale items
Environmental Concern (Haws et al., 2014) Likert scale, 7-point	It is important to me that the product I use does not harm the environment I consider the potential environmental impact of my actions when making many of my decisions my purchase habits are affected by my concern for our environment I am concerned about wasting the resources of our planet I would describe myself as environmentally responsible I am willing to be inconvenienced in order to take actions that are more environmentally friendly
Willingness to choose the green delivery option (self-made) Likert scale, 7-point	I am willing to choose delivery option 1 (same-day delivery) or 2 (standard delivery) I am willing to choose delivery option 3 (green delivery)
Online purchase process (self-made)	Imagine that you are going to make an online purchase on an e-commerce website such as Amazon, Zalando, etc. Select a product category you may be interested in buying: Beauty and personal care Books Clothing, shoes and accessories Baby Electronics Computers Home Gardening Automotive
	Type a specific product that you may be interested in buying within the previously selected category. Open question
Gender (self-made)	Male Female Non-binary / third gender Prefer not to say
Age (self-made)	18-25 25-35 36-45 46-55 55-65 > 65
Occupation (self-made)	Student Employed Self-employed Retired Unemployed Other
Education (self-made)	Graduate from high school Bachelor's Degree Master's Degree PhD
Nationality (self-made)	Open question

Table 3.1: "Measurement items"

3.3 Results

Before analysing the results and discussing the findings, a thorough cleaning of the data was carried out to remove incomplete answers. In the end, the final dataset consists of 460 responses.

The following results were analysed using the software IBM SPSS Statistics. Both Kruskal-Wallis H test and PROCESS v3.5 analysis have been performed in order to inspect the effect of different green nudges on the willingness to choose the green delivery option and the moderating effect of environmental concern. To do this in an appropriate way, several preliminary steps have been carried out.

First of all, the variable that includes the different scenarios was coded in a new variable ScenarioRecoded (SR) as follows:

- 0 represents the first scenario, namely the control condition, with no nudge involved (CC=0).
- 1 represents the second scenario, with the eco-label as green nudge (GN1=1).
- 2 represents the third scenario, with default option as green nudge (GN2=2).
- 3 represents the fourth scenario, with feedback as green nudge (GN3=3).
- 4 represents the fifth scenario, with social norm as green nudge (GN4=4).

Then, the variable environmental concern, originally measured as a continuous variable (EC), has been analysed as a categorical one (ECC). One method for converting a continuous variable to a categorical one is to use a Median Split. Basically, it aims at finding the median of the continuous variable. As a result, all values below the median value (5.75) are labelled "Low" and coded as 0, while all values above it are labelled "High" and coded as 1.

Before proceeding with the analysis, the following section will provide general information about the sample taken into consideration. Then, the validity and reliability of the environmental concern scale is considered. Finally, the hypothesis testing is carried out through Kruskal-Wallis H test and PROCESS v3.5 in order to inspect whether the hypotheses developed about the relationship between independent and dependent variable are supported or not.

3.3.1 Sample description

The final sample consists of 460 individuals, 93% of whom are Italian, counting 428 people. With respect to gender, the majority of the sample is represented by women (53.9%); however, the sample is also well represented by men (42.6%). The rest of the sample is composed by non-binary/third gender (1.3%) and people who preferred not to specify the gender (2.2%).

For what concerns age, 32% of respondents' age ranges from 18 and 25 years old; 16.1% of participants reported an age between 26 and 35 years old; the third most frequent age range is the one between 56 and 65 years old, which accounts for 15.9% of people; it is followed by people whose age ranges between 46 and 55 (15.4%) and between 36 and 45 (13.7%); only 7% of participants are over 65 years old.

Regarding occupation, the highest number of respondents is employed (37.2%); it is followed by students (30.2%). The third most frequent category is the one of self-employed (17%), followed by the category of people ("Other") who did not specify their professional occupation (7%); then, there are retired (5.7%) and unemployed (3%) respondents.

Concerning education, most of the sample is represented by people with master's degree (39.6%), followed by people with bachelor's degree (31.7%) and people graduated from high school (22.2%); only 6.5% of the participants have a PhD.

All information concerning the respondents' profile is summarized in the table below (Table 3.2).

	Classification	**Sample Amounts**	**Percentage (%)**
Gender	Female	248	53.9
	Male	196	42.6
	Non-binary / third gender	6	1.3
	Prefer not to say	10	2.2
Age	> 65	32	7
	18-25	147	32
	26-35	74	16.1
	36-45	63	13.7
	46-55	71	15.4
	56-65	73	15.9
Occupation	Employed	171	37.2
	Other	32	7
	Retired	26	5.7
	Self-employed	78	17
	Student	139	30.2
	Unemployed	14	3
Education	Bachelor's Degree	146	31.7
	Graduate from high school	102	22.2
	Master's Degree	182	39.6
	PhD	30	6.5

Table 3.2: "Respondent's profile"

Furthermore, for what concerns the online shopping process, by asking participants the product category they would be interested in buying, it emerged that "Clothing, shoes and accessories" is the most frequent category purchased online (29.1%); the other most popular categories are "Books" (20.2%), "Electronics" (14.8%) and "Beauty and personal care" (10.4%).

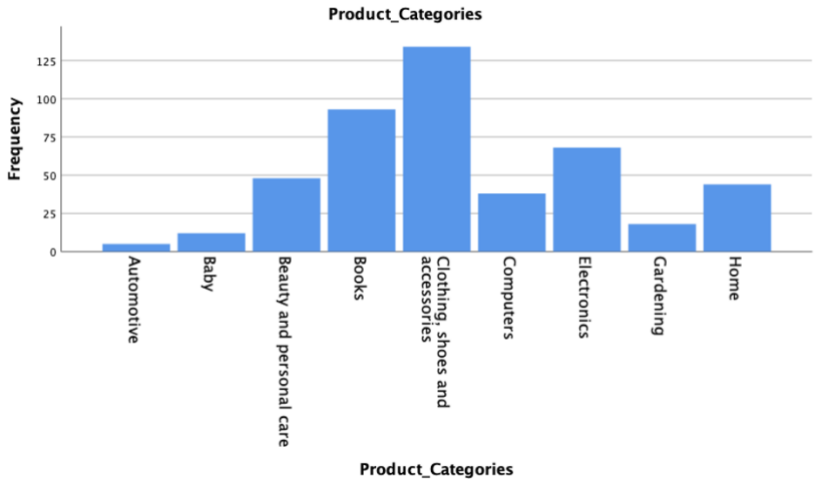


Figure 3.2: "Product Categories"

3.3.2 Scale validity and reliability

The aim of this section is to inspect the validity and reliability of the multi-item scale developed by Haws et al. in 2014[362], which measures the construct of environmental concern. This step is fundamental to check whether the scale measures that it is intended to measure and whether it produces similar results under consistent conditions. Firstly, the validity of the scale is inspected through the factor analysis which identifies the groups of variables that are related to create new factors (or principal components).

To this effect, in this analysis, a principal component factor analysis is performed to validate the environmental concern multi-item scale and to inspect whether the items that compose it can be combined into a new factor.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,934
Bartlett's Test of Sphericity	Approx. Chi-Square	2575,636
	df	15
	Sig.	,000

Table 3.3: "OUTPUT SPSS: KMO and Bartlett's Test for Environmental Concern scale"

First of all, the two tests showed in Table 3.3 indicate the suitability of the data for the structure detection, namely data reduction or Factor Analysis.

The Kaiser-Meyer-Olkin (KMO) Test is a measure of sampling adequacy for each variable in the model. It is a statistic that indicates the proportion of variance in the variables that might be caused by underlying factors. High values (close to 1) generally indicate that a factor analysis may be useful with the data collected. If the value is less than 0.50, the results of the factor analysis probably will not be very useful. In this case, the sampling is adequate since the value of the KMO Test statistic (0.934) is higher than the recommended threshold and is close to 1.

[362] Haws, K. L., Winterich, K. P., & Naylor, R. W. (2014). Seeing the world through GREEN-tinted glasses: Green consumption values and responses to environmentally friendly products. Journal of Consumer Psychology, 24(3), 336-354, p. 339

Then, the Bartlett's test of sphericity tests the hypothesis (H0) that the correlation matrix is an identity matrix, which would indicate that the variables are unrelated and therefore unsuitable for structure detection. In this case, the value of the Bartlett's test (p-value=0.000) is lower than the significance level ($\alpha = 0.05$); therefore, the null hypothesis is rejected since the variables are related and suitable for the structure detection.

Communalities

	Initial	Extraction
Item1	1,000	,778
Item2	1,000	,843
Item3	1,000	,792
Item4	1,000	,795
Item5	1,000	,816
Item6	1,000	,770

Extraction Method: Principal Component Analysis.

Table 3.4: "OUTPUT SPSS: Communalities for Environmental concern scale"

Secondly, through communalities, it is inspected the amount of variance in each variable that is accounted for. Table 3.4 shows the extraction communalities which are estimates of the variance in each variable accounted for by the component. In the table above, they are all high and above 0.30, meaning that the extracted component represents the variable well.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,794	79,904	79,904	4,794	79,904	79,904
2	,302	5,035	84,939			
3	,292	4,871	89,810			
4	,228	3,796	93,606			
5	,205	3,415	97,020			
6	,179	2,980	100,000			

Extraction Method: Principal Component Analysis.

Table 3.5: "OUTPUS SPSS: Total variance explained for Environmental Concern scale"

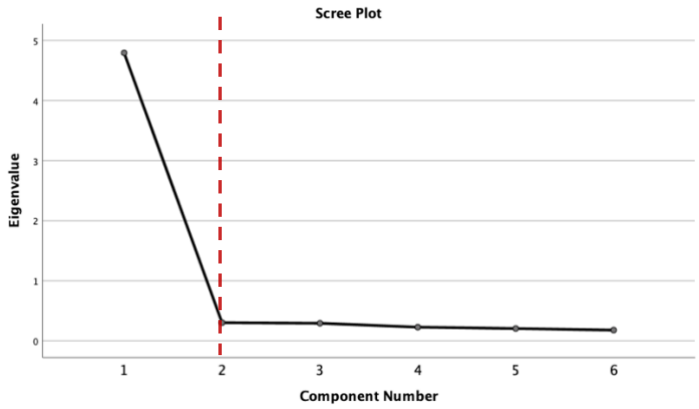


Figure 3.3: "OUTPUT SPSS: Scree plot for Environmental Concern scale"

Finally, after confirming the suitability of the factor analysis for our data, we need to define the number of factors to retain. In order to do that, one of the following three rules must be observed:

1) Only those factors with eigenvalue greater than 1 are retained.
2) The number of factors is determined when the cumulative percentage of variance extracted by the factors reaches a satisfactory level (60%).

3) Finally, by making the scree plot, only the factor before the elbow point must be retained.

Accordingly, looking at the Table 3.5, only the first factor has an eigenvalue (4.794) larger than 1, which accounts for about 80% (>60%) of the total variance. The same applies for the scree plot (Figure 3.3), which shows only one factor before the elbow point.

To conclude, all the item of this scale are valid and can be combined into one factor (or principal component) which is represented by the environmental concern.

To test reliability of the environmental concern scale, Cronbach's alpha (α) has been analysed.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,949	,950	6

Table 3.6: "OUTPUT SPSS: Cronbach's Alpha for Environmental Concern scale"

Specifically, Table 3.6 shows the reliability statistics for the six items of the scale to measure consumers' environmental concern. The relative Cronbach's alpha is excellent in terms of internal consistency (α=0.949).

Inter-Item Correlation Matrix

	Item1	Item2	Item3	Item4	Item5	Item6
Item1	1,000	,782	,733	,767	,736	,716
Item2	,782	1,000	,800	,780	,805	,752
Item3	,733	,800	1,000	,739	,780	,720
Item4	,767	,780	,739	1,000	,747	,750
Item5	,736	,805	,780	,747	1,000	,773
Item6	,716	,752	,720	,750	,773	1,000

Table 3.7: "OUTPUT SPSS: Inter-Item Correlation Matrix for Environmental Concern scale"

In confirmation of this, there is a positive and high correlation between items of the scale (Table 3.7).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Item1	26,56	48,321	,829	,696	,942
Item2	26,79	48,839	,878	,775	,936
Item3	27,07	49,416	,839	,714	,940
Item4	26,55	49,098	,842	,714	,940
Item5	26,87	49,430	,857	,744	,938
Item6	26,96	49,822	,822	,685	,942

Table 3.8: "OUTPUT SPSS: Item-Total Statistics for Environmental Concern scale"

Lastly, as the Table 3.8 shows, not including any of item further increases the alpha value. As a result, all items of the scales have been considered.

Results of this analysis suggest that environmental scale is reliable, meaning that it is accurate, consistent, and reproducible. For this reason, such a scale is useful for measuring respondents' attitudes toward the environment in a consistent manner.

3.3.3 Hypothesis testing

This section aims at testing the hypotheses presented above. First of all, we focus on the interaction between the different green nudges proposed and the willingness to engage in sustainable online purchases by choosing the green delivery option.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CC	98	1	7	4,09	2,071
CGN1	89	1	7	5,01	1,534
CGN2	90	1	7	5,42	1,716
CGN3	90	1	7	5,02	1,709
CGN4	93	1	7	5,39	1,830
Valid N (listwise)	0				

Table 3.9: "OUTPUT SPSS: Descriptive Statistics"

From a descriptive point of view, we compare the average willingness to choose the green delivery option in the five scenarios: as indicated in Table 3.9, when respondents are presented with the control condition the dependent variable shows the lowest mean value (M_{CC}= 4,09). It seems to reveal that the participants, when no green nudge occurs, are less willing to choose the green delivery option if compared to other scenarios where green nudges are implemented. The highest mean value of the dependent variable is detected in the case of default option condition (M_{GN1}=5,42), which is followed by the social norm condition (M_{GN4}=5,39). For what concerns the ecolabel and feedback conditions, participants seem to prefer them almost equally (M_{GN2}=5,01; M_{GN3}=5,02).

In order to confirm the results of the descriptive analysis and, especially to test the above-mentioned hypotheses, it is necessary to proceed with the method of statistical inference.

First of all, it is conducted a preliminary analysis to check a significant difference in the willingness to choose green delivery between the condition in which participants are presented with no nudge and the one in which they are exposed to green nudges.

In this regard, since we cannot assume a normal distribution of the data, the Kruskal-Wallis H test is used. The Kruskal-Wallis H test (also called the "*one-way ANOVA on ranks"*) is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. It is considered the nonparametric alternative to the one-way ANOVA. In this context, the null hypothesis (H0) is that the medians of all groups are equal, and the alternative hypothesis (H1) is that at least one population median of one group is different from the population median of at least one other group. The Kruskal-Wallis H test is run with willingness to choose the green delivery option (WTCGDO) as a continuous dependent variable and the five scenarios, including the control condition, as a categorical independent variable.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of WTCGDO is the same across categories of SR.	Independent-Samples Kruskal-Wallis Test	,000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,050.

Table 3.10: "OUTPUT SPSS: Independent-Samples Kruskal-Wallis Test –SR: independent variable – WTCGDO: dependent variable"

From the Table 3.10, it is clear that p-value is smaller than the conventional significance level (p-value=0.000 < α=0.05), so we can reject the null hypothesis (H0) and infer that at least one group's median is different form the other groups' medians on the dependent variable. Thus, there seems to be some kind of difference of effects of green nudges on the willingness to choose the green delivery option when compared with no green nudge condition.

Pairwise Comparisons of SR

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
0-1	-47,188	19,079	-2,473	,013	,134
0-3	-54,388	19,024	-2,859	,004	,042
0-2	-89,616	19,024	-4,711	,000	,000
0-4	-90,957	18,863	-4,822	,000	,000
1-3	-7,200	19,479	-,370	,712	1,000
1-2	-42,428	19,479	-2,178	,029	,294
1-4	-43,769	19,322	-2,265	,023	,235
3-2	35,228	19,424	1,814	,070	,697
3-4	-36,569	19,267	-1,898	,058	,577
2-4	-1,341	19,267	-,070	,945	1,000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,05.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Table 3.11: "OUTPUT SPSS: Independent-Samples Kruskal-Wallis Test – Pairwise comparison of SR"

The pairwise comparisons in the Table 3.11 allow us to gain more accurate insights showing which groups are significantly different from each other. The control condition group (0, i.e., no green nudge) is significantly different from the four groups conditions, that is, respectively eco-label (1) (p-value=0.013 < α=0.05), default option (2) (p-value=0.000 < α=0.05), feedback (3) (p-value=0.004 < α=0.05) and social norm (4) (p-value=0.000 < α=0.05). Consequently, we can assume that there are differences in consumers' willingness to choose the green delivery option when green nudges are displayed compared to when no green nudge is implemented.

From the Table 3.11, it is possible to compare not only the control and experimental groups, i.e., the no nudge scenario compared with the other four scenarios, but also a comparison between the four experimental or green nudges conditions can be made: indeed, there is a high statistically significance difference between eco-label condition (1) and default option condition (2) (p-value=0.029 < α=0.05) as well as between eco-label condition (1) and social norm condition (4) (p-value=0.023 < α=0.05). In addition, there is a marginally significant difference between feedback group (3) and default option group (2) (p-value=0.070 < α=0.1), as well as between feedback group (3) and social norm group (4) (p-value=0.058 < α=0.1). Conversely, there is no statistically significant difference between eco-label condition (1) and feedback condition (3) (p-value=0.712 > α=0.05), as well as between default option (2) and social norm group (4) (p-value=0.954 > α=0.05).

So far we have verified that there is a difference in effects on the dependent variable between no nudge and green nudge condition. We have also tested the differences between the implemented nudges.

Now, it is necessary to test the interaction between the independent variable (green nudges) and the dependent variable (willingness to choose the green delivery option) in order to check whether hypotheses H1a to H1d can be supported or not. After that, the following step consists in testing the hypotheses H2a to H2d checking whether a moderating effect occurs thanks to the introduction of environmental concern in the context of the relationships between green nudges and willingness to choose the green delivery option. To inspect such interactions, PROCESS v.3.5 model 1 (Andrew F. Hayes) is used performing regression analysis.

Primarily, it is important to test if there is explanatory power by checking the model fit with F-test and adjusted R-squared statistics. Here, the F-test is used to test the significance of the regression model, while the adjusted R-squared allows us to understand how much variability of the dependent variable is explained by the independent variable.

```
OUTCOME VARIABLE:
 WTCGDO

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,5101      ,2602     2,5674    13,0734    12,0000   446,0000      ,0000
```

Table 3.12: "OUTPUT SPSS: PROCESS v.3.5 – Model Summary – WTCGDO: dependent variable – SR: independent variable – ECC: moderating variable – GenCat, AgeCat, EdCat: covariates"

Table 3.12 shows that there is an overall model fit ($F(12, 446)= 13.0734$, p-value$=0.000< \alpha =0.05$), meaning that the explanatory power of the model is sufficient. As a result, at least one of the partial regression coefficients is significantly different from zero. Then, we consider the adjusted R-squared to check how good is the model fit: here, the model accounts for 26% of variability in the dependent variable. In other words, 26% of the variance of the green nudges (IV) is explained by willingness to choose green delivery option (DV).

Moving ahead, to test H1a to H1d, we analyse the effect of the independent variable on the dependent variable. The former has five levels, including the control condition or no green nudge (0) which represents the reference category. In the analysis, three covariates (categorical variables) have been introduced: Gender (GenCat), Age (AgeCat) and Education (EdCat).

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,9912	,2773	10,7880	,0000	2,4463	3,5361
X1	1,3482	,3403	3,9623	,0001	,6795	2,0170
X2	1,2641	,3307	3,8224	,0002	,6141	1,9140
X3	,7280	,3384	2,1517	,0320	,0631	1,3930
X4	1,2654	,3329	3,8012	,0002	,6112	1,9196
ECC	1,4317	,3261	4,3905	,0000	,7909	2,0726
Int_1	-,7119	,4718	-1,5089	,1320	-1,6391	,2153
Int_2	,2883	,4697	,6139	,5396	-,6348	1,2115
Int_3	,4418	,4691	,9418	,3468	-,4801	1,3638
Int_4	,0387	,4652	,0833	,9337	-,8755	,9530
GenCat	,3089	,1221	2,5303	,0117	,0690	,5488
AgeCat	,0122	,0459	,2654	,7908	-,0779	,1023
EdCat	,1128	,0861	1,3106	,1907	-,0564	,2820

Product terms key:

Int_1	:	X1	x	ECC
Int_2	:	X2	x	ECC
Int_3	:	X3	x	ECC
Int_4	:	X4	x	ECC

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	,0111	1,6784	4,0000	446,0000	,1539

Table 3.13: "OUTPUT SPSS: PROCESS v.3.5 – Regression Model –- WTCGDO: dependent variable – SR: independent variable – ECC: moderating variable – GenCat, AgeCat, EdCat: covariates"

Results reveal a significant interaction for what concerns the main effect. Thus, compared to the control condition (0), all four green nudges have a positive and significant effect on willingness to choose the green delivery option (WTCGDO) (t=3.9623, p-value=0.001< α=0.05; t=3.8224, p-value=0.002<α=0.05; t=2.1517, p-value=0.0320< α=0.05; t=3.8012, p-value=0.002< α=0.05). Given the verified influence of all four green nudges on the willingness to behave ecologically by choosing green delivery, we can confirm hypothesis H1a to H1d. In particular, comparing the effect of the nudges used, the eco-label seems to be the most effective nudge (β = 1.3842). Moreover, social norm and green default are the following most effective nudges (β=1.2654 and β=1.2641), which as Kruskal-Wallis H test has already shown, do not significantly differ in terms of influence on the dependent variable. Finally, feedback is the least effective nudge implemented (β= 0.7280).

Furthermore, Table 3.13 shows that also environmental concern (ECC) has a positive and significant effect on the dependent variable (t=4.3905, p-value=0.000< α =0.05).

In addition, another variable that resulted to be statistically significant is gender, coded as 0 for males (reference category), 1 for females, 2 for non-binary/third gender and 3 for participants who selected "Prefer not to say". Findings allow to infer that the willingness to choose the green delivery option for women (third gender and those who did not specify the gender, to a proportionally reduced extent, due to the fact that they amount to 1,3% and 2,2% of the sample) is significantly higher (β= 0.3089, p-value=0.0117< α =0.05) than men. Among the other covariates, education and age do not influence the dependent variable.

Finally, there is no evidence of an interaction between environmental concern and green nudges, suggesting that both environmentally and non-environmentally concerned customers showed an increase in the willingness to choose the green delivery option (F(4, 446)=1.6784, p-value=0.1539> α =0.05). In other words, surprisingly the level of environmental concern does not significantly alter the form and the strength of the interaction between independent and dependent variable. Therefore, environmental concern does not have a moderating effect on the above-mentioned relationship. For this reason, hypotheses H2a to H2d cannot be supported.

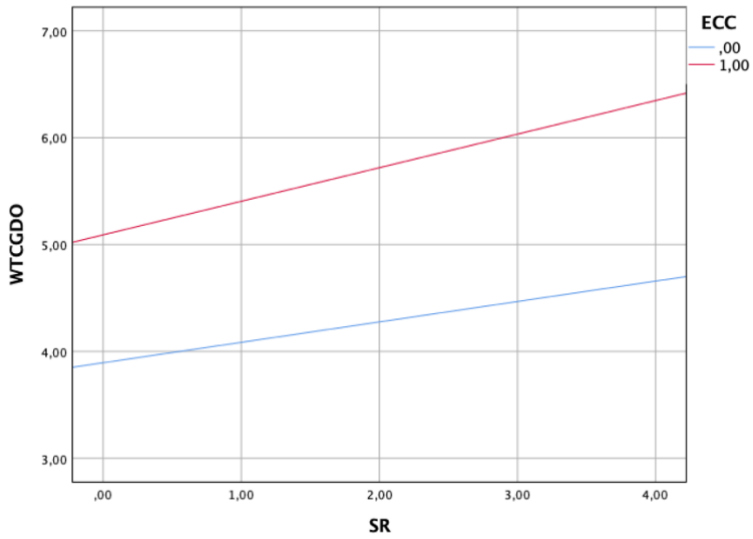


Figure 3.4: "OUTPUT SPSS: Willingness to choose green delivery option in response to Green Nudges, considering different levels of Environmental Concern"

In this regard, Figure 3.4 above shows that environmentally concerned customers are more likely to adopt the green delivery than those non-environmentally concerned. However, it confirmed the absence of interaction between the moderator and the independent variable, therefore the lack of moderation effect on the dependent variable.

3.4 Discussion

Several studies established that individual's choices can be influenced by the nudging approach, especially during their purchase behaviour. Most of the previous studies have proven the effectiveness of nudges on traditional purchasing process, while few have focused on the effectiveness of such a tool in affecting individual choices during the online purchasing process. For this reason, this study tested the effects of four nudges, namely eco-label, default option, feedback and social norm, on the choice regarding sustainable delivery service in the online environment. In particular, the objective was firstly to determine whether and to what extent these four nudges influence a sustainable purchase online behaviour. Second, it stressed the idea of environmental concern as a driver strong enough to lead consumers switching from a fast or standard delivery toward an eco-friendly service.

Several considerations arise with regard to what has been measured.

The main results show that, when presented with all four aforementioned green nudges, consumers are more willing to choose the green delivery than when no green nudges are used (H1a to H1d). Thus, nudging has a significant effect on the sustainable consumer choice in the online environment.

The Kruskal-Wallis H test underlined the significant difference in the willingness to choose green delivery between the control condition and the four treatments conditions. In addition, it showed that there is no significant difference in the dependent variable between the use of an eco-label or feedback as nudge; likewise,

there is no significant difference between a purchasing process with default at the most sustainable delivery or the use of social norm as a nudge.

The regression analysis with PROCESS v3.5 confirmed such results and showed the specific effects of the four green nudges on the dependent variable. In particular, the eco-label resulted to be the most effective nudge. This is in line with the idea that simple eco-labels, like the one used in this study, which do not require high levels of literacy, reduce information overload by making the most relevant information, such as the environmental consequences of the individual's choice, more salient[363]. As a result, eco-labels are a useful tool to raise awareness of consumers, enticing them toward an ecological behaviour[364].

The following two most effective nudges are social norm and green default. More specifically, social norms resulted to prompt online consumers to engage in a sustainable behaviour as much as default choice. In this study, descriptive norm information, that is the mere description of a collective behaviour related to the relevant reference network (Italian people) is supported by an injunctive message added into the visual cue that signals a normative information, i.e., a sad, neutral and smiley face next to respectively fast, standard and green delivery options. Such results confirmed the previously verified impact of social norms, that is the efficacy of norms massages combined with a clear social judgment about behaviour[365].

Furthermore, the positive and significant effect of green default is consistent with the previous literature which evidenced the behavioural impact of defaults due to the status quo bias (or inertia), loss aversion and the perception of the default as endorsement by some external authority[366]. It is an interesting finding, since allows to extend the use of defaults as nudges in the online environment, so as to promote not only the choice of sustainable products but also ecological delivery services enhancing the nudge effectiveness[367].

Despite proving to be the least effective nudge, feedback also turns out to have a positive influence on the choice of sustainable delivery due to its promptness, accuracy and specificity, confirming what C. Fischer noted in previous experiments[368].

Besides nudges, another variable that directly influence the online consumers' buying behaviour is the feeling of concern towards the planet. Findings indicate that environmental concern directly influence consumers' purchases. However, such variable unexpectedly does not affect the relationship between green nudges and willingness to engage in a pro-environmental behaviour by choosing the green delivery. Thus, results showed that there is no interaction between environmental concern and green nudges, therefore it seems that both environmentally and non-environmentally concerned customers showed an increase in the willingness to

[363] Slapø, H. B., & Karevold, K. I. (2019). Simple Eco-Labels to Nudge Customers Toward the Most Environmentally Friendly Warm Dishes: An Empirical Study in a Cafeteria Setting. Frontiers in Sustainable Food Systems, 3, 40, p.2

[364] Brécard, D., Hlaimi, B., Lucas, S., Perraudeau, Y., & Salladarré, F. (2009). Determinants of demand for green products: An application to eco-label demand for fish in Europe. Ecological economics, 69(1), 115-125, p.116

[365] Bhanot, S. P. (2018). Isolating the effect of injunctive norms on conservation behavior: New evidence from a field experiment in California. Organizational Behavior and Human Decision Processes.

[366] Schubert, Christian (2016). Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg, p.19

[367] Antonides, G., & Welvaarts, M. (2020). Effects of default option and lateral presentation on consumer choice of the sustainable option in an online choice task. Sustainability, 12(13), 5484

[368] Bonini, N., Hadjichristidis, C., & Graffeo, M. (2018). Green nudging. Acta Psychologica Sinica, 50(8), 814-826.

choose the green delivery option. This means that the two variables operate independently of each other on the dependent variable.

Indeed, on the one side, the more online consumers are concerned about the environment, the more they choose green delivery option at the end of their purchase process. This is not surprising, as it is consistent with idea that environmental concern is a positive attitude towards the planet, which imply a cognitive evaluation of the consequences of human activities on the environment and, as a result, an evaluation of how choices could impact the planet's well-being[369]. In other words, people with a higher environmental concern level are more likely to react to environmental problems by taking environmental protection actions[370]. It has been confirmed by previous studies which showed how such attitude spills over into pro-environmental behaviours, which include buying sustainable products, saving energy and recycling[371].

On the other side, nudges leverage consumers' reliance on the subconscious mind (or automatic System 1) whose decisions are fast and intuitive and therefore based on heuristics and cognitive biases[372]. In this framework, green nudges may help consumers make better decisions, namely, behave in a sustainable way, decisions which they would not have made with cognitive awareness.

To summarize, as it is shown in Figure 3.4, notwithstanding there is no interaction effect between the two independent variables, it is possible to observe an interesting insight: when consumers are concerned about the environment, they result to be highly willing to choose the green delivery, independently on the green nudge implemented. However, the results show that nudging approach has precisely the desired effect in terms of delivery choice as it succeeds in convincing even those who are not concerned about the environment to make an ecological choice by choosing green delivery. This makes nudging and the green delivery option a winning combination in the online purchase process whatever the customers' degree of concern for the environment.

3.4.1 Theoretical contribution and managerial implication

Theoretically, this study contributes in different ways to the increasingly important stream of research concerning nudging approach, environment and online purchase.

The study concerns sustainability in the online purchase environment. In particular, it analyses different nudges with regard to the promotion of a green delivery service which may reduce the everyday environmental impact of online purchases. Thus, it demonstrates that green nudging represents a powerful tool to influence individuals' decision-making even in the online environment, being consistent with past literature.

[369] Mendleson, N., & Polonsky, M. J. (1995). Using strategic alliances to develop credible green marketing. Journal of consumer marketing,

[370] Yue, B., Sheng, G., She, S., & Xu, J. (2020). Impact of consumer environmental responsibility on green consumption behavior in china: The role of environmental concern and price sensitivity. Sustainability, 12(5), 2074, p.4

[371] Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. Journal of environmental psychology, 23(1), 21-32

[372] Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin

Furthermore, the distinctive characteristic of this study is to compare different nudges in order to understand which one is more effective. Therefore, it needs the attention not only of academic research, but also public and private organizations, policymakers, governments and institutions.

Moreover, the current study contributes to the literature on consumers' sustainable behaviour by revealing an interesting perspective on environmental concern: it seems to have a strong impact on consumers' willingness to choose a sustainable service when buying online, but it does not moderate their decision-making. It indicates that, in the online environment, the nudging approach affects people choices regardless their feeling of concern for the environment.

From a practical standpoint and a managerial perspective, this study provides interesting implications for both consumers and companies. Indeed, the present research recognizes the crucial importance of behavioural economics in achieving sustainable goals in the online retailer sector, especially not to lose the last-mile delivery challenge.

The nudging approach has proven to be a powerful tool to induce a behavioural change. In this regard, depending on the nudge implemented, slightly different results in the willingness to choose green delivery option occur. Thus, according to the results of the present study, the eco-label seems to be the most effective strategy to help people in choosing a sustainable delivery. To follow, providing online consumers with a green delivery as default choice significantly influences their decisions, as well as giving a social judgment combined with normative information (social norm) to make green delivery stand-out as the best and most approved choice. Feedback resulted to be the least persuasive in its purpose.

According to these findings, this research suggests new managerial implications for both e-commerce and logistic companies. In the first chapter, the huge cost of home deliveries and their impact on the environment was addressed, and the term used to refer to this problem was *"last-mile delivery challenge"*. Green delivery is part of the solution to this challenge, but in order for it to yield benefits, it needs to be adopted by a large portion of online consumers. Therefore, applying the principles of behavioural economics and nudging approach helps achieving this goal. As past studies proved, making green shipping to be chosen by a great portion of online customers allows several benefits. From an environmental sustainability point of view, companies are allowed to consolidate customers' orders maximizing the capacity of tracks, reduce the number of travels, optimize routes, reduce traffic congestion and, as a result, diminish greenhouse gas emissions.

What is more, from a profitability point of view, the collective adoption of green delivery also helps companies to differentiate logistic efforts, optimize the distance travelled and therefore the number of stops, achieving costs savings in term of labour, fuel and fleet[373].

From a consumers' demand point of view, due to the increasing concern toward the planet, people are looking for companies that share their values and offer a value proposition that satisfy their needs. In this regard, the introduction of a green delivery option satisfactorily matches such demand. Hence, this strategy could help

[373] Martínez, J.V. & Cottrill, K. (2020). E-commerce retailers should put more value on green delivery options. Greenbiz.com. Retrieved from: https://www.greenbiz.com/article/e-commerce-retailers-should-put-more-value-green-delivery-options

companies to increase their market share. Instead, for what concerns consumers who are not environmentally concerned, the application of a nudging approach could help companies to induce those people to adopt a green option, and eventually raise their awareness about environmental issues.

Moreover, the present findings should lead governments to be more aware of the role of behavioural economics in preventing environmental degradation. Therefore, institutional campaigns should aim at considering nudging as soft extension of environmental policy instrument among the others in the regulatory toolkit. Nudging may be more considered for the fact that its implementation is easy and at low cost.

Basically, this study claims the need of a holistic cooperation involving all the stakeholders of the online retail sector to promote and safeguard the environment without threatening profitability of companies.

3.4.2 Limitations and future research opportunities

The current study has some flaws that may have skewed the findings and, as a result, may be further integrated for future research.

First of all, the results of this study depended on the method of experiment. Indeed, there might be disadvantages related to the online questionnaire. One of them consists in the difficulty to measure some kind of information, such as the environmental concern. In addition, through an online survey it is also difficult to measure how much the intention to choose a given delivery service is real. As a matter of fact, there could be discrepancies between purchase intention and actual purchase behaviour. A field experiment could be more suitable to explore this gap and return a more precise evaluation of actual online consumers' behaviour.

Furthermore, in this study, a 93% Italian sample was selected. Future research should perform a cross-national study to understand whether findings about green nudges and their general influencing mechanism on online sustainable behaviour could be considered universally acceptable or if there are cross-cultural differences.

Moreover, the participants in the sample were only exposed to a specific nudge once. In this regard, in future research, it would be interesting to investigate the tendency to choose the green shipping repeatedly over time being subjected to additional future nudges in subsequent online purchases. In other words, it would be insightful to test the efficacy of nudging approach over time across the consumer's various online purchases.

Additionally, further research could compare the effect of other nudges on the willingness to choose green delivery options in order to the detect the one that has the highest influence on individuals' decision-making, with respect to the others.

Finally, another factor that could influence the power of nudges in home delivery choices could be the type of products purchased. Future research could study whether the willingness to wait more days, i.e., choosing green delivery, to receive the orders, depends on the type of product customers choose to buy.

Conclusion

Over the last decades, there has been a disrupting growth of e-commerce and increasing concern about the consequences that the related business activities have on the environment. More specifically, the increasing sales of e-commerce have started to be influenced by the type of delivery services provided. As a result, the faster the delivery service offered, the more satisfying the online purchase experience, the higher customer loyalty to a given e-retailer. The differentiation of delivery options provided guarantees a fast, personalized and satisfying experience which has consequences not only on the companies' profitability, but also on the environment. In particular, a fast delivery service involves high logistics costs but also a negative impact on the environment in terms of greenhouse gases emissions. Therefore, besides the innovative technologies implemented to reduce the emissions related to freights transportation, the introduction of a new green delivery option is being mapped out. It implies a delivery in few more days than the standard delivery, allowing companies to optimize logistics costs and minimize the impact on the planet. This research examines nudging as a way to influence online consumers' choice of delivery service prompting them to choose the most ecological one. Findings show that the four nudges proposed to the potential online customers significantly affect their decision-making process. In fact, wherever there is a nudge, be it in the case of the eco-label, the default option, the feedback and the social norm, people are more willing to behave in an ecological way than when there is no such nudge. Alternatively, also environmental concern influences individual's behaviour. Therefore, environmentally concerned individuals are more likely to choose the ecological delivery than those who are not concerned about the impact of human activities on the planet. However, environmental concern does not interact with nudging approach, meaning that nudges positively affect consumers' decisions independently from the consumers' feeling of concern for the environment.

Therefore, the present research is interesting in that it reveals that nudging is a very useful and cost-effective technique that can entice people to behave in an eco-friendly way, even those who are not concerned about the environment.

Appendix

Survey

Start of Block: Introduction

Q1 Dear respondent,
Thank you for agreeing to take part in this research. I'm a Marketing Analytics student at LUISS University, and I am currently writing my Master's Thesis. Your answers will be completely anonymous. Only a limited number of people will be interviewed, so your opinion is very important. Please answer as openly and truthfully as you can - there are no right or wrong answers!
It will take you few minutes to complete this survey.
Thank you again for your time and effort.

End of Block: Introduction

Start of Block: Environmental Concern

Q2 Please rate the extent to which you agree/disagree with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree):

	Strongly disagree (6)	Disagree (7)	Somewhat disagree (8)	Neither agree nor disagree (9)	Somewhat agree (10)	Agree (11)	Strongly agree (12)
It is important to me that the products I use do not harm the environment (1)	○	○	○	○	○	○	○
I consider the potential environmental impact of my actions when making many of my decisions (2)	○	○	○	○	○	○	○
My purchase habits are affected by my concern for our environment (3)	○	○	○	○	○	○	○
I am concerned about wasting the resources of our planet (4)	○	○	○	○	○	○	○
I would describe myself as environmentally responsible (5)	○	○	○	○	○	○	○
I am willing to be inconvenienced in order to take actions that are more environmentally friendly (6)	○	○	○	○	○	○	○

End of Block: Environmental Concern

Start of Block: Online purchase process

Q3 Imagine that you are going to make an online purchase on an e-commerce website such as Amazon, Zalando, etc. Select a product category you may be interested in buying:

- ○ Beauty and personal care (1)
- ○ Books (2)
- ○ Clothing, shoes and accessories (3)
- ○ Baby (4)
- ○ Electronics (5)
- ○ Computers (6)
- ○ Home (7)
- ○ Gardening (8)
- ○ Automotive (9)

Q4 Type a specific product that you may be interested in buying within the previously selected category:

_____

End of Block: Online purchase process

Start of Block: Shopping cart

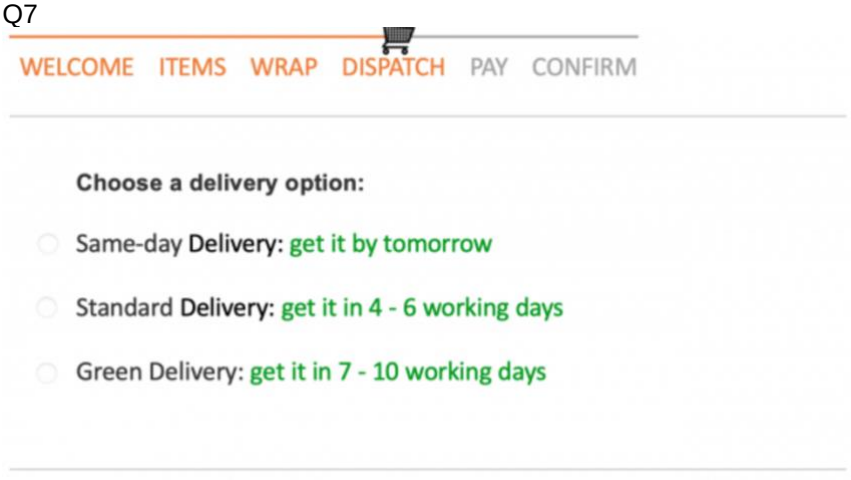
Q5 The product chosen has been added to your cart.

End of Block: Shopping cart

Start of Block: Control Condition

Q6 You have decided to purchase the item you were interested in buying. Now you need to select a delivery option

Q7



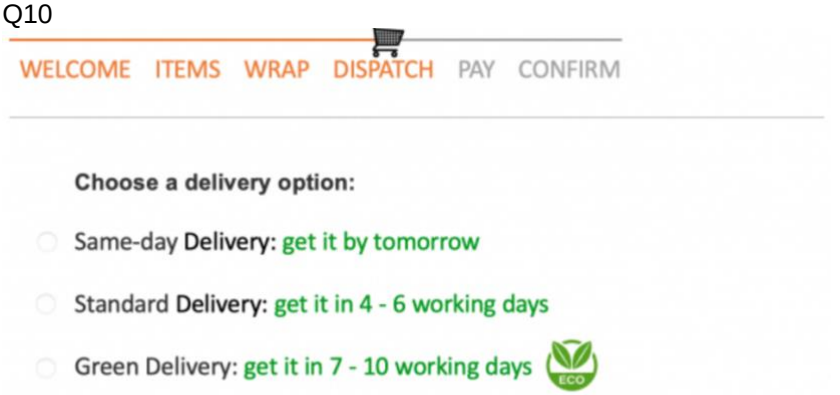
Q8 Please rate the extent to which you agree/disagree with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree):

	Strongly disagree (13)	Disagree (14)	Somewhat disagree (15)	Neither agree nor disagree (16)	Somewhat agree (17)	Agree (18)	Strongly agree (19)
I am willing to choose delivery option 1 (same-day delivery) or 2 (standard delivery) (1)	○	○	○	○	○	○	○
I am willing to choose delivery option 3 (green delivery) (2)	○	○	○	○	○	○	○

End of Block: Control Condition

Start of Block: Eco-label

Q9 You have decided to purchase the item you were interested in buying. Now you need to select a delivery option
Q10



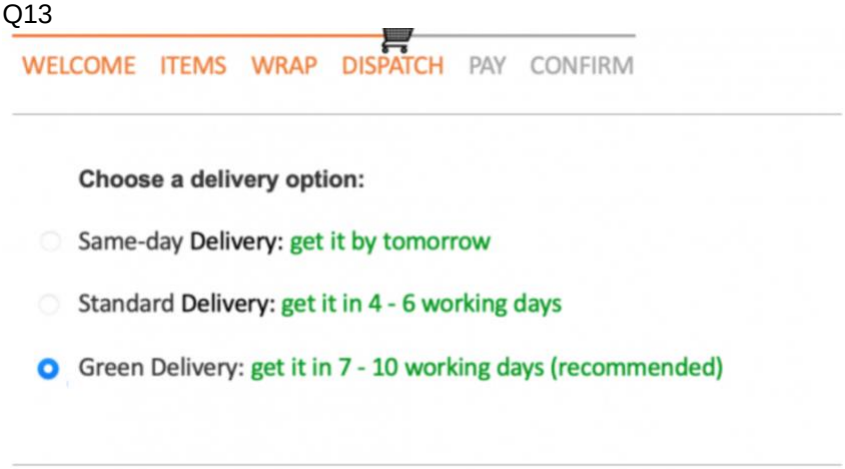
Q11 Please rate the extent to which you agree/disagree with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree):

	Strongly disagree (13)	Disagree (14)	Somewhat disagree (15)	Neither agree nor disagree (16)	Somewhat agree (17)	Agree (18)	Strongly agree (19)
I am willing to choose delivery option 1 (same-day delivery) or 2 (standard delivery) (1)	○	○	○	○	○	○	○
I am willing to choose delivery option 3 (green delivery) (2)	○	○	○	○	○	○	○

End of Block: Eco-label

Start of Block: Default Option

Q12 You have decided to purchase the item you were interested in buying. Now you need to select a delivery option
Q13



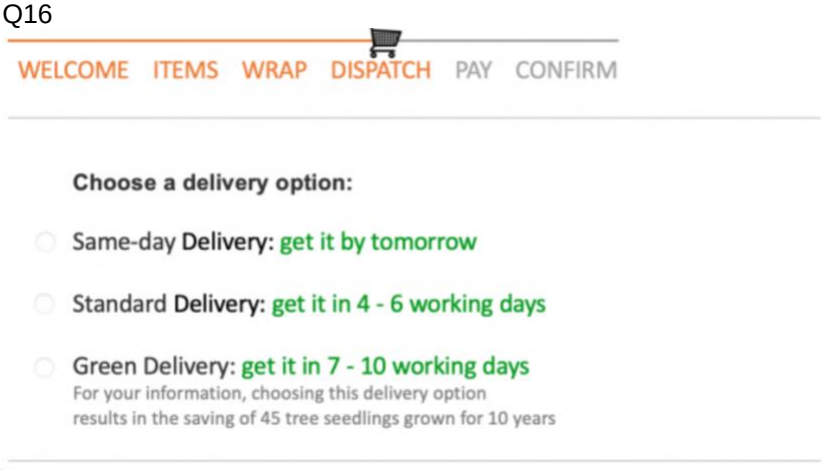
Q14 Please rate the extent to which you agree/disagree with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree):

	Strongly disagree (13)	Disagree (14)	Somewhat disagree (15)	Neither agree nor disagree (16)	Somewhat agree (17)	Agree (18)	Strongly agree (19)
I am willing to choose delivery option 1 (same-day delivery) or 2 (standard delivery) (1)	○	○	○	○	○	○	○
I am willing to choose delivery option 3 (green delivery) (2)	○	○	○	○	○	○	○

End of Block: Default Option

Start of Block: Feedback

Q15 You have decided to purchase the item you were interested in buying. Now you need to select a delivery option
Q16



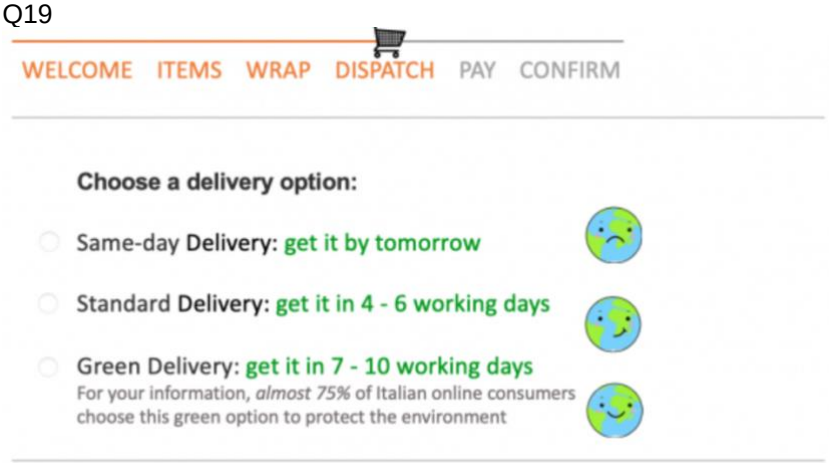
Q17 Please rate the extent to which you agree/disagree with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree):

	Strongly disagree (13)	Disagree (14)	Somewhat disagree (15)	Neither agree nor disagree (16)	Somewhat agree (17)	Agree (18)	Strongly agree (19)
I am willing to choose delivery option 1 (same-day delivery) or 2 (standard delivery) (1)	○	○	○	○	○	○	○
I am willing to choose delivery option 3 (green delivery) (2)	○	○	○	○	○	○	○

End of Block: Feedback

Start of Block: Social norm

Q18 You have decided to purchase the item you were interested in buying. Now you need to select a delivery option
Q19



Q20 Please rate the extent to which you agree/disagree with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree):

	Strongly disagree (13)	Disagree (14)	Somewhat disagree (15)	Neither agree nor disagree (16)	Somewhat agree (17)	Agree (18)	Strongly agree (19)
I am willing to choose delivery option 1 (same-day delivery) or 2 (standard delivery) (1)	○	○	○	○	○	○	○
I am willing to choose delivery option 3 (green delivery) (2)	○	○	○	○	○	○	○

End of Block: Social norm

Start of Block: Demographics

Q21 Gender

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Q22 Age

- ○ 18-25 (1)
- ○ 26-35 (2)
- ○ 36-45 (3)
- ○ 46-55 (4)
- ○ 56-65 (5)
- ○ > 65 (6)

Q23 Occupation

- ○ Student (1)
- ○ Employed (2)
- ○ Self-employed (3)
- ○ Retired (4)
- ○ Unemployed (5)
- ○ Other (6)

Q24 Education

- ○ Graduate from high school (1)
- ○ Bachelor's Degree (2)
- ○ Master's Degree (3)
- ○ PhD (4)

Q25 Nationality

_____

End of Block: Demographics

SPSS OUTPUT

Descriptive analysis for the sample

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	248	53,9	53,9	53,9
	Male	196	42,6	42,6	96,5
	Non-binary / third gender	6	1,3	1,3	97,8
	Prefer not to say	10	2,2	2,2	100,0
	Total	460	100,0	100,0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	> 65	32	7,0	7,0	7,0
	18-25	147	32,0	32,0	38,9
	26-35	74	16,1	16,1	55,0
	36-45	63	13,7	13,7	68,7
	46-55	71	15,4	15,4	84,1
	56-65	73	15,9	15,9	100,0
	Total	460	100,0	100,0	

Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed	171	37,2	37,2	37,2
	Other	32	7,0	7,0	44,1
	Retired	26	5,7	5,7	49,8
	Self-employed	78	17,0	17,0	66,7
	Student	139	30,2	30,2	97,0
	Unemployed	14	3,0	3,0	100,0
	Total	460	100,0	100,0	

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's Degree	146	31,7	31,7	31,7
	Graduate from high school	102	22,2	22,2	53,9
	Master's Degree	182	39,6	39,6	93,5
	PhD	30	6,5	6,5	100,0
	Total	460	100,0	100,0	

Nationality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	American	6	1,3	1,3	1,3
	Bosnia	1	,2	,2	1,5
	British	7	1,5	1,5	3,0
	Canadian	3	,7	,7	3,7
	Danish	1	,2	,2	3,9
	English	3	,7	,7	4,6
	French	2	,4	,4	5,0
	German	2	,4	,4	5,4
	Iranian	1	,2	,2	5,7
	Italian	428	93,0	93,0	98,7
	Lithuanian	1	,2	,2	98,9
	Mixed, North african and British	1	,2	,2	99,1
	Moldavian	1	,2	,2	99,3
	Philippine	1	,2	,2	99,6
	Turkish	2	,4	,4	100,0
	Total	460	100,0	100,0	

Product_Categories

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Automotive	5	1,1	1,1	1,1
	Baby	12	2,6	2,6	3,7
	Beauty and personal care	48	10,4	10,4	14,1
	Books	93	20,2	20,2	34,3
	Clothing, shoes and accessories	134	29,1	29,1	63,5
	Computers	38	8,3	8,3	71,7
	Electronics	68	14,8	14,8	86,5
	Gardening	18	3,9	3,9	90,4
	Home	44	9,6	9,6	100,0
	Total	460	100,0	100,0	

Kruskal - Wallis H test

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of WTCGDO is the same across categories of SR.	Independent-Samples Kruskal-Wallis Test	,000	Reject the null hypothesis.

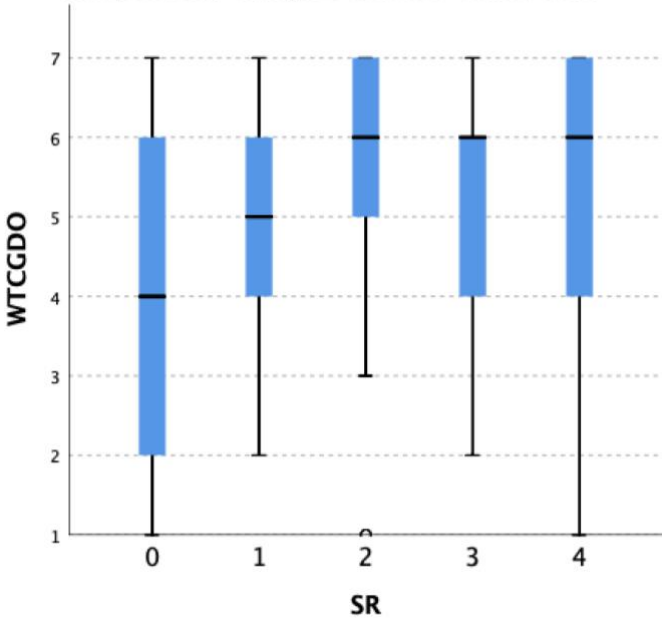
Asymptotic significances are displayed. The significance level is ,050.

Independent-Samples Kruskal-Wallis Test Summary

Total N	460
Test Statistic	31,203[a]
Degree Of Freedom	4
Asymptotic Sig.(2-sided test)	,000

a. The test statistic is adjusted for ties.

Independent-Samples Kruskal-Wallis Test

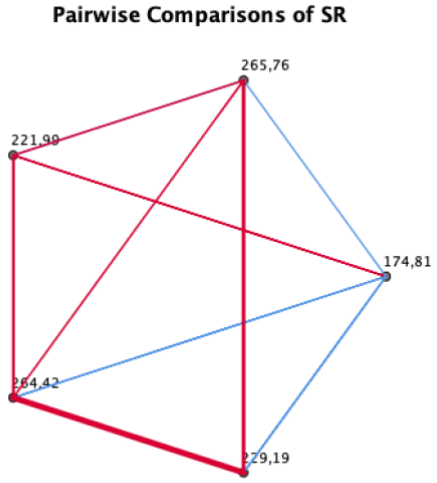


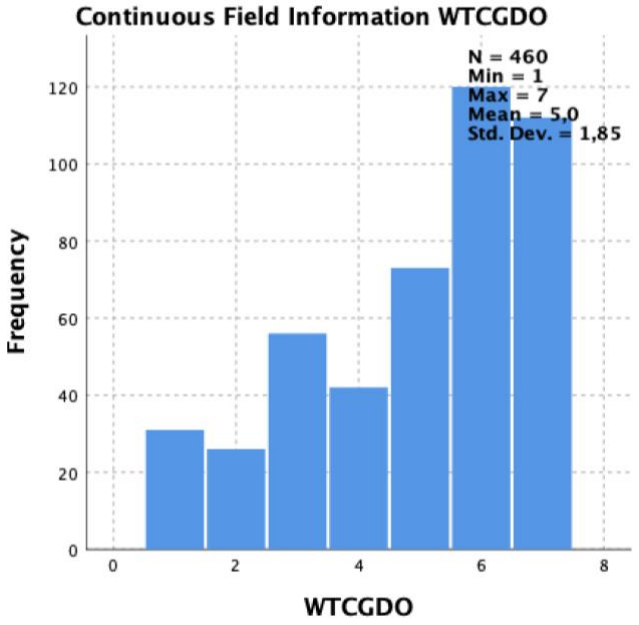
Pairwise Comparisons of SR

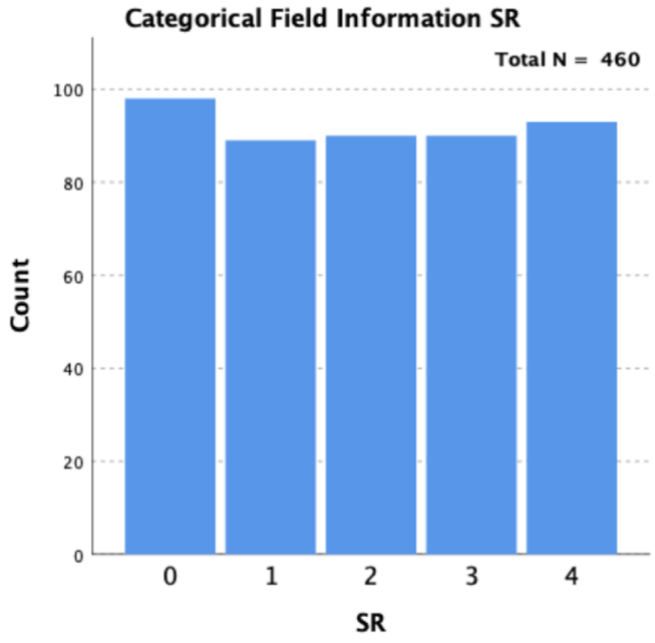
Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
0-1	-47,188	19,079	-2,473	,013	,134
0-3	-54,388	19,024	-2,859	,004	,042
0-2	-89,616	19,024	-4,711	,000	,000
0-4	-90,957	18,863	-4,822	,000	,000
1-3	-7,200	19,479	-,370	,712	1,000
1-2	-42,428	19,479	-2,178	,029	,294
1-4	-43,769	19,322	-2,265	,023	,235
3-2	35,228	19,424	1,814	,070	,697
3-4	-36,569	19,267	-1,898	,058	,577
2-4	-1,341	19,267	-,070	,945	1,000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,05.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

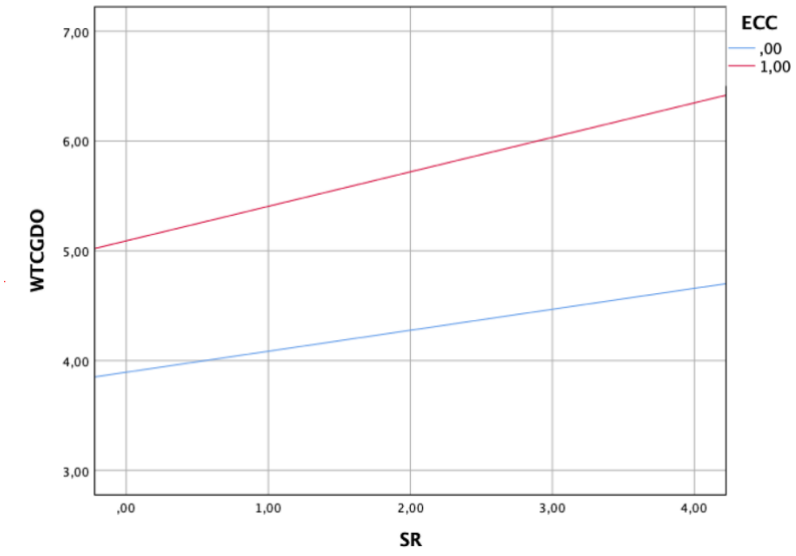

Pairwise Comparisons of SR
265,76
221,99
174,81
264,42
229,19
Each node shows the sample average rank of SR.


Continuous Field Information WTCGDO
N = 460
Min = 1
Max = 7
Mean = 5,0
Std. Dev. = 1,85
Frequency
120
100
80
60
40
20
0
0
2
4
6
8
WTCGDO


Categorical Field Information SR
Total N = 460
Count
100
80
60
40
20
0
0
1
2
3
4
SR

PROCESS v3.5 Model 1: Regression Analysis

```
OUTCOME VARIABLE:
 WTCGDO

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,5101      ,2602     2,5674    13,0734    12,0000   446,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     2,9912      ,2773    10,7880      ,0000     2,4463     3,5361
X1           1,3482      ,3403     3,9623      ,0001      ,6795     2,0170
X2           1,2641      ,3307     3,8224      ,0002      ,6141     1,9140
X3            ,7280      ,3384     2,1517      ,0320      ,0631     1,3930
X4           1,2654      ,3329     3,8012      ,0002      ,6112     1,9196
ECC          1,4317      ,3261     4,3905      ,0000      ,7909     2,0726
Int_1        -,7119      ,4718    -1,5089      ,1320    -1,6391      ,2153
Int_2         ,2883      ,4697      ,6139      ,5396     -,6348     1,2115
Int_3         ,4418      ,4691      ,9418      ,3468     -,4801     1,3638
Int_4         ,0387      ,4652      ,0833      ,9337     -,8755      ,9530
AgeCat        ,0122      ,0459      ,2654      ,7908     -,0779      ,1023
GenCat        ,3089      ,1221     2,5303      ,0117      ,0690      ,5488
EdCat         ,1128      ,0861     1,3106      ,1907     -,0564      ,2820

Product terms key:
 Int_1    :        X1       x        ECC
 Int_2    :        X2       x        ECC
 Int_3    :        X3       x        ECC
 Int_4    :        X4       x        ECC

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      ,0111     1,6784     4,0000   446,0000      ,1539
----------
    Focal predict: SR       (X)
          Mod var: ECC      (W)

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   SR         ECC        WTCGDO     .
BEGIN DATA.
      ,0000      ,0000     3,3555
     1,0000      ,0000     4,7038
     2,0000      ,0000     4,6196
     3,0000      ,0000     4,0836
     4,0000      ,0000     4,6209
      ,0000     1,0000     4,7873
     1,0000     1,0000     5,4236
     2,0000     1,0000     6,3397
     3,0000     1,0000     5,9571
     4,0000     1,0000     6,0914
END DATA.
GRAPH/SCATTERPLOT=
 SR       WITH     WTCGDO   BY       ECC      .
```



Bibliography

Ajzen, I. (1991). The theory of planned behavior. Organizational behavior and human decision processes, 50(2), 179-211.

Antonides, G., & Welvaarts, M. (2020). Effects of default option and lateral presentation on consumer choice of the sustainable option in an online choice task. Sustainability, 12(13), 5484.

Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. Journal of environmental psychology, 23(1), 21-32.

Bhanot, S. P. (2018). Isolating the effect of injunctive norms on conservation behavior: New evidence from a field experiment in California. Organizational Behavior and Human Decision Processes.

Bicchieri, C. (2016). Norms in the wild: How to diagnose, measure, and change social norms. Oxford: Oxford University Press.

Bicchieri, C., & Dimant, E. (2019). Nudging with care: The risks and benefits of social information. Public choice, 1-22.

Bonini, N., Hadjichristidis, C., & Graffeo, M. (2018). Green nudging. Acta Psychologica Sinica, 50(8), 814-826.

Browne M., Sweet M., Woodburn A., Allen J. (2005) Urban freight consolidation centers- final report. Prepared for the Department for Transport London by Transport Studies Group. University of Westminster, London.

Davari, A., & Strutton, D. (2014). Marketing mix strategies for closing the gap between green consumers' pro-environmental beliefs and behaviors. Journal of Strategic Marketing, 22(7), 563-586.

Demarque, C., Charalambides, L., Hilton, D. J., & Waroquier, L. (2015). Nudging sustainable consumption: The use of descriptive norms to promote a minority behavior in a realistic online shopping environment. Journal of Environmental Psychology, 43, 166-174.

Dzionek-Kozłowska, J. (2017). The early stages in the evolution of Economic Man. Millian and marginal approaches. Annales. Etyka w życiu gospodarczym, 20(6), 33-51.

Evans, N., Eickers, S., Geene, L., Todorovic, M., & Villmow, A. (2017). Green Nudging: A discussion and preliminary evaluation of nudging as an environmental policy instrument.

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). "The affect heuristic in judgments of risks and benefits". Journal of behavioral decision making, 13(1), 1-17.

Fischer, C. (2008). Feedback on household electricity consumption: a tool for saving energy?. Energy efficiency, 1(1), 79-104.

Franzini, M. (2014). Il paternalismo liberale, i nudge e la politica economica. Meridiana, 71-84.

Fu, A. J., & Saito, M. (2018). "Would You Be Willing to Wait?": Consumer Preference for Green Last Mile Home Deliver.

Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. Journal of consumer Research, 35(3), 472-482.

Grampp, W. (1948). "Adam Smith and the Economic Man". Journal of Political Economy, 56(4), 315-336.

Hagman, W., Andersson, D., Västfjäll, D., & Tinghög, G. (2015). Public views on policies involving nudges. Review of philosophy and psychology, 6(3), 439-453.

Hardin, G., & Coccoli, L. (2009). La tragedia dei beni comuni. Bollettino telematico di filosofia politica.

Haws, K. L., Winterich, K. P., & Naylor, R. W. (2014). Seeing the world through GREEN-tinted glasses: Green consumption values and responses to environmentally friendly products. Journal of Consumer Psychology, 24(3), 336-354.

Igliński, H., & Babiak, M. (2017). Analysis of the potential of autonomous vehicles in reducing the emissions of greenhouse gases in road transport. Procedia engineering, 192, 353-358.

Jaller, M., & Pahwa, A. (2020). Evaluating the environmental impacts of online shopping: A behavioral and transportation approach. Transportation Research Part D: Transport and Environment, 80, 102223.

Joshi, Y., & Rahman, Z. (2017). Investigating the determinants of consumers' sustainable purchase behaviour. Sustainable Production and consumption, 10, 110-120.

Kahneman, D. (2002). Maps of bounded rationality: A perspective on intuitive judgment and choice. Nobel prize lecture, 8, 351-401.

Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux.

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. Econometrica, 47(2), 263-291.

Laibson, D., & List, J. A. (2015). Principles of (behavioral) economics. American Economic Review, 105(5), 385-90

Levy, J. (1992). An Introduction to Prospect Theory. Political Psychology, 13(2), 171-186.

Lin, J., Chen, Q., & Kawamura, K. (2016). Sustainability SI: logistics cost and environmental impact analyses of urban delivery consolidation strategies. Networks and Spatial Economics, 16(1), 227-253.

Mangiaracina, R., Perego, A., Perotti, S., & Tumino, A. (2016). Assessing the environmental impact of logistics in online and offline B2C purchasing processes in the apparel industry. International Journal of Logistics Systems and Management, 23(1), 98-124 .

Mendleson, N., & Polonsky, M. J. (1995). Using strategic alliances to develop credible green marketing. Journal of consumer marketing.

Michalek, G., Meran, G., Schwarze, R., & Yildiz, Ö. No 21–October 2015. Nudging as a new “soft” tool in environmental policy. An analysis based on insights from cognitive and social psychology.

Mickwitz, P. (2003). A framework for evaluating environmental policy instruments: context and key concepts. Evaluation, 9(4), 415-436.

Mill, J. S. (1836). On the definition and method of political economy. The philosophy of economics, 41-58.

Momsen, K., & Stoerk, T. (2014). From intention to action: Can nudges help consumers to choose renewable energy?. Energy Policy, 74, 376-382.

Musu, I. (2013). Economic Analysis, Sustainability and Environmental Commons.

Newell, A., Shaw, J. C., & Simon, H. A. (1962). The processes of creative thinking. In Contemporary Approaches to Creative Thinking, 1958, University of Colorado, CO, US. In Schwartz, H. (2002). In: Herbert Simon and behavioral economics. The Journal of Socio-Economics, 31(3), 181-189.

Newton, J. D., Tsarenko, Y., Ferraro, C., & Sands, S. (2015). Environmental concern and environmental purchase intentions: The mediating role of learning strategy. Journal of Business Research, 68(9), 1974-1981.

Ölander, F., & Thøgersen, J. (2014). Informing versus nudging in environmental policy. Journal of Consumer Policy, 37(3),

Persky, J. (1995). The ethology of homo economicus. Journal of Economic Perspectives, 9(2), 221-231.

Ranieri, L., Digiesi, S., Silvestri, B., & Roccotelli, M. (2018). A review of last mile logistics innovations in an externalities cost reduction vision. Sustainability, 10(3), 782.

Schubert, Christian (2016).Green nudges: Do they work? Are they ethical?, MAGKS Joint Discussion Paper Series in Economics, No. 09-2016, Philipps-University Marburg, School of Business and Economics, Marburg.

Schwartz, H. (2002). Herbert Simon and behavioral economics. The Journal of Socio-Economics, 31(3), 181-189.

Simon H.A. (1990) Bounded Rationality. In: Eatwell J., Milgate M., Newman P. (eds). Utility and Probability. The New Palgrave. Palgrave Macmillan, London.

Slapø, H. B., & Karevold, K. I. (2019). Simple Eco-Labels to Nudge Customers Toward the Most Environmentally Friendly Warm Dishes: An Empirical Study in a Cafeteria Setting. Frontiers in Sustainable Food Systems, 3, 40.

Soman, D. (2015). The last mile: Creating social and economic value from behavioral insights. University of Toronto Press.

Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin.

Thidell, Å. (2009). Influences, effects and changes from interventions by eco-labelling schemes-What a Swan can do? (Vol. 2009, No. 5). Lund University.

Tiefenbeck, V., Goette, L., Degen, K., Tasic, V., Fleisch, E., Lalive, R., & Staake, T. (2018). Overcoming salience bias: How real-time feedback fosters resource conservation. Management science, 64(3), 1458-1476.

Tomer, J. F. (2007). What is behavioral economics?. The Journal of Socio-Economics, 36(3), 463-479.

Tullani, H., Dahiya, R., (2017). A Turn In Green Purchase Intentions Through Eco-Labelling, International Journal Of Engineering Research & Technology (Ijert) Ncietm - 2017 (Volume 5 - Number 11).

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. science, 185(4157), 1124-1131.

Van Loon, P., Deketele, L., Dewaele, J., McKinnon, A. & Rutherford, C., 2015. A comparative analysis of carbon emissions from online retailing of fast moving consumer goods. Journal of Cleaner Production, 106, pp.478-486.

Vedung, E., Bemelmans-Videc, M., & Rist, R. (1998). Policy instruments: typologies and theories. Carrots, sticks, and sermons: Policy instruments and their evaluation, 5, 21-58.

Viu-Roig, M., & Alvarez-Palau, E. J. (2020). The Impact of E-Commerce-Related Last-Mile Logistics on Cities: A Systematic Literature Review. Sustainability, 12(16), 6492.

White, K., Habib, R., & Hardisty, D. J. (2019). How to SHIFT consumer behaviors to be more sustainable: A literature review and guiding framework. Journal of Marketing, 83(3), 22-49.

Yeung, S. P. M. (2004). Teaching approaches in geography and students' environmental attitudes. Environmentalist, 24(2), 101-117.

Yue, B., Sheng, G., She, S., & Xu, J. (2020). Impact of consumer environmental responsibility on green consumption behavior in china: The role of environmental concern and price sensitivity. Sustainability, 12(5), 2074.

Zalega, T. (2014). Consumer and Consumer Behaviour in the Neoclassical and Behavioural Economic Approach. konsumpcja i rozwój, (4 (9)), 64-79.

Sitography

Abboud, L. and Hodgson, C. (2019). Climate costs mount as retailers compete on fast delivery". Ft.com. Retrieved from: https://www.ft.com/content/2f7203dc-1b63-11ea-97df-cc63de1d73f4

Amazon.com (n.d.) Retrieved from: https://sustainability.aboutamazon.com/environment/packaging-and-products/packaging

Belloc, M. (2012). Economia comportamentale. Treccani.com. Retrieved from: https://www.treccani.it/enciclopedia/economia-comportamentale_%28Dizionario-di-Economia-e-Finanza%29/

Best, R. (2019). The Return of the Package [Digital image]. Statista.com. Retrieved from: https://www.statista.com/chart/16615/e-commerce-product-return-rate-in-europe/

Capgemini Research Institute (2019). The last-mile delivery challenge. Retrieved from: https://www.capgemini.com/wp-content/uploads/2019/01/Report-Digital-%E2%80%93-Last-Mile-Delivery-Challenge1.pdf

Cecchini, G. (2020). Nudging in COVID-19 era. Università Luiss Guido Carli. Retrieved from: http://tesi.luiss.it/28030/1/710201_CECCHINI_GIACOMO.pdf

Chen, C. & Saril,S. (2020). Amazon Day is a Prime member perk that lets you schedule your package deliveries — here's how it works. Businessinsider.com .Retrieved from: https://www.businessinsider.com/what-is-amazon-day-schedule-deliveries-prime-benefit?IR=T

CPG, FMCG & Retail (2018). Global Consumers Seek Companies That Care About Environmental Issues. Nielsen.com. Retrieved from: https://www.nielsen.com/eu/en/insights/article/2018/global-consumers-seek-companies-that-care-about-environmental-issues/

D'Agostino, E. (2020). Acquisti online o in negozio? Il vero impatto dell'e-commerce sull'ambiente. Thegreenevolution.vaillant.it. Retrieved from: https://thegreenevolution.vaillant.it/acquisti-online-o-in-negozio-il-vero-impatto-delle-commerce-sullambiente/

Day, M. (2020). Amazon Nixed 'Green' Shipping Proposal to Avoid Alienating Shoppers. Bloomberg.com. Retrieved from: https://www.bloomberg.com/news/articles/2020-03-05/amazon-nixed-green-shipping-proposal-to-avoid-alienating-shoppers

Dista (n.d.). 5 ways to make your last mile delivery sustainable. Dista.ai. Retrieved from: https://www.dista.ai/blog/how-to-make-your-last-mile-delivery-sustainable/

Dizionario Di Economia E Finanza (2012). Homo Oeconomicus In Treccani.it. Retrieved from: https://www.treccani.it/enciclopedia/homo-oeconomicus_%28Dizionario-di-Economia-e-Finanza%29/

Dolan. S.(2021). The challenges of last mile delivery logistics and the tech solutions cutting costs in the final mile. Businessinsider.com. Retrieved from: https://www.businessinsider.com/last-mile-delivery-shipping-explained?IR=T

Donadi, E. (2013). Dalla teoria dell'utilità attesa alle teorie alternative: analisi del comportamento degli individui nelle scelte di portafoglio in laboratorio. Università Ca' Foscari Venezia. Retrieved from: http://dspace.unive.it/bitstream/handle/10579/3136/811552-1164411.pdf?sequence=2

Ecommercedb (n.d.) Store Ranking & Overview. Ecommercedb.com. Retrieved from: https://ecommercedb.com/en/ranking/it/all

EcommerceDB.com & Statista (2021). Top online stores in Italy in 2019, by e-commerce net sales", Statista.com. Retrieved from: https://www.statista.com/forecasts/871153/italy-top-online-stores-italy-ecommercedb

Elogii (2020). 11 New Trends in 2020 for the Next 11 Years in Delivery. Elogii.com. Retrieved from: https://elogii.com/blog/delivery-management-trends/

eMarketer (2020). Retail e-commerce sales worldwide from 2014 to 2024, Statista.com. Available on: https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/

eMarketer & Vision Monday (2021) E-commerce share of total global retail sales from 2015 to 2023, Statista.com. Available on: https://www.statista.com/statistics/534123/e-commerce-share-of-retail-sales-worldwide/

Enright, T. (2019). The Need for Supply Chain Multispeed and Sustainability in Retail's Shipping Practices. Gartner.com. Retrieved from: https://www.gartner.com/en/documents/3975547/the-need-for-multispeed-and-sustainability-in-retail-s-l

EyeforTransport Ltd (2020). Supply Chain Last Mile Report. Retrieved from: https://discover.3ds.com/supply-chain-last-mile-report-2020

Gartner.com (2019). Retrieved from: https://www.gartner.com/en/supply-chain/insights/retail-supply-chain-management

Hochfelder, B. (2017). What retailers can do to make the last mile more efficient. Supplychaindive.com. Retrieved from: https://www.supplychaindive.com/news/last-mile-spotlight-retail-costs-fulfillment/443094/

Idealo (2020). Report annuale sull'e-commerce italiano: come si sta evolvendo il commercio digitale nel nostro Paese. Retrieved from: https://www.idealo.it/dam/jcr:4a9dfdfb-6992-4af2-a23d-54fd0b39738e/2020_ebook_ecommerce_idealo_scarica_gratis_IT.pdf

Ingraham , C. (2017). What's a urinal fly, and what does it have to with winning a Nobel Prize?. Washingtonpost.com. Retrieved from: https://www.washingtonpost.com/news/wonk/wp/2017/10/09/whats-a-urinal-fly-and-what-does-it-have-to-with-winning-a-nobel-prize/

Jiang, E. (2016). Is e-commerce really better for the environment than traditional retail?. Businessoffashion.com. Retrieved from: https://www.businessoffashion.com/articles/sustainability/is-e-commerce-really-better-for-the-environment

Kemp, S. (2021). Global Ecommerce Overview January 2021. Datareportal.com. Retrieved from: https://datareportal.com/reports/digital-2021-global-overview-report

Kenton, W. (2020). Behavioral Economics. Investopedia.com. Retrieved from: https://www.investopedia.com/terms/b/behavioraleconomics.asp

Krajinska, A. (2021). Electric vehicles are far better than combustion engine cars when it comes to air pollution. Here's why. Transportenvironment.org. Retrieved from: https://www.transportenvironment.org/newsroom/blog/electric-vehicles-are-far-better-combustion-engine-cars-when-it-comes-air-pollution

Lampert, M., Metaal, S., Liu, S. & Gambarin, L. (2019). Global rise in environmental concern. Retrieved from: https://www.courthousenews.com/wp-content/uploads/2019/08/ClimateChangeGlocalities.pdf

Losito, C. (2020). Analyzing the Trade-off between Healthiness & Sustainability in Food-Related Behaviors: The Role of Environmental Concern in Food Packaging Choices, Università LUISS Guido Carli. Retrieved from: http://tesi.luiss.it/28041/1/708321_LOSITO_CRISTOFORO.pdf

Manitoba Wildlands (2014). Environmental Externalities. Retrieved from: http://manitobawildlands.org/pdfs/2.6.1-EnvironmentalExternalities-Jan12.pdf

Martínez, J.V. & Cottrill, K. (2020). E-commerce retailers should put more value on green delivery options. Greenbiz.com. Retrieved from: https://www.greenbiz.com/article/e-commerce-retailers-should-put-more-value-green-delivery-options

McKinsey & Company (2018). Fast forwarding last-mile delivery - implications for the ecosystem. Retrieved from: https://www.mckinsey.com/~/media/mckinsey/industries/travel%20logistics%20and%20infrastructure/our%20insights/technology%20delivered%20implications%20for%20cost%20customers%20and%20competition%20in%20the%20last%20mile%20ecosystem/fast-forwarding-last-mile-delivery-implications-for-the-ecosystem.pdf

Meisenzahl, M. (2021). Amazon's first electric delivery vans are now making deliveries — see how they were designed. Businessinsider.com. Retrieved from: https://www.businessinsider.com/amazon-creating-fleet-of-electric-delivery-vehicles-rivian-2020-2?IR=T#according-to-amazon-the-team-spent-18-months-considering-available-electric-vehicle-options-before-deciding-to-make-its-own-1

Nava, G. (2018). Organizzare il cambiamento – razionalità limitata & mental biases (1/3). Madeforexport.it. Retrieved from: https://www.madeforexport.it/innovazione/razionalita-limitata-ed-organizzazione-parte-i/

Netcomm (2020). Evoluzione degli acquisti online degli italiani ed effetto del Lockdown sui comportamenti di consumo omnicanale - versione LIGHT. Retrieved from: https://www.consorzionetcomm.it/download/netretail-ottobre-2020-versione-light/

OptimoRoute (2021). What Is Last Mile Delivery? Costs & How to Optimize. Retrieved from: https://optimoroute.com/last-mile-delivery/

Optoro (2021). Impact Report: Powering Resilient Retail 2020. Retrieved from: https://info.optoro.com/hubfs/The%20Optoro%202020%20Impact%20Report.pdf

Osservatorio eCommerce B2c (2019). L'eCommerce B2c: il motore di crescita e innovazione del Retail!. Retrieved from: https://www.osservatori.net/it/ricerche/comunicati-stampa/continua-la-crescita-dellecommerce-b2c-in-italia-gli-acquisti-online-superano-i-31-mld-di-euro-e-il-40-provengono-da-smartphone

Ostrom E., (1990). Governing the Commons. Cambridge: Cambridge University Press Retrieved from: https://wtf.tw/ref/ostrom_1990.pdf,

Pelligra, V. (2019). «Nudging», quella spinta gentile che vale una vita. Ilsole24ore.com. Retrieved from: https://www.ilsole24ore.com/art/nudging-quella-spinta-gentile-che-vale-vita-AC9LmOt?refresh_ce=1

Pitney Bowes. (2019). "Pitney Bowes Online Shopping Study 2019" . Retrieved from: https://www.pitneybowes.com/content/dam/pitneybowes/us/en/ecommerce/shopping-study/2019-global-ecommerce-report-v3-web.pdf

Pontiggia,V. (2018). Logistica eCommerce: l'importanza della consegna ultimo miglio, Blog.osservatori.net. Retrieved from: https://blog.osservatori.net/it_it/logistica-ecommerce-ultimo-miglio

ProLogis research special report (2019). Logistics Real Estate and E-commerce Create Sustainability Advantages. Retreived from: https://prologis.getbynder.com/m/59b2eafd08339273/original/Logistics-Real-Estate-and-E-commerce-Create-Sustainability-Advantages.pdf

Retailweek (2018). Counting up the cost of failed deliveries. Retail-week.com. Paid for post by PCA Predict (2018). retail-week.com. Retrieved from: https://www.retail-week.com/retail-voice/counting-up-the-cost-of-failed-deliveries/7028019.article?authent=1

Reynodls, M. (2020). Jeff Bezos wants to fix climate change. He can start with Amazon. Wired.co.uk. Retrieved from: https://www.wired.co.uk/article/jeff-bezos-climate-change-amazon

Sarma, S. (2019). Last Mile Delivery Route Optimization and the Changing Logistics of Grocery Stores. Suppluchain.com. Retrieved from: https://www.supplychain247.com/article/last_mile_delivery_route_optimization_and_the_changing_logistics_of_grocery/locus

Statista (2020). Environment in Italy. Retrieved from: https://www.statista.com/study/47118/environment-in-italy/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/framing-effect/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/base-rate-fallacy/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/illusion-of-validity/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/gamblers-fallacy/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/illusory-correlation/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/affect-heuristic/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/optimism-bias/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/status-quo-bias/

Thedecisionlab.com (n.d.). Retrieved from: https://thedecisionlab.com/biases/salience-bias/

Trimble Smartdelivery (2019). The Impact of Green Delivery on Customer Satisfaction. Smartdelivery.trimble.com. Retrieved from: https://smartdelivery.trimble.com/the-impact-of-green-delivery-on-customer-satisfaction/

UPS. (2019). Reasons for returning online purchases according to online shoppers worldwide as of January 2019. Statista.com. Retrieved from: https://www.statista.com/statistics/348087/order-return-rates-worldwide/

We Are Social et al. (2021). Global digital population as of January 2021. Statista.com. Retrieved from: https://www.statista.com/statistics/617136/digital-population-worldwide/

World Economic Forum (2020). The Future of the Last-Mile Ecosystem. Retrieved from: http://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf

Summary

Introduction

E-commerce has been developing in depth throughout the years, redefining the world's business activity. In particular, online shopping is one of the most popular online activities. The global expansion of e-commerce has resulted in a dramatic increase in online sales, especially during the COVID-19 pandemic. Since consumers have increased their online shopping, e-commerce offerings have changed in order to adapt to consumers' demand. As a result, in addition to expanding the number of product categories offered, e-retailers have started differentiating their sales services, including home delivery services. Hence, fast delivery has been added to the standard delivery service; it was initially introduced by Amazon and then by all competitors operating in the online environment. Whilst fast delivery is part of a competitive e-commerce strategy to gain both market share and a larger customer base, it requires an efficient management of logistics activities that undermine the company's profitability. Also, it has a considerable impact on the environment, in terms of greenhouse gas emissions caused by the increased freight transportations necessary to ensure a timely service. As a result, companies face the "last-mile delivery challenge". Among the possible solution alternatives, this study aims to analyse the introduction of a green delivery option placed in the last step of the online purchase process. The implementation of this option would require online customers to wait a few extra days to get their orders, thus reducing logistics efforts and the related environmental impact. In this regard, this research seeks to analyse the effect of a powerful and cost-effective strategy that would make final consumers choose sustainable delivery in their online purchases. This strategy relies on the principles of behavioural economics and applies the nudging approach. This research focuses on the effect of green nudges techniques (eco-label, green default, feedback and social norm) on the consumers' willingness to engage in a sustainable behaviour by choosing the green delivery option when purchase online. In addition, the role of environmental concern will be explored, as a driver that potentially leads consumers to switch from fast or standard to green delivery option.

The present work is articulated in 3 chapters: the first chapter deals with the growth of e-commerce; it analyses the drivers underlying the last-mile delivery challenge and introduces the green delivery option as a feasible solution to meet the challenge. The second chapter introduces the principles on which behavioural economy is established and discuss the concept of nudging, especially in the environmental field (green nudging); furthermore, four green nudges that research focuses on are discussed in detail. Finally, the third chapter shows the empirical analysis which measures the effect of the four green nudges on the willingness to choose the green delivery option in the online purchase. It also measures the influence of environmental concern of consumers in the above-mentioned relationship.

1. E-commerce, its environmental impact and the opportunities for more sustainable deliveries

Fast-moving e-commerce

One of the most popular online activities worldwide is represented by online shopping through e-commerce.

Online shopping led e-commerce sales to triple between 2014 and 2019, from 1.3 up to 3.5 trillion U.S dollars. E-commerce has developed so much and the number of consumers buying online is increasing as well, especially in the wake of the COVID-19 pandemic. The increase in the online customer base led to new ways of selling and delivering products. This is due to the ever-changing and demanding consumer wants and needs. During the online decision-making process, consumers evaluate not only the purchasing experience, prices, and product reliability, but also the speed and variety of delivery services. For these reasons, e-commerce has started to develop services to increase the speed of delivery and implement innovative distribution strategies. Companies are engaging in proposing additional services with the intention to provide customers with the same convenience that they would experience when buying in-store. In other words, e-retailers have mainly focused on the last-mile delivery.

Globally, in the last-mile environment, even though the standard delivery (from 1 to 5 days) continues to be the most used one, same-day and instant delivery are about to grow annually. This is because, according to the research conducted by McKinsey, it has been proven that customers who buy online abandon their shopping carts or decide not to buy because delivery times are too long or unspecified.

Besides supporting the increasingly sophisticated demands of consumers, fast delivery resulted to provide e-commerce with a set of relevant benefits. In this regard, according to the study of Capgemini Research Institute, if customers are satisfied with delivery service, they increase their loyalty, pay a higher price for faster delivery, increase the amount of expenditure and their purchase frequency.

Evaluating the environmental impact of online vs offline purchase process

The exponential growth of e-commerce has been studied in terms of environmental externalities generated by online shopping. The most common environmental externalities are climate change, air pollution, noise pollution and traffic congestion. In the context of online purchase, these issues are stressed by the high rate of deliveries connected to the uptick in online sales.

The environmental impact of online shopping has been analysed by making a comparison with traditional shopping. Past research considered the worrying aspects of consumer purchasing processes in terms of sustainability. In particular, it focused on the main drivers of greenhouse gas emissions.

The ProLogis Report of 2019 states that, in both online and offline shopping, parcels' transportation is the main responsible for environmental pollution. In addition, the amount of CO_2 emitted by online purchases is reduced by more than 50% with respect to offline shopping. This is because, when consumers purchase products online, the customers' orders are consolidated into trucks and vans, which travel along a single delivery route; for what concerns the in-store shopping, instead, we need to consider individual trips of customer's vehicles from their home to the stores and back. Therefore, it is possible to infer that buying online is a good way to reduce pollution caused by the individual trips of consumers. However, these results are influenced by several factors, such as the product sector of reference, the distance covered by the customer in the purchase process, the structure of the distribution network of reference, the number of deliveries made in

a delivery round, the number of items in the shopping basket, and the rate of return. Thus, each situation is unique, so it is hard to tell that e-commerce is always more environmentally sustainable than a traditional purchase. The efficiencies of online shopping and logistic-related strategies are counteracted by the introduction of fast delivery. It dramatically reduces the consolidations levels, since more frequent shipments split occur; this leads to an increase in the number of deliveries per tour and, consequently, the vehicle miles travelled rise, augmenting the transportations' negative externalities.

Studies have clearly shown that, due to freight transportation, the logistics activities in online shopping, especially the last-mile delivery phase, are the most critical component of the purchase process, in terms of sustainability. That is, to speed up the transportation of orders through fast delivery leads to extra emissions of carbon dioxide exceeding more than double the emissions expected by non-expedited delivery methods; thus, the use of fast delivery offsets the environmental benefits of not driving to the physical store.

Summing up, e-commerce is a more sustainable solution as long as standard delivery is preferred to fast delivery. For this reason, we refer to "last-mile delivery challenge", that is the struggle of e-commerce in trying to provide consumers with a satisfying purchase and delivery experience, being environmentally sustainable and, at the same time, ensuring profitability.

The last-mile delivery challenge: logistics in terms of financial and environmental costs

The e-commerce growth is shifting the market share from B2B to B2C. For this reason, consumers' attitudes, preferences and purchase behaviours have become a relevant component to analyse in order to implement a successful business strategy, whose key differentiator is the last-mile.

The first aspect of the last-mile delivery challenge is related to the attempt to find a balance between customer satisfaction and delivery cost in the supply chain.

From the customer point of view, expectations related to the online purchase experience, are high and rising. Consumer demands concern not only product quality, product differentiation and the opportunity to compare several offerings in the online store; but, today, also delivery time is changed, since people ask for their purchases immediately. As a result, on the one hand, e-retailers have to make sure that online services are affordable and agile to be appreciated by customers. Therefore, to support the increase in online sales and the consumers' expectations of delivery times, e-commerce companies need to improve their delivery logistics so that they can move more products at a faster pace. On the other hand, e-retailers have to implement a successful logistics strategy in order to be profitable, while maintaining strong customer satisfaction. Indeed, from the e-commerce point of view, one of the biggest challenges to be faced in the last-mile delivery is related to the reduction of logistics costs: today, the last-mile delivery costs account for 53% of the total delivery costs.

As customers have increased the use of online stores, the expectation related to free and fast deliveries has increased, and the number of parcels delivered as well. To face this issue, businesses have to increase the number of vehicles and drivers involved. Moreover, since fast delivery has become a "must-have" feature for

online purchases, people are less willing to pay for that service so that companies have to bear the cost on their own. By doing so, they charge customers less than the amount they should pay to fulfil the orders.

Moreover, by taking into account the average driver's salary, warehousing, fuel, and vehicle maintenance, it is easy to understand the extent of the delivery cost problem. For these reasons, the overall last-mile delivery cost represents a pressure on the budget of companies that are suffering from marginal profits.

The second aspect of the last-mile delivery challenge faced by e-commerce is related to the attempt to reduce as much as possible the environmental impact of the last-mile logistics. The advantage of online shopping, in terms of sustainability, disappears if the shopper chooses fast delivery. This happens because, by considering a standard delivery, e-retailers are allowed to consolidate products on vans and trucks, that travel on a single route to deliver them to a bunch of final customers; but, if we consider a reduction in the delivery time the situation is different: here, e-retailers have to decrease the number of parcels to drop off per mile, because they need to manage deliveries in smaller time windows; this problem is faced by increasing the number of vehicles that, in order to deliver parcels as soon as possible, do not have time to fill up and therefore run half-empty. Such condition involves the lack of optimization, in terms of both capacity and route travelled and therefore leads to higher greenhouse gas emissions. We can therefore argue that accelerating delivery times not only results in a great strain on the budget but also, leads to an increase in greenhouse gas emissions from e-commerce and logistics companies that fulfil deliveries.

In light of these environmental issues, a new era of sustainability is rising. Recently, people have begun to express increased concern about the environmental impact of their daily activities. More specifically, for what concern their shopping habits, consumers have become more aware of the hidden environmental costs associated to the purchase processes: today, consumers are trying to adjust their shopping habits, by looking for companies that share their sustainability policies and help them to behave eco-consciously. Considering this, the concern about the impact of last-mile delivery logistics is also becoming increasingly relevant in terms of sustainability. During their online decision-making process, consumers are increasingly concerned about packaging materials for orders purchased online, the delivery options and the related CO_2 emissions.

E-retailers are becoming aware of environmental issues as well. They show their positive attitude toward the attempt to make the online purchase process more sustainable. Indeed, to reduce the environmental impact and optimize the last-mile logistics, e-commerce retailers are going to rethink their delivery strategies by implementing innovative profitable solutions that offer sustainability-related fulfilment services.

In order to accomplish this goal, online companies have started to implement last-mile innovations. More specifically, such innovations are grouped into three main categories: organizational, technology-enabled, and data-technique-enabled. They help contribute not only to the company's profitability, so that to become more competitive in the online marketplace, but also to the environmental sustainability of the last-mile delivery step. Among the organizational innovations, we find the urban consolidation centres. The technological innovations concern innovative vehicles, automated lockers, and robots. Instead, data techniques refer to data

mining, data analytics, big data, which allow improving efficiency of the last-mile logistics. For instance, the route optimization software could be implemented for this purpose.

If, on the one hand, these innovations can be adopted at the discretion of the company, here we propose a further alternative whose adoption is mainly by choice of the online consumer. Such alternative concerns the introduction of a "green delivery option", placed at the final stage of the online purchase process. The green delivery option consists of a sustainable method of shipping products purchased on an online platform. This alternative requires the online consumer to choose a delivery option that will take at least three or four days to deliver the order to the customer's doorstep. It can represent a huge change with respect of the fast delivery. More specifically, green shipping attempts to avoid the problem of vehicles that travel even when they have not reached their maximum capacity in order to deliver parcels quickly. To let vans and trucks not use their maximum filling capacity means an increase in the carbon footprint and logistics costs. Thus, e-commerce is asking their customers to wait a few days more for package delivery, in order to employ greener service delivery systems. To benefit from the introduction of green shipping, it is necessary to implement a strategy that influences people to engage in a more pro-environmental behaviour by selecting this option at the end of the online purchasing process. This strategy could be successful because of the opportunity to change customer behaviour by educating shoppers on the importance of choosing a sustainable service. In order to accomplish this goal, the approach suggested is based on behavioural science. In particular, the technique to be used is the so-called *nudging*.

2. Behavioural economics and nudging approach to drive a sustainable online purchase

Behavioural economics

The introduction of green delivery choice in the online purchase process is a feasible solution to cope with the last-mile delivery challenge. To get the advantages of introducing a sustainable delivery, it is necessary to alter consumers' behaviour so that they can adopt it, without avoiding or forbidding any other option. In this context, the nudging approach seemed to be suitable to accomplish this goal. Nudging is an application of insights from behavioural economics used to influence individuals' decisions.

Behavioural Economics is a branch of economics that, through experimental analysis and psychology, develops alternative models of behaviour to those formulated by traditional economics.

While human behaviour and the decision-making process used to be studied in areas such as sociology, psychology and anthropology, things have changed.

Behavioural economics emerged from the interaction of achievements in economics, as well as other social sciences. Thanks to the development of economics, the perception of the economic man's behaviours has also changed in neoclassical and behavioural economic models.

The first evidence of economic man is traced to Adam Smith, in the late 18th century. However, the concept of *homo economicus* has been attributed to John Stuart Mill. Both of them referred to the economic man as a rational being who aim at maximizing wealth by using scarce means in the most efficient way.

In the second half of 1800s, the marginal revolution began: marginal economists replace the wealth maximization with utility maximization as the main goal of economic activity.

From marginalism emerged neoclassical economics. It is based on three basic assumptions: firstly, it assumes people's rational preferences between outcomes; secondly, while individuals maximize their utility, firms maximize their profits; finally, people actions are based on full and relevant information.

The neoclassical theory of decision making is also based on the expected utility theory of J. von Neumann and O. Morgenstern, which aims at analysing human behaviour. This theory considers man both as a rational and predictable being and studies his preferences. According to this, the individual knows the available alternatives, evaluates them, and chooses the one that provide him the greatest utility.

In recent years, critics have identified several limitations in the capacity of neoclassical theories to explain and analyse the human behaviour. In particular, the expected utility theory has been charged with inconsistency between the actual behaviour adopted by individuals and the theoretical behaviour predicted.

In light of this, economists try to create new theories through the violation or weakening of the theory proposed by von Neumann and Morgenstern, which are the requirements that determine rationality.

Therefore, exactly where neoclassical economics fails to answer to the critical questions, behavioural economics comes into play. It aims at fulfilling the gaps stemmed from the traditional economic theories, including neoclassical economy. In particular, behavioural economics questions the assumption about rationality of human actions, to drop the *homo economicus* model; recourses to psychology to explain the human behaviour in its complexity; and, finally, strays from the simplified economic models, to examine anomalies in traditional economic theories. The first to address this challenge was Herbert Simon. He contested the traditional economy assumptions of rationality and self-interest. In 1950, Simon coined the term *"bounded rationality"* highlighting the constraints in the human decision making process. According to Simon, decision makers are not able to obtain all the relevant information to make a final decision by the time it has to be made; they are not able to perceive and evaluate accurately all the information accessed; they also have cognitive limits in processing information. These constraints prevent decision makers from maximizing the expected value of the solution chosen. Because of the introduction of bounded rationality, the rational choice model, based on *homo economicus* and expected utility, was weakened.

Twenty years later, Daniel Kahneman and Amos Tversky confirmed that humans do not match the *homo economicus* model. In 1979, they developed one of the most important concepts in behavioural economics, namely prospect theory. It aims at being an alternative to expected utility theory as a theory of decision under conditions of risk. According to this theory, people think in terms of expected utility or gains and losses relative to a reference point (e.g., current wealth) rather than absolute outcomes.

In this context, the authors show some systematic errors (cognitive biases) that affect humans reasoning preventing them from making fully rational choices. Among them: loss aversion, endowment effect and framing effect. Dilip Soman properly defines the cognitive bias as *"any systematic deviations from a response or decision that would expect a decision maker to make".*

Moreover, in order to better describe how humans make decisions, Kahneman presented the dual process theory, a model of human cognition based on two modes of thinking that influence our behaviour: System 1 and System 2. System 1, also known as *"intuitive thinking"*, is emotional, impulsive and automatic, operates quickly, with little or no effort and, as it is an involuntarily system, individuals have no control on it. On the other side, System 2, also known as *"slow thinking"*, is distinguished because it is slower, serial, deliberate and allocates attention to effortful mental activities that require it in order to evaluate the alternatives.

While System 2 represents the conscious, which controls thoughts, has beliefs and make choices, System 1 originates easily impressions and feeling, underlying beliefs and choices of System 2.

Kahneman stresses the interaction between the two systems. In particular, System 2 has *"to monitor and control thoughts and actions "suggested" by System 1, allowing some to be expressed directly in behaviour and suppressing or modifying others"*. Yet, System 2 operates through processes that are slow or may also never be triggered due to the mental effort required, therefore it is defined as a *"lazy controller"*. As a result, as System 1 ends up struggling under a work overload, it relies on simplifying heuristics or rules of thumb that reduce the mental effort required to make difficult choices. Finally, this leads intuitive preferences to systematically violate the rules of rational choice, resulting in biased decisions. Heuristics are defined as *"simple procedure that helps find adequate, though often imperfect, answers to difficult questions"*.

Kahneman and Tversky described the role of heuristics in individuals' judgment. According to them, there are three main heuristics that affect human judgement: representativeness, availability and anchoring .

In light of this, individuals' decision making process is not rational since they rely on these heuristics which may lead to cognitive biases. Moreover, it is fundamental to specify that these and other heuristics are not applied only to naïve people, but also to experts who are aware of them.

Nudge theory and choice architecture

On the basis of findings regarding the irrational reasoning of people, the shortcuts used during decision-making and the biased decisions they come up with, Richard H. Thaler began to look into this in more detail, ending up evolving behavioural economics theories. Thaler together with Cass R. Sunstein developed the *"Choice architecture"* or *"Nudge theory"*. They start from the assumption that individuals' choices depend on a large extent, on the context in which choices are made. Our choices are not made in isolation. We choose within places, environments and architectures. The way these environments are designed has a major influence on our decisions and it can push us in one direction rather than another. Hence, the concept of choice architecture explains the practice of influencing the choices of the individuals designing the physical and social environment in which they make decisions. In this regard, a choice architect *"has the responsibility to organize the context in which people make decisions"* to influence their final choices.

Once again, the principle of full rationality is undermined by admitting the ability to influence the choices of the decision maker by changing the ways in which options are presented to them, in terms of design, sequence, and number of options available.

Nudge theory uses bounded rationality to prompt behavioural change, influencing people to make better decisions. In this light, a nudge is defined as *"any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options, or significantly changing their economic incentives. To count as a mere nudge the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not."*

There are some relevant aspects of nudge to be highlighted: first of all, it leverages heuristics to steer individuals toward defined directions and to help them to overcome their cognitive biases; then, in order to be considered a nudge, it should be a gentle indirect suggestion that do not limit other options; in addition, it should be easy to be avoid as well as easy to be followed, influencing biased humans' decisions without them even realizing.

In addition, the nudge theory is based on the idea that the choice architect influences the decisions of individuals without limiting freedom of choice. If this condition is satisfied, then the intervention can be qualified as nudge. Therefore, the choice architect works according to the paradigm of "libertarian paternalism". Thaler and Sunstein argue that *"libertarian paternalism is a relatively weak, soft, and nonintrusive type of paternalism because choices are not blocked, fenced off, or significantly burdened."*

For this reason, nudges are considered a suitable policy tool to influence the sustainable online consumer's behaviour in the environmental field. If this is the case, we talk about green nudges.

Green nudging

Green nudges aim at pushing people toward an "environmentally responsible behaviour". Evans et al. defined green nudging as a *"soft, non-regulatory extension of the environmental policy toolkit. […] potentially non-intrusive way of pursuing environmental ends"*. Green nudging is introduced as an environmental policy tool that can better address the human bounded rationality than conventional regulatory policy interventions. These latter are divided into regulatory, economic, and information instruments.

Typologies of green nudges

Four types of green nudges that seem to be distinctive examples of the overall approach to public policy-making will be discussed. In particular, eco-labels, green default, feedback, and green social norms.

Eco-labels can be messages that simplify product or service information or can be organic markers to make some characteristics more salient, so that to appeal consumers' desire to maintain a positive self-image. That is, choice architects are able to foster a pro-environmental behaviour by motivating people to "*cultivate a positive self-image as considerate "pro-environmental consumers".*

Furthermore, it is possible to encourage pro-environmental actions by carefully determining the default, that is, set a predefined option that prevails when people do not make an active decision. The effectiveness of defaults relies on psychological factors, i.e., inertia (status quo bias), loss aversion and implicit endorsement.

People can be also nudged toward greener choices by giving them feedback on the effects of their decisions (i.e., the amount of electricity they consume). On the basis of the type of feedback individuals get, the decision context is influenced as well as individuals' decisions and behaviours. Indeed, feedback is a simple but effective strategy to help people to improve their performance and correct wrong behaviour. Doing so, this tool has to be well-designed. Research shows that, in order to be effective, feedback has to be provided over a long period of time, in real-time and in a specific and clear way.

Green nudging is also applied to collective behaviours, as it exploits the power of descriptive and social norms. In this regard, we refer to norm-nudging. Norm-nudging consists in conveying information about how "most people" behave and what they approve/disapprove of. Norm-nudging elicits social expectations to induce a behavioural change, assuming that preferences of individual's targeted behaviour are conditional, namely influenced by social expectations. Several experiments showed how using nudges that rely on green descriptive and social norms is effective to change collective behaviours towards more pro-environmental ones.

3. An experimental analysis on green nudging: exploring the moderating role of environmental concern on the relationship between different green nudges and sustainable online purchase behaviour

The conceptual model and hypothesis development

The aim of this thesis is to enhance literature about the influence of green nudging on individuals' decision-making. In particular, the literature about green nudging in the online environment is scarce. To narrow the search field, the study will focus on the influence of green nudging on the individual's choice of a sustainable delivery service when purchasing online. In this framework, the role of the consumers' environmental concern is also explored. To design a conceptual model, the main research questions follow:

RQ1: Do and to what extent different green nudges stimulate consumers to choose the green delivery option in their online purchase behaviour?

RQ2: Does the role of environmental concern affects the direction and the strength of the relationship between different green nudges and the willingness to choose the green delivery option in online purchase behaviour?

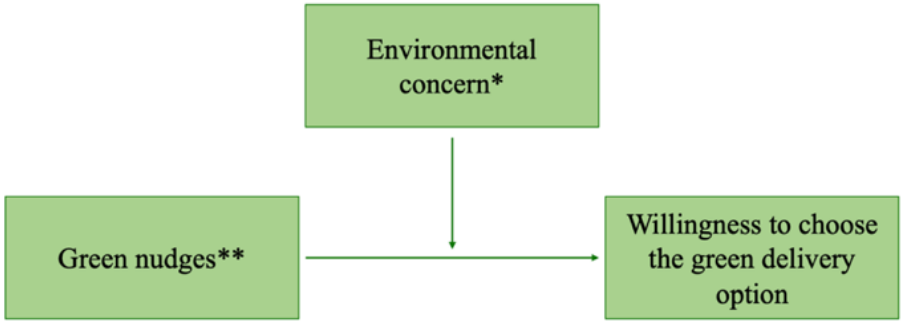


Figure 3.1: "Conceptual model"

*Customers environmentally concerned VS customers non environmentally concerned

**Green nudges: eco-label, default option, feedback, social norm

In order to fill the research gap and answer the questions above, a moderation model is set, the elements of which are the following: the different green nudges (eco-label, default option, feedback and norm-nudges), represent the independent variable; the willingness to choose the green delivery option is the dependent variable; finally, the environmental concern represents the moderator, as illustrated above.

The literature of last decades demonstrated that green nudging is an effective policy tool when used for environmental ends. More specifically, among all the available green nudges, eco-labels represent instruments that facilitate customers' identification and location of green products. To solve the difficulties in finding green offerings, eco-labels provide customers with salient information about environmental characteristics of the products to make customers more aware of the opportunity to engage in a more environmentally friendly behaviour.

Eco-labels have been introduced to by the European Union to identify the energy efficient electronic appliances, demonstrating the role of such nudges to push people towards ecological behaviour. Another stream of research has studied the effectiveness of eco-labels in improving the eco-friendliness of customers' food choices in a cafeteria setting. Given these results, it seems reasonable to use eco-labels in the online purchase process in order to promote a sustainable delivery service, by making green delivery option more salient. Therefore, it is hypothesized that:

H1a. *Online customers are more likely to engage in sustainable purchase behaviour by selecting the green delivery option when provided with an eco-label as a green nudge rather than in the case where no green nudge is used.*

In addition, another nudge that influences consumers to buy in a sustainable way is the green default option.

K. Momsen and T. Stoerk showed how green default nudge increases the likelihood of consumers choosing renewable energy when entering into a home electricity contract. Moreover, G. Antonides and M. Welvaarts studied the power of defaults in online choice environment considering the customers' purchase of make-up products. The research showed that when the sustainable product was set as default option, it was 8% more likely to be selected than if the default was an unsustainable product. A feasible explanation of this behaviour might be that people tend to stick to the default choice, because it allows them to save time and it is also seen as an implicit recommendation of the provider. Hence, it is hypothesized that:

H1b. *Online customers are more likely to engage in sustainable purchase behaviour by selecting the green delivery option when provided with a default option as a green nudge rather than in the case where no green nudge is used.*

Even feedback is considered an important mean which is able to influence consumers to engage in an eco-friendly behaviour. Through feedback, it is possible to convey information concerning the performance related to a task or behaviour carried out. Studies showed that a salient real-time feedback is an efficient tool to induce ecological behaviour. C. Fischer proved that providing customers with feedback on their energy usage results in energy savings from 1.1% to 20% . In addition, V. Tiefenbeck et al. revealed the power of a real-time feedback in the reduction of energy and water consumption. When provided in a simple and intuitive way, it

allows individuals to adapt their behaviour on the basis of the feedback itself. Starting from these findings, it seems reasonable to apply feedback to nudge pro-environmental online purchase behaviour, by making benefits of eco-friendly delivery choice more salient. Therefore, it is hypothesized that:

H1c. *Online customers are more likely to engage in sustainable purchase behaviour by selecting the green delivery option when provided with a feedback as a green nudge rather than in the case where no green nudge is used.*

Finally, we investigated the power of norm-nudging to influence environmentally responsible behaviour, i.e., the choice of green delivery service. Several studies have focused on the role of norms in influencing pro-environmental behaviours. More specifically, C. Demarque et al., have proven the effectiveness of descriptive norms in promoting the purchase of a sustainable product within the online environment . What is more, P.W. Schultz et al., in 2007, and later S. Bhanot, in 2018 showed that social norms should act more effectively than descriptive norms, also in light of the fact that the former are supported by both empirical and normative condition, rather than only the empirical one as in the case of descriptive norms. From these insights, we aim at understanding if the employment of social norms may be an effective nudge in purchasing decisions within the online environment. Thus, it is hypothesized that:

H1d. *Online customers are more likely to engage in a sustainable purchase behaviour by selecting the green delivery option when provided with a social norm as green nudge rather than in the case where no green nudge is used.*

In addition, this study explores the moderating role of environmental concern in the context of the relationships between green nudges and sustainable online purchase behaviour.

Previous literature has clearly highlighted as the increasing environmental concern is a relevant factor in influencing consumers' shopping habits. Environmental concern is an evaluation of environmental issues and therefore is an antecedent to environmental purchase intention. In other words, consumers' environmental beliefs form attitudes that generate intentions to purchase environmentally friendly products. Indeed, consumers environmentally concerned are more likely to be intrinsically motivated to choose and consume sustainable products, namely, to look for them in specific stores and pay higher prices to purchase them. The key role of environmental concern in shaping people's behaviour is well-established not only when they buy ecological products or services, but also in domains like recycling and energy saving. The past research has thoroughly proven that environmental concern plays a relevant role in affecting consumers' decision-making. This work extends this acknowledgement to the context of choice of sustainable delivery service in the online purchase process. In this regard, A.J Fu and M. Saito proved the effect of an increase in consumers' interest in sustainable offerings on the online purchase, more specifically, their willingness to wait few more days to receive their orders with a more sustainable delivery service. Indeed, it is reasonable to say that consumers environmental concern may moderate the impact of green nudging strategy on the consumers' intention to engage in a sustainable online purchase behaviour, by selecting the green delivery option. As a result, hypotheses on all four declinations of the presented nudging approach follow:

H2a. *Environmental concern moderates the relationship between the eco-label as green nudge and consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of eco-label on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

H2b. *Environmental concern moderates the relationship between the default option as green nudge and consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of default option on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

H2c. *Environmental concern moderates the relationship between the feedback as green nudge and consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of feedback on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

H2d. *Environmental concern moderates the relationship between the social norm as green nudge and a consumer's willingness to choose the green delivery option. That is, when a consumer's environmental concern increases, the effect of social norm on willingness to choose the green delivery option is more likely to be higher than when a consumer's environmental concern decreases.*

Research Methodology

To test the hypothesis developed, a conclusive causal research design was chosen. The study used a 5x2 between-subjects experimental design (Green Nudge: no green nudge or control condition (CC), eco-label (GN1), green default (GN2), feedback (GN3), social norm (GN4); environmental concern: high vs low). To test H1a to H1d, the independent variable (X) is represented by green nudge/no green nudge adoption; in the case of green nudge adoption, four alternatives are provided: eco-label, default option, feedback and social norm. In addition, the dependent variable (Y) is the willingness to choose the green delivery option.

To test H2a to H2d, the presented conceptual model, implies the use of a moderation model to analyse data. Here, environmental concern is used as moderating variable (W) (Figure 3.1).

In this framework, green nudge is a nonmetric variable while the willingness to choose the green delivery option is a metric variable. Moreover, environmental concern is a metric variable which has been studied as dichotomous one (coded as 1 = high and 0 = low) by using the method of Median Split.

The study is conducted through an online survey (see Appendix), developed on Qualtrics XM. After assessing the environmental concern, through a 7-point Likert scale of 5 items developed by Haws et al. in 2014, respondents are asked to choose a delivery option in a simulated online shopping process. The options proposed were same-day delivery, standard delivery (4-6 working days) and green delivery (7-10 working days). Here, the respondent is presented with a randomly assigned stimulus/scenarios, one out of five, which shows the green delivery option in different ways i.e., applying a specific type of green nudge. Each scenario is followed by questions that analyse the willingness to choose same-day, standard or green delivery option.

Results

After dataset cleaning, the results were analysed using the software IBM SPSS Statistics. Both Kruskal-Wallis H test and PROCESS analysis have been performed in order to inspect the effect of green nudges on the willingness to choose the green delivery option and the moderating effect of environmental concern.

The final sample consists of 460 individuals, 93% of whom are Italian. The majority of the sample is represented by women (53.9%); however, it is also well represented by men (42.6%).

PROCESS v.3.5 has been used to test the interaction between the green nudges (IV) and the willingness to choose the green delivery option (DV) and test whether a moderating effect occurs thanks to the introduction of environmental concern (W). In the analysis three covariates are introduced: Gender, Age and Education.

Results reveal a significant interaction for what concerns the main effect. Thus, compared to the control condition, all four green nudges have a positive and significant effect on willingness to choose the green delivery option ($t=3.9623$, p-value$=0.001< \alpha=0.05$; $t=3.8224$, p-value$=0.002<\alpha=0.05$; $t=2.1517$, p-value$=0.0320< \alpha=0.05$; $t=3.8012$, p-value$=0.002< \alpha=0.05$). For this reason, hypothesis H1a to H1d are supported. Furthermore, environmental concern has a positive and significant effect on the dependent variable ($t=4.3905$, p-value$=0.000< \alpha =0.05$). In addition, another variable that resulted to be statistically significant is gender, coded as 0 for males (reference category), 1 for females, 2 for non-binary/third gender and 3 for participants who selected "Prefer not to say". Findings allow to infer that the willingness to choose the green delivery option for women (third gender and those who did not specify the gender, to a proportionally reduced extent, due to the fact that they amount to 1,3% and 2,2% of the sample) is significantly higher ($\beta= 0.3089$, p-value$=0.0117< \alpha =0.05$) than men. Among the other covariates, education and age do not influence the dependent variable.

Finally, there is no evidence of an interaction between environmental concern and green nudges, suggesting that both environmentally and non-environmentally concerned customers showed an increase in the willingness to choose the green delivery option ($F(4, 446)=1.6784$, p-value$=0.1539> \alpha =0.05$). For this reason, hypotheses H2a to H2d cannot be supported.

Discussion

Past studies established that individual's choices can be influenced by the nudging approach, especially during their purchase behaviour. Nudges have been proven to be effective on traditional purchase process, but few have focused on the effectiveness of nudges in affecting individual choices during the online purchase process. For this reason, this study tested the effects of four nudges, namely eco-label, default option, feedback and social norm, on the choice regarding sustainable delivery service in the online environment. In particular, the objective was firstly to determine whether and to what extent these four nudges influence a sustainable purchase online behaviour. Second, it stressed the idea of environmental concern as a driver strong enough to lead consumers switching from a fast or standard delivery toward an eco-friendly service.

Results show that consumers are more willing to choose the green delivery when presented with green nudges than when no nudge is used. So, nudging has a significant effect on the sustainable consumer choice.

The regression analysis with PROCESS v3.5 model 1 showed the specific effects of the four green nudges on the dependent variable. In particular, the eco-label resulted to be the most effective nudge ($\beta = 1.3842$). The following two most effective nudges are social norm and green default ($\beta=1.2654$ and $\beta=1.2641$). More specifically, social norms resulted to prompt online consumers to engage in a sustainable behaviour as much as default choice. Despite proving to be the least effective nudge, feedback also turns out to have a positive influence on the choice of sustainable delivery due to its promptness, accuracy and specificity ($\beta= 0.7280$).

Besides nudges, also environmental concern directly influences the online consumers' buying behaviour. However, it unexpectedly does not affect the relationship between green nudges and willingness to choose the green delivery. Thus, being no interaction between environmental concern and green nudges, it seems that both environmentally and non-environmentally concerned customers showed an increase in the willingness to choose the green delivery option. Therefore, the two variables operate independently of each other on the dependent variable. Notwithstanding there is no interaction effect between the two independent variables, it is possible to observe an interesting insight: when consumers are concerned about the environment, they result to be highly willing to choose the green delivery, independently on the green nudge implemented. However, the results show that nudging approach has precisely the desired effect in terms of delivery choice as it succeeds in convincing even those who are not concerned about the environment to make an ecological choice by choosing green delivery. This makes nudging and the green delivery option a winning combination in the online purchase process whatever the customers' degree of concern for the environment.

Theoretically, this study contributes in different ways to the increasingly important stream of research concerning nudging approach, environment and online purchase. Indeed, the results of the present research integrate the existing literature by confirming the power of nudging in influencing individuals' decision-making, regardless their feeling of concern for the environment.

From a managerial perspective, this study provides implications for companies, consumers and institutions.

First of all, logistics and e-commerce companies could be interested in this study, as using nudging approach to undertake a business strategy which promote sustainable delivery would lead to benefits in terms of logistics and profits. This will allow them to successfully meet the last-mile delivery challenge.

In addition, the adoption of such a strategy would have positive effects on the environment, reducing the environmental impact of e-commerce activities, especially that of home delivery services. What is more, ensuring a sustainable business would help e-commerce to meet the needs of environmentally concerned consumers looking for companies that share their values, increasing their market share. Finally, such a study would be useful for policy makers and institutions by providing them with an additional tool, namely the principles of behavioural economics and nudging, to achieve the common goal of environmental protection.

The current study has some flaws that may have skewed the findings and, as a result, may be further integrated for future research. First of all, the results of this study are limited by the method of experiment, namely the

online questionnaire. A field experiment may be more suitable to return a more precise evaluation of actual online consumers' behaviour. Furthermore, future research should not limit the study to Italian sample. Indeed, a cross-national study enable to understand whether findings about green nudges and their influence on online sustainable behaviour could be considered universally acceptable or if there are cross-cultural differences. Moreover, the participants in the sample were only exposed to a specific nudge once. In this regard, future research could investigate the tendency to choose the green shipping repeatedly over time being subjected to further future nudges in subsequent online purchases.

Additionally, further research could compare the effect of other nudges on the willingness to choose green delivery option in order to the detect the most effective one. Finally, future research might examine if the willingness to select green delivery relies on the type of product consumer to buy.

Conclusion

Over the last decades, there has been a disrupting growth of e-commerce and increasing concern about the consequences that the related business activities have on the environment. More specifically, the increasing sales of e-commerce have started to be influenced by the type of delivery services provided. As a result, the faster the delivery service offered, the more satisfying the online purchase experience, the higher customer loyalty to a given e-retailer. The differentiation of delivery options provided guarantees a fast, personalized and satisfying experience which has consequences not only on the companies' profitability, but also on the environment. In particular, a fast delivery service involves high logistics costs but also a negative impact on the environment in terms of greenhouse gas emissions. Therefore, the introduction of a green delivery option is being mapped out. This research examines nudging as a way to influence online consumers' choice of delivery service prompting them to choose the most ecological one.

Findings show that the four nudges proposed to the potential online customers significantly affect their decision-making process. In fact, wherever there is a nudge, be it in the case of the eco-label, the default option, the feedback and the social norm, people are more willing to behave in an ecological way than when there is no such nudge. Alternatively, also environmental concern influences individual's behaviour. Therefore, environmentally concerned individuals are more likely to choose the ecological delivery than those who are not concerned about the impact of human activities on the planet. However, environmental concern does not interact with nudging approach, meaning that nudges positively affect consumers' decisions independently from the consumers' feeling of concern for the environment. Therefore, the present research is interesting in that it reveals that nudging is a very useful and cost-effective technique that can entice people to behave in an eco-friendly way, even those who are not concerned about the environment.