Article

E-Commerce Calls for Cyber-Security and Sustainability: How European Citizens Look for a Trusted Online Environment

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Abstract: The pandemic has changed the citizens' behavior, inducing them to avoid any real contact. This has given an incredible impulse to e-commerce; however, the complexity of the topic has not yet been adequately explored in the literature. To fill this gap, this study has a twofold purpose: (1) to investigate how European countries comparatively perform in e-commerce, and (2) to describe what are the most important challenges for the further expansion of e-commerce. To this end, we adopted a hybrid methodology based on multi-criteria decision analysis (MCDA) and a Likert scale survey. The first method allows to us rank the e-commerce performance of different European countries, while the second one looks at the problems and barriers that characterize online shopping. The results of the study show that European countries have different sensitivities to the issue of cyber-security, and among them it is possible to identify three groups with different levels of attention to the critical issues of e-commerce. The Netherlands, Sweden and Denmark belong to the group of countries most responsive to e-commerce. This request is part of a broader framework of transition toward sustainable development, i.e., a reliable digital environment where citizens and businesses can exercise their rights and freedoms in complete security. Finally, from a theoretical perspective, this paper adds a new baseline to the literature on the state of the art of e-commerce in Europe that addresses the effects of the pandemic. From a managerial point of view, decision makers can find in the results of this analysis a support for the setting of business strategies for the expansion of firms in certain markets and guidance for public authorities when defining regulatory policies for e-commerce.

Keywords: cyber-security; e-commerce; Europe; sustainability

1. Introduction

Since the 2000s, the sudden development of digital technologies and the exponential spread of the Internet Economy have revolutionized people's lives due to the simultaneous and progressive increase in bandwidth for web connections, first on fixed locations and then on mobile ones [1]. All this has generated a great paradigm change in society, which has influenced users' purchasing habits and the companies' way of selling products or services [2]. Thus, the evolution of cyber-security has followed the ongoing progress of communication technologies [3]. In this new environment, cyber-security is gaining special relevance, just like the innovations that are rapidly appearing in this new digital market. Speed, mobility, data and information exchange are also exploited by those who seek to profit from them fraudulently, the so-called cyber-criminals [4]. Among these fraudulent activities, the theft of personal data, phishing, attempted fraud or the blocking of web services are the order of the day when it comes to cyber-security [5]. E-commerce, one of the sectors that moves the most business on the Internet, is therefore one of the most exposed

to the risks of cyber-attacks. So, taking cyber-risks and data protection into consideration is crucial when setting up an e-commerce business [6].

This clearly highlights the need to investigate the relationship between resilience and sustainability, and the positive link between them has been verified in several areas [7–9]. The goal is to contribute to a sustainable revolution [10].

The recent pandemic crisis affecting the world's economies has forced organizations to redesign their operating models, leveraging digital technologies to ensure the continuity of current operations even remotely [11]. This change has affected mainly the employees of companies who have seen their work habits radically transformed [9,12], but the impact has also affected consumer behavior [13]. Individual habits of selecting and purchasing a product or service online have changed, forcing manufacturers and retailers to adapt their offers to new demand requirements, especially by leveraging the widespread use of technology and customer data [14].

Thus, the COVID-19 crisis has forced companies to respond quickly to critical operational issues and new business needs with technology, inevitably increasing the likelihood of becoming the victims of cyber-attacks, as cyber-criminals have exploited the uncertainty of this unpredictable scenario [15]. The many effects of the pandemic include a huge increase in e-commerce; lockdown measures have caused consumers to increasingly turn to online retailers, seeking security and convenience [16]. This trend was confirmed by data published by Salesforce in its Shopping Index report for the first quarter of 2021 [17]. According to this study, in the first quarter of 2021, global e-commerce grew 58% year-over-year compared to 17% in the first quarter of 2020. In detail, the report shows that traffic on shopping sites increased by 28% on PC and 29% on mobile devices.

Figure 1, clearly shows how e-commerce has grown significantly throughout 2021, driven by the closure of physical stores due to the pandemic. It is also evident how in the same period some European countries (Italy, France, Great Britain and The Netherlands) have grown in e-commerce more than the United States and the global level. A direct result of this incredible trend, the online sales volume increase, is the rise in the number of cyber-attacks on online retailers by cyber-criminals taking advantage of changing shopping habits.
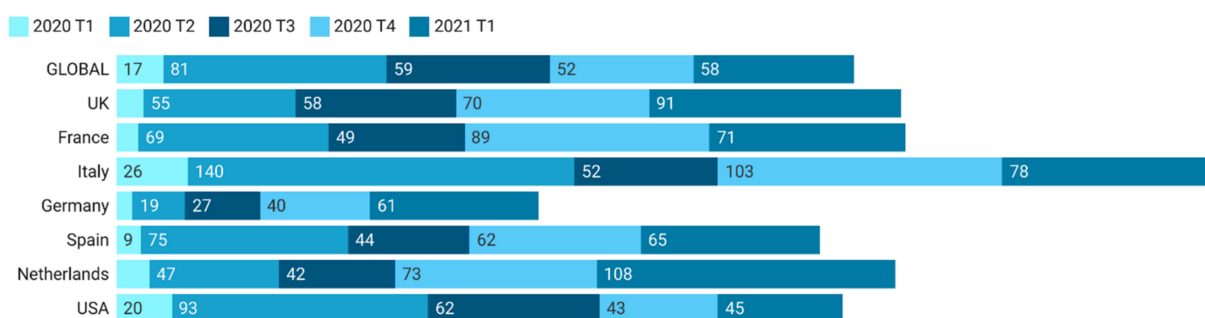
Figure 1. Online shopping growth in 2020–21 by quarter (Source: Own elaborations on Salesforce's Q1 Shopping Index data).

These phenomena also exert a serious effect on consumer behavior in the process of buying a good or service online. Some studies have shown how individual behavior is influenced by the perceived level of security in the exchange of private data at the time of the transaction [18,19]. In fact, it is unlikely that consumers will turn for their online purchases to an organization that has recently suffered a cyber-attack. However, it remains to be investigated whether consumers' increased awareness of the vulnerability of ecommerce platforms can affect their purchasing decisions. In addition, the literature has not yet sufficiently explored how the pandemic period oriented consumers' intention

toward online purchasing [20]. Along with this, the literature also highlights how cross-national and cross-cultural studies on online consumer behavior are scarce and how most of them are based on data collected in a single country [21]. Thus, it becomes clear how important it is to delve into the advantages and criticalities of e-commerce, not only because the data evidence shows a trend of great growth of this sales channel, but also because the scientific literature demands that this gap be filled [22–24]. In addition, a cross-country methodological approach is needed to better exploit the potential of the predictive dimension of the analysis. In fact, the effectiveness of this predictive feature has been proved in recent research studies [25,26].

Therefore, based on the above discussion, the following research questions can be stated:

- RQ1: How do European countries perform comparatively in e-commerce?
- RQ2: What are the most important challenges to the further expansion of e-commerce?

2. Materials and Methods

The literature proposes a mixed approach, collecting data from websites and evaluating the users' experience [27]. MCDA was proposed to evaluate a comparison among European countries in order to highlight the different performances (see RQ1—Section 2.1), while a Likert Scale Survey was proposed to investigate both the problems encountered by individuals and the perceived barriers to buying/ordering over the Internet (see RQ2—Section 2.2).

2.1. Multicriteria Analysis

The MCDA is a well-known methodology in the literature, which is useful to compare multiple and conflictual alternatives [28]. It is based on both the score associated with each alternative (i.e., the scoring criterion) and the weight assigned to the relevance of each criterion. One difficulty in this analysis relates to data acquisition. To this end, a very useful database is that of Eurostat, which facilitates the harmonization of statistical methods among the various member states (MSs). Data provided by Eurostat are used in the literature [29,30] and typically used to compare several MSs [25,31].

In this research, we analyzed a set of criteria proposed by Eurostat for a specific topic, "Science, technology, digital Society", that was subdivided in (i) science and technology and ii) digital economy and society(t_isoc). Within this second group, five sub-topics were identified: i) ICT usage in households and by individuals (t_isoc_i), (ii) ICT usage in enterprises (t_isoc_e), (iii) digital skills (t_isoc_sk), iv) ICT sector (t_isoc_se) and v) digital economy and society—historical data. Within the first sub-topic, several items are proposed, including the one related to the core topic of this research. Table 1 proposes several criteria associated to e-commerce, proposing six categories.

Table 1. List of criteria.

Category	Criteria
Internet purchases by individuals	Last online purchase: in the last 3 months Last online purchase: in the 12 months Frequency of online purchases in the last 3 months: 1 or 2 times Frequency of online purchases in the last 3 months: 3 to 5 times Frequency of online purchases in the last 3 months: 6 to 10 times Frequency of online purchases in the last 3 months: more than 10 times
Internet purchases—goods or services	Online purchases (3 months): clothes (including sport clothing), shoes or accessories Online purchases (3 months): furniture, home accessories or gardening products Online purchases (3 months): printed books, magazines or newspapers Online purchases (3 months): deliveries from restaurants, fast-food chains, catering services Online purchases (3 months): music as a streaming service or downloads Online purchases (3 months): films or series as a streaming service or downloads

Table 1. *Cont.*

Category	Criteria
Internet purchases—origin of sellers	Online purchases (3 months): from national sellers Online purchases (3 months): from sellers from other EU countries Online purchases (3 months): from sellers of the rest of the world (non-EU countries) Online purchases (3 months): from sellers from unknown countries Online purchases (3 months): from sellers from other countries (EU or non-EU)
Internet purchases—collaborative economy	Online purchases (3 months) from private persons: any physical goods Online purchases (3 months) from private persons: household services Online purchases (3 months) from a private person: transport service Online purchases (3 months) from a private person: rented accommodation Online purchases (3 months) from a private person: goods, household services, transport services or rented accommodation
Internet purchases—money spent	Online purchases in the last 3 months for less than 50 euro Online purchases (3 months) for between 100 and 499 euro Online purchases (3 months) for between 500 and 999 euro Online purchases (3 months) for 1000 euro or more
Financial activities over the Internet	Online purchases (3 months): insurance policies, including travel insurance, also as a package together with, e.g., a plane ticket Online purchases (3 months): took a loan or a mortgage or arranged credit from banks or other financial providers Online purchases (3 months): bought or sold shares, bonds, units in funds or other financial assets Online purchases (3 months): at least one of the financial activities (I_BFIN_SH1, I_BFIN_IN1, I_BFIN_CR1)

The criteria chosen were all of those available on Eurostat and referred to 2020 as the latest year available. All data were reported as percentages and are thus comparable to each other. Finally, the panel data set was always expressed as a percentage and therefore the different criteria were comparable to each other. The choice of alternatives was associated with the number of MSs and, in this case, they were equal to twenty-five out of twenty-seven, as data from two countries, such as Italy and France, were absent.

The multi-criteria analysis consists of two distinct phases in which values and weights are calculated.

$$PV_{(MS)} = \sum_{J=1}^{N} RV_{(MS)} * CV \tag{1}$$

where the result of the MCDA analysis is the calculation of a performance value (PV), obtained by multiplying a row vector (RV), representing the values of the criteria (J), and a column vector (CV), representing the weights of the criteria. The PV is calculated for each alternative, which, as mentioned earlier, is represented by the MS aggregating N criteria.

Regarding the assessment of RV, several values are normalized [25]. Starting from the set of data available for each of the 30 criteria proposed in Table 1, the maximum value was identified and assigned a value of 1. Subsequently, an intermediate value calculated as a function of the maximum value was identified for all 24 remaining values (associated with the MSs). It should be noted that a minimum value, to which the value of 0 would be associated, was not calculated, in order not to accentuate the negative performance. The results are therefore objective, since they are exactly those which Eurostat has found, but transformed to make them congruent with an MCDA.

Concerning the assessment of CV, a subjectivity criterion was used for the assignment of the weights. The literature typically proposes well-established methods to define the weights of the criteria, such as Analytic Hierarchy Process [32], Promethee [33] or Delphi analysis [34]. These methods are not chosen for three main reasons: i) the need to identify new approaches; ii) the nature of the criteria analyzed, which tend to be sometimes alternative and not complementary; and iii) the topic under investigation in this work. Thus, one is aware that a pairwise comparison analysis can be seen as a more robust method to compare countries [25], but the topic of e-commerce finds its origin in the network. Consequently, the method most suitable to evaluating these criteria is one in which the weights are defined according to the number of views of the individual criteria on the Google search engine. A similar approach was also used by some authors to provide insights into population behavior [35]. In addition, we integrated the assessment of CV

with a method well consolidated in the literature, which is based on the calculation of local priority and global priority [36]. Initially, a weight was assigned to each category, and then within each category a weight was assigned to the individual criteria. This weight is called the local priority, and the global priority is obtained by multiplying the local priority by the category priority. This method has the advantage of comparing a significant number of criteria. This work considers two scenarios:

- Different weights (DW) scenario, in which both the local and the category priority were based on the number of views in the Google search engine.
- Hybrid equal weights (HEW) scenario, in which only the local priority was defined as in the previous scenario, while the same weight was assigned to all category priorities.

An Equal weights (EW) scenario, in which all criteria have the same relevance, was not considered in this work because it was not representative of reality. All input data used in this work are available at Supplementary Materials.

2.2. A Likert-Scale-Based Survey

Within the Eurostat database there were not only the criteria proposed in Table 1 under the heading "e-commerce" but also both of the problems encountered by individuals (Table 2) and the perceived barriers (Table 3) to buying/ordering over the Internet. However, the data were not available for all countries. Within this framework, an alternative method was to use a panel of experts. In particular, the aim was not to propose the impact for individual countries but to build a framework from which to discuss the findings and potential policy implications.

Table 2. Problems encountered by individuals when buying/ordering over the Internet.

N°	Individuals Who Encountered the Following Problem When Making Purchases over the Internet:
1	difficulties concerning guarantees
2	speed of delivery longer than indicated
3	delivery costs higher than indicated
4	final price higher than indicated
5	delivery costs or final price higher than indicated
6	wrong goods delivered
7	damaged goods delivered
8	wrong or damaged goods delivered
9	wrong or damaged good/services delivered
10	lack of security of payments
11	problems with fraud
12	complaints and redress were difficult
13	no satisfactory response received after complaint
14	complaints and redress were difficult or no satisfactory response received
15	other
16	no problems
17	technical failure
18	difficulties finding information concerning guarantees, other legal rights
19	for private use
20	foreign retailer did not sell in my country

Table 3. Perceived barriers to buying/ordering over the Internet.

N°	Individuals Who Have Not Ordered Goods or Services over the Internet, Because
1	they have no need
2	they prefer to shop in person, they like to see the product, loyalty to shops or force of habit
3	for their own private use (relevant information about goods difficult to find on website)
4	they lack the necessary skills
5	It is too expensive
6	of too long delivery times
7	of problems receiving the ordered goods at home
8	of too long delivery times/due to problems in receiving the ordered goods at home
9	for their own private use (payment security concerns)
10	for their own private use (privacy concerns)
11	of security concerns, they are worried about giving credit card details over the Internet
12	of privacy concerns, they are worried about giving personal details over the Internet
13	I am worried about giving credit card or personal details over the Internet
14	of trust concerns about receiving or returning goods, complaint/redress
15	they do not have a payment card
16	the speed of the Internet connection is too low
17	of other reasons
18	the foreign retailer did not sell in my country

A well-established method in the literature is the Likert-scale-based survey [37], with five levels of assessment that were defined as follows: 1 = totally disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = completely agree [38].

The choice of experts was based on an announcement published on the LinkedIn social network in which the required characteristics were indicated. Having at least 10 years of experience in the sector, interest in participating in a survey for the purpose of a scientific publication and propensity to participate in a video-call through Skype or Google Meet to discuss the topic e-commerce. The announcement also stated that the maximum interview time would be one hour and that only 10 experts would be selected according to [39].

The number of applications received was significant and led us to post a new message stating that the 10 experts had been chosen. After acceptance they were sent an official invitation e-mail in which the two RQs were explained and the Excel file containing the questions proposed in Tables 2 and 3 was sent. It was specified that the questions had been identified by Eurostat and for this reason they were not asked to validate them at the beginning. All respondents sent their input via e-mail, and then the video-call was used to initially gather feedback on what they had compiled in Excel and then to discuss the topic in general (from March to April 2021). Table 4 proposes the list of experts.

Table 4. List of experts.

N°	Role	Country	No. Years
1	Marketing manager	Spain	12
2	Operations manager	France	11
3	Account manager	Sweden	21
4	Consultant	United Kingdom	15
5	Marketing manager	Italy	18
6	Operations manager	Germany	20
7	Consultant	Denmark	12
8	Account manager	Finland	18
9	Marketing manager	Spain	15
10	Consultant	Italy	13

3. Results

The theme of e-commerce has become crucial in the pandemic period, as the fear of infection, the lockdown and the closure of many commercial activities has led consumers to choose this channel of purchase. In this section, the main results obtained from the analyses that focused on both the MCDA and the Likert scale are offered.

3.1. A Comparison among European Countries

A cross-country comparison has the advantage of highlighting certain critical points and characteristics. However, comparing each individual criterion has the limitation of focusing just on a single aspect and the criteria may also conflict with each other. To this end, it is important to adopt a methodology capable of synthesis, as MCDA. The development of these indicators is by no means simple. Aggregating values and weights based on both Eurostat and Google data yields a single indicator, based on the contribution of the six reference categories (Table 5) considering the DW scenario.

Table 5. Results of multicriteria analysis. Key: I (Internet purchases—collaborative economy), II (Internet purchases—money spent), III (Financial activities over the Internet), IV (Internet purchases—goods or services), V (Internet purchases—origin of sellers) and VI (Internet purchases by individuals). Italy and France were not considered because of absent data in Eurostat.

	I	II	III	IV	V	VI	Total
EU 27	0.025	0.022	0.194	0.081	0.064	0.027	0.413
Belgium	0.030	0.026	0.145	0.083	0.075	0.032	0.392
Bulgaria	0.005	0.012	0.086	0.018	0.017	0.009	0.147
Czechia	0.026	0.018	0.129	0.062	0.058	0.030	0.323
Denmark	0.034	0.022	0.379	0.147	0.090	0.039	0.712
Germany	0.017	0.022	0.210	0.120	0.086	0.037	0.492
Estonia	0.011	0.027	0.521	0.057	0.068	0.029	0.713
Ireland	0.018	0.017	0.359	0.083	0.078	0.032	0.586
Greece	0.008	0.014	0.097	0.038	0.038	0.019	0.214
Spain	0.024	0.028	0.164	0.067	0.069	0.027	0.380
Croatia	0.008	0.022	0.243	0.045	0.052	0.023	0.393
Cyprus	0.001	0.007	0.063	0.034	0.045	0.017	0.167
Latvia	0.006	0.030	0.539	0.035	0.047	0.020	0.678
Lithuania	0.008	0.024	0.242	0.041	0.050	0.022	0.386
Luxembourg	0.040	0.021	0.237	0.089	0.075	0.035	0.497
Hungary	0.027	0.031	0.145	0.055	0.059	0.025	0.341
Malta	0.023	0.026	0.277	0.081	0.079	0.027	0.512
The Netherlands	0.027	0.030	0.453	0.146	0.089	0.038	0.784
Austria	0.006	0.013	0.126	0.082	0.066	0.028	0.322
Poland	0.008	0.025	0.098	0.053	0.041	0.024	0.249
Portugal	0.008	0.020	0.145	0.047	0.041	0.018	0.280
Romania	0.001	0.010	0.047	0.026	0.020	0.012	0.117
Slovenia	0.028	0.028	0.145	0.046	0.061	0.026	0.334
Slovakia	0.029	0.026	0.129	0.055	0.053	0.025	0.317
Finland	0.025	0.020	0.509	0.078	0.064	0.031	0.727
Sweden	0.027	0.023	0.465	0.123	0.078	0.036	0.753

The results obtained show how the distribution of weights determines that the category of financial activities over the Internet (item III as showed in Table 5) has a considerable influence on comparisons between the various performances of European countries. In fact, it appears that its weight is equal to around 59.80% of the total value, followed by the category Internet purchases—goods or services, with 15.20% (item IV), and the category Internet purchases—origin of sellers, with 11.40% (item V). The other three categories have a weight that varies between 4.00% and 5.40%.

An analysis of the performance of individual countries shows that Denmark leads the way in items VI, V and VI, Hungary in item II and Luxembourg in item I. As far as item III is concerned, it is Latvia that comes first, with 0.539, equal to about 80% of the total value. As mentioned above, it is this item that determines the final results. It follows that the first six countries in the ranking (Table 6) occupy the first six positions for the item Financial activities over the Internet. It should also be noted that the countries that follow Latvia in the ranking show a significant percentage weight that tends to decrease. This is an expected result, but it is significant to look at the differences that are equal to 27% of the total computation. In fact, we have Estonia with 0.521 (73% of the total), Finland with 0.509 (70%), Sweden with 0.465 (62%), The Netherlands with 0.453 (58%) and Denmark with 0.379 (53%). The same is not verified for Ireland, which is the seventh in this category, with 0.359, but has a weight on the total of 61%.

Table 6. Ranking of European countries in 2020.

Different Weights (DW) Scenario			Hybrid Equal Weights (HEW) Scenario		
No.	Country	Value	No.	Country	Value
1	The Netherlands	0.784	1	The Netherlands	0.780
2	Sweden	0.753	2	Denmark	0.755
3	Finland	0.727	3	Sweden	0.705
4	Estonia	0.713	4	Luxembourg	0.627
5	Denmark	0.712	5	Germany	0.612
6	Latvia	0.678	6	Finland	0.604
7	Ireland	0.586	7	Belgium	0.571
8	Malta	0.512	8	Estonia	0.569
9	Luxembourg	0.497	9	Malta	0.567
10	Germany	0.492	10	Ireland	0.558
	EU27	0.413	11	Spain	0.518
11	Croatia	0.393		EU27	0.513
12	Belgium	0.392	12	Hungary	0.495
13	Lithuania	0.386	13	Slovenia	0.486
14	Spain	0.380	14	Latvia	0.481
15	Hungary	0.341	15	Slovakia	0.471
16	Slovenia	0.334	16	Czechia	0.466
17	Czechia	0.323	17	Austria	0.410
18	Austria	0.322	18	Croatia	0.401
19	Slovakia	0.317	19	Lithuania	0.395
20	Portugal	0.280	20	Poland	0.368
21	Poland	0.249	21	Portugal	0.333
22	Greece	0.214	22	Greece	0.284
23	Cyprus	0.167	23	Cyprus	0.223
24	Bulgaria	0.147	24	Bulgaria	0.171
25	Romania	0.117	25	Romania	0.165

This analysis at the category level should be conducted at the level of each individual criterion to understand which criteria primarily determine these final values. To this end, item III is composed of four criteria which, as shown in the data, have different weights. The criterion Online purchases (3 months): at least one of the financial activities (I_BFIN_SH1, I_BFIN_IN1, I_BFIN_CR1) has a local weight of 0.727 and a global weight of 0.435. The countries present an order that mirrors that which was presented for the category in general.

However, an alternative method (HEW scenario) could be to consider a weight in which the local weight was always calculated using the same approach as before, while it was assumed that the weights of the six categories were the same (Table 6). These analyses are useful for evaluating the trends to understand how much impact the weights have on the final indicator. For example, the criterion Online purchases (3 months): at least one of the financial activities (I_BFIN_SH1, I_BFIN_IN1, I_BFIN_CR1) has always a local weight

of 0.727, while the global weight is now 0.121 (since the weight of category III is 0.167). Figure 2 shows the difference between two different (DW and HEW) scenarios.
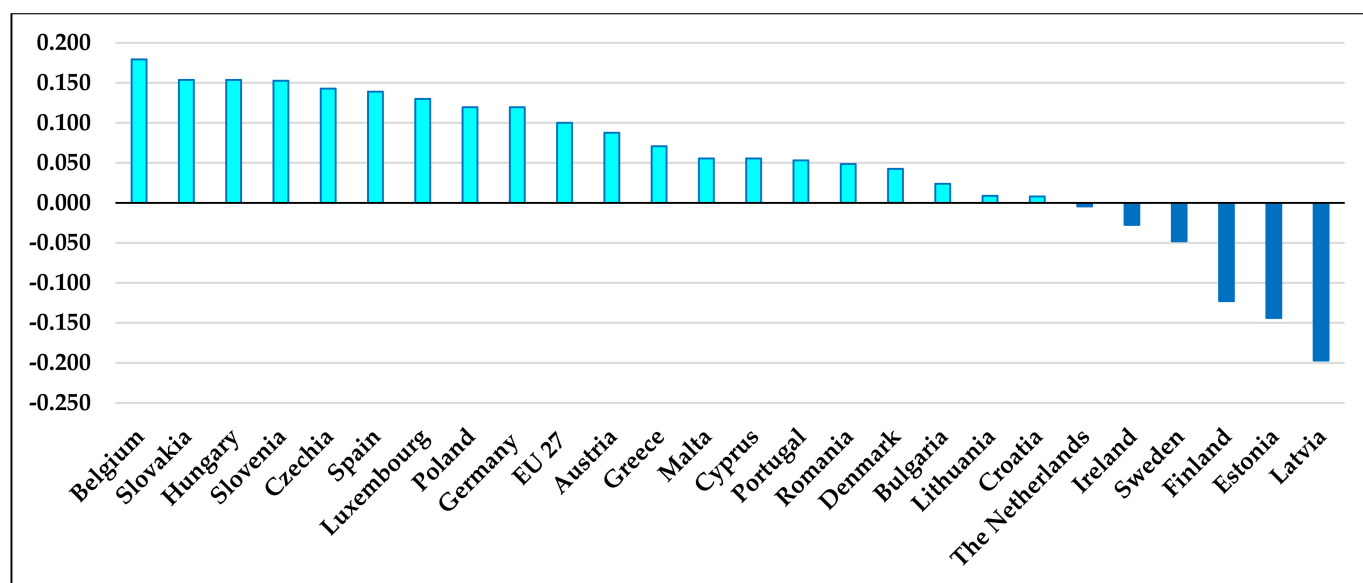

Figure 2. Delta between HEW and DW scenarios.

The results are influenced by the value of the weights, that brings the EU 27 from a total value of 0.413 in the DW scenario to 0.513 in the HEW scenario, recording an increase (HEW-DW scenario) of 0.100. The advantages of the alternative scenarios are to provide results depending on the proposed point of view. In fact, this research had chosen the number of views as the reference method, considering it strategic to evaluate the perspectives of a greater number of stakeholders. Similarly, a panel of experts from specific stakeholder categories could provide valuable information, but the simpler method of equal weights also provided important insights. The HEW model represents an intermediate point between a DW and an EW scenario.

In the DW scenario, the top seven countries are those identified by the most relevant criterion, Online purchases (3 months): at least one of the financial activities (I_BFIN_SH1, I_BFIN_IN1, I_BFIN_CR1), but the order of the ranking changes. This means that this category is relevant but not decisive. In particular, The Netherlands leads with 0.784, followed by Sweden (0.753) and Finland (0.727). At the same time, it is also logical that these seven countries are the ones that present the greatest deviation when considering the HEW scenario, where it is Latvia that has a reduction of 0.197.

The latter is the only country that, when passing from the DW scenario to the HEW scenario, no longer has a value higher than the European average, while Belgium and Spain move in the opposite direction and acquire a value higher than the European average. More precisely, Belgium increases its indicator by 0.179. The Netherlands remains in first place in the alternative scenario, with 0.780, followed by Denmark (0.755) and Sweden (0.705). On the other hand, it can be seen that the lowest ranking is held by Greece, Cyprus, Bulgaria and Romania in both scenarios.

These data should be monitored over time, perhaps integrating them with the specific results of Italy and France to evaluate temporal trends that are always suitable for understanding how a topic evolves. However, compared to a simple subdivision of the European countries above or below the European average, it is possible to use a range to distinguish those countries that have a significantly higher/lower value compared to those that have a more limited value (Figure 3). The delta considered always depends on the case study being analyzed, and in this case a percentage weight of 20% was chosen. Consequently, those countries that have a value greater than 0.496 in the DW scenario and/or 0.616 in the

HEW scenario will be virtuous. On the other hand, those countries that have a value of less than 0.330 in the DW scenario and/or 0.410 in the HEW scenario will be defined as laggard. Finally, other countries will be defined as in-between.
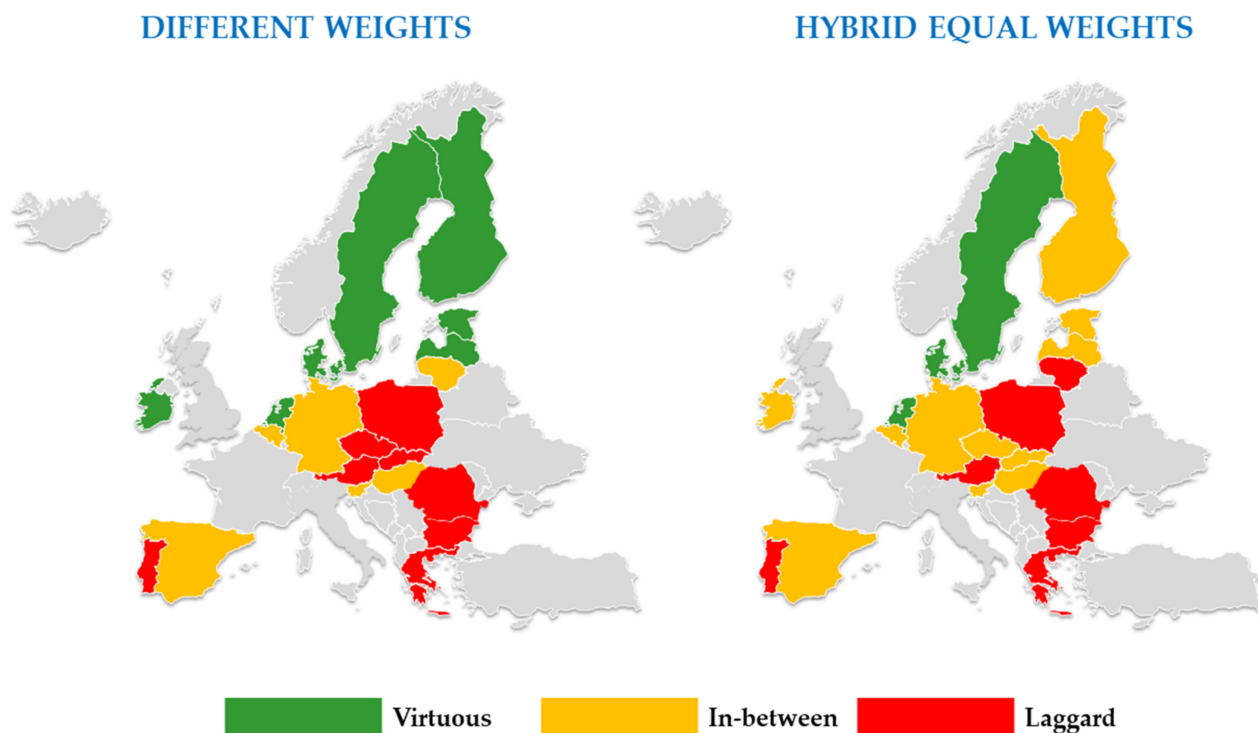

Figure 3. The subdivision of countries in three groups. Data not available for Italy and France.

The results show that there are only three countries (The Netherlands, Sweden and Denmark) that are virtuous and seven countries (Austria, Poland, Portugal, Greece, Cyprus, Bulgaria and Romania) that are laggards in both scenarios. These values indicate that, regardless of the weights considered, the target values proposed by Eurostat make it possible to rank the European countries and then to classify them into groups. This summary analysis is necessary in a context where the multiplicity of data is significant, and methodologies are proposed for assigning weights that vary according to the specificity of the topic under analysis.

3.2. Expert Assessment

The panel of experts could be seen as subjective because only certain categories of stakeholders are involved in the analysis and because the individual respondents may not have a global view. However, the Likert scale is an established method in the literature, and the previous section demonstrates precisely that its use, as an evaluation system in surveys, is a generally accepted method. Experts provide their judgment by looking not at a personal perspective but at the overall perspective that has been formed over time through years of experience. Figure 4 proposes the ranking related to problems encountered during the purchasing phases, while Figure 5 illustrates the ranking related to perceived barriers.
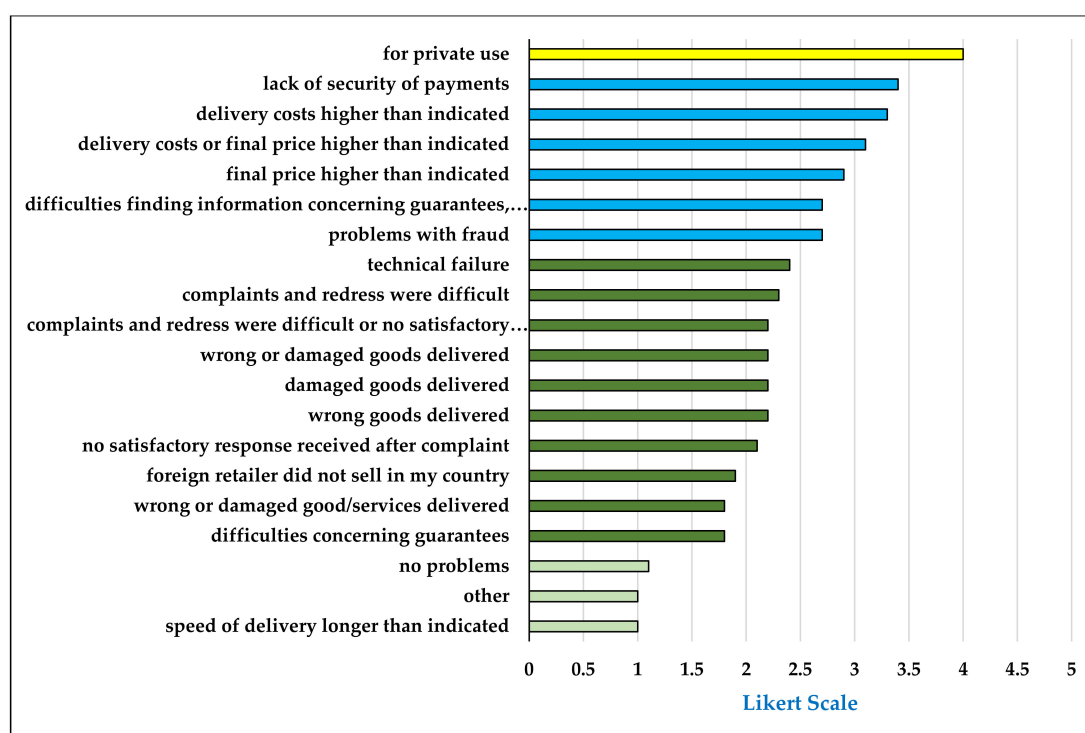
Figure 4. Results of a Likert-scale-based survey (Problems encountered by individuals). The following color bars are used: totally disagree (pink), disagree (orange), neither agree nor disagree (blue), agree (yellow) and completely agree (green).

Figure 5. Results of a Likert-scale-based survey (Perceived barriers). The following color bars are used: totally disagree (pink), disagree (orange), neither agree nor disagree (blue), agree (yellow) and completely agree (green).
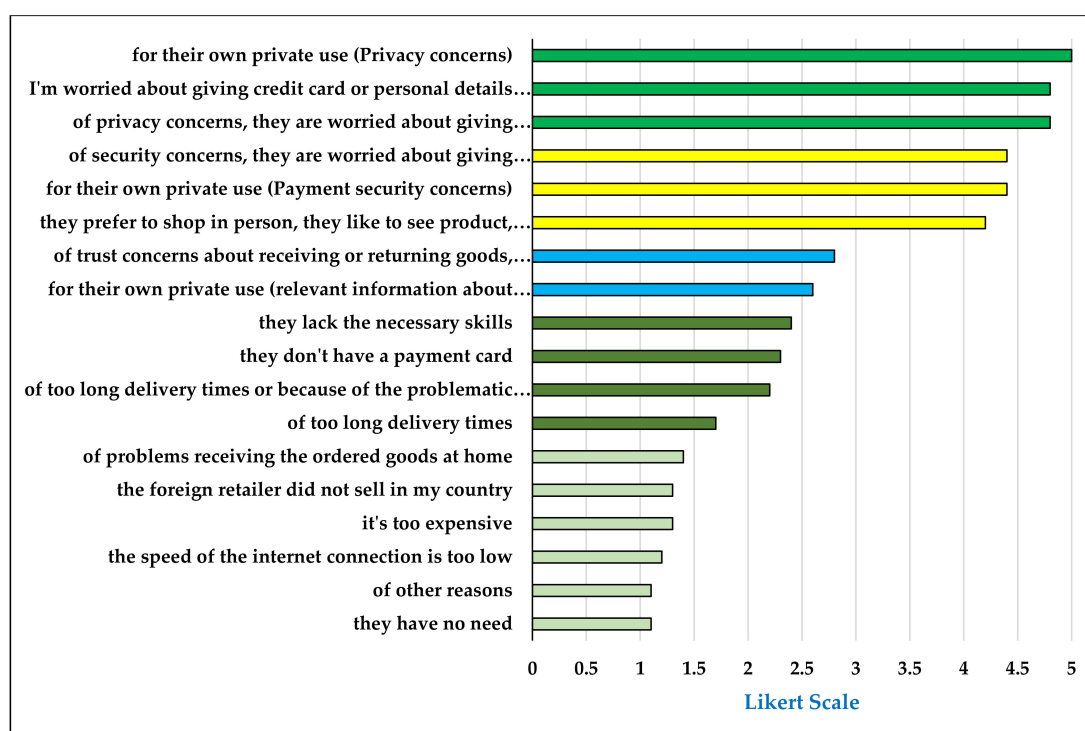
The results show that the problems encountered by individuals when buying/ordering over the Internet are not considered relevant by the expert panel. No item received a significant relevance, while the item related to private use always collected a value of 4 and

is the only one that presents a moderate relevance. Next in the ranking appears the fear associated with the security of payment (average value of 3.4). It emerges, therefore, that e-commerce is no longer seen as an alternative to face-to-face shopping but has now entered the habits of citizens. The pandemic period has widened this phenomenon. Moreover, this consideration emerges not only from the assignment of Likert Scale values, but is a concept reiterated by all respondents. Those who buy through this channel have a clear idea of what they want to buy. Indeed, more than problems they see opportunities, and can compare the price they have seen in a store with the price they can quickly see on a cell phone or a tablet. At the same time, delivery costs are slightly more critical than the selling price (3.3 vs. 2.9). Protection in terms of privacy and fraud is considered neither relevant nor irrelevant (average value 2.7).

The situation changes when the experts are asked to identify potential barriers. In fact, it emerges that there are three items that are considered very relevant and, in particular, all the experts have assigned a value of 5 to private use (confirming the previous figure). However, the privacy concerns component is given the highest value, while payment security concerns are given a value of 4.4. Privacy concerns are also considered very relevant when talking specifically about concerns about personal details (average value of 4.8). Similarly, when we talk specifically about security concerns in terms of credit cards, the value of 4.4 is confirmed. Finally, the preference to purchase in person is also moderately significant (4.2).

4. Discussion

4.1. Nexus between e-Commerce, Cyber-Security and Sustainability

The theme of e-commerce is viewed with great concern by some operators, as they fear serious economic repercussions. Still, the definition of a relationship between demand and offer is an extremely complex matter, and those operators that are able, more than others, to fulfill demands of the market can be deemed successful. The present work aims to place the accent on a topic that is debated in the literature, focusing on aspects that are still insufficiently explored. For instance, how is it possible to manage the amount of data that Eurostat makes available? In addition to the results proposed in the previous parts of the paper, the interviews with the experts also covered other topics. It emerged that the experts would have liked to investigate further aspects of this topic, and this clearly represents a limitation of this work. In particular, this work was not directed at investigating the topic of sustainability. However, the expert panel underlined the importance of this topic and the need to further investigate the relationship between e-commerce and sustainability. If the consumer buys the final product directly from the producer, the transport could be about the same as between the producer and the point of sale and between a point of sale and the consumer. The same could apply to the packaging, even if, in this case, the mono-product delivery is notoriously more impacting than the delivery of a stock that is quantitatively more meaningful. The answer to this question is to apply the 'polluter pays' principle. The sustainable revolution calls for the calculation of the cost of pollution per unit of product, and it is then up to the logic of the market to see how it will be shared between the producer and the consumer. In this context, the use of green fuels and reused, recycled and recovered materials can lead to a significant reduction in the environmental impact associated with a single product. However, another major theme of analysis cannot go unnoticed: the sustainability of digitization. Similarly, experts highlight how Europe is moving toward the combination of sustainability and resilience. The reading that is given is that of creating competitive conditions. Investing in the opportunities of natural resources and building dynamic models capable of reacting to unpredictability are basic components for companies positioned in a global context.

Furthermore, e-commerce can also be seen in terms of an expansion through which some small businesses can find space in larger markets without paying expensive rents in a big city, in the most luxurious neighborhood. They can reach customers who are not used to traveling and therefore would not have been able to purchase such products. The openings

of distribution points of large international players in local contexts are seen as positive for direct employment outlets but are then identified as negative because in some cases they lead to the closure of some activities. In this context, local products can gain momentum because a product is made available beyond its usual borders: exporting is what can make the difference in times of crisis. One of the problems of e-commerce is the loss of human contact. To solve this problem, support services can make the consumer feel that he or she has not been left to his or her own devices to deal with any doubts that may arise during the purchasing process. Many companies practice a zero-cost return service, and this has been a market move that has represented a tsunami for companies that used to use only traditional channels. Within other realities (e.g., Media World), an internal competition is created between the two different sales channels, characterized by specific offers.

Our interviewees paid attention to the cyber-security issues that could be generated in this new context. The main concern of consumers is to lose part of their privacy and to share personal data even if they do not want to. Also of concern is the traceability that results in the many e-mails and phone calls that are received daily. In short, the time that could be saved through e-commerce could be reduced for these phenomena, and a still more incisive element is that not all the consumers are social, that is, they are not so prone to sharing their life habits on the net. To these aspects we must add the problems connected to the security of payments. There can be no resilience when one's personal data have been used by others or when one's money has been stolen.

Economic growth and sustainability are aspects of sustainable development that are increasingly present in the policies and strategies of European countries. Digitalization and cyber-security represent two of the main enabling factors of sustainable development, and for this reason they play a primary role in the Next Generation EU (NGEU). The NGEU aims to support the positive relationship between sustainability and resilience, and this work underlines the need of new studies in the context of e-commerce able to demonstrate their relative advantages.

This study has highlighted how European citizens increasingly benefit from digital infrastructure and applications through which they exercise their fundamental rights and freedoms, such as the process of purchasing goods or services online. For this reason, the NGEU also provides the enhancement and strengthening of public and private technological infrastructure to create a safe online environment for consumers and businesses. The results of the survey provide important insights into how the NGEU will be implemented. Each European country, when defining its digital transformation policies and strategies, should plan investments in cyber-security that include actions aimed at orienting organizational, process and technological issues, also thanks to the adoption of a systematic approach to risk management. As a direct consequence, the importance of considering the issue of cyber-security in a comprehensive and systematic way arises. In fact, it is imperative to appropriately protect the information of citizens and businesses that is collected and processed through digital channels. These actions are able to generate a positive relationship between sustainability and resilience.

Finally, it is necessary to underline the impact of the impetuous growth of e-commerce on the environmental dimension of sustainability. The closure of physical stores during the pandemic and the subsequent growth of e-commerce has resulted in an increase in shipping and packaging waste. Nevertheless, operators in e-commerce supply chains, having fewer middlemen, can exercise greater control over packaging solutions and delivery logistics. In addition, there is a trend among consumers to support those companies that operate responsibly toward the environment, also thanks to the action exerted, especially among the younger generations, by social media and eco-influencers. Therefore, the demand for eco-friendly products is high, especially among Millennials and Generation Z, who are becoming the most sensitive customers to sustainability issues. So, also for e-commerce organizations, it has become necessary to design and implement sustainability policies that communicate to consumers in a transparent way the actual actions taken to reduce the environmental impact of the product, packaging and delivery system. For e-commerce

organizations, this means adopting green marketing strategies that expand the consumer market and increase sales.

4.2. Featured Application

Through this research it was possible to build a benchmark able to identify and correlate the different items that represent the topic of e-commerce within Eurostat. These data are normally used by European countries mainly to carry out decisions, so a synthesis-based benchmark can help decision makers. In this perspective, the results of this study have both theoretical and managerial implications, as described below.

4.3. Theoretical Contribution

This study contributes to the literature by analyzing the revolution in e-commerce development caused by the current health crisis. Pre-pandemic studies need to be updated because e-commerce has changed the playing field. This provides a homogeneous starting point for future studies. Using an expert opinion panel, based on a Likert scale survey, a less biased overall view of e-commerce challenges has been achieved. The use of hybrid methodologies allows the study to be carried out according to the research objectives.

4.4. Managerial Contribution

From an organizational management perspective, the study facilitates decision-making at two levels. The development stages of different countries have been mapped through different indicators, both at the individual and aggregate level. Businessmen can use this information to develop their expansion strategies in the countries whose development levels best match their characteristics. In a complementary way, the concerns and preferences of consumers have been studied in depth, which is fundamental for organizations to design their products and services. In addition, various activities in their value chain, such as post-sales activities, can be refined. This contribution is essential for making future investments efficiently, which can provide competitive advantages at a global level.

The importance for consumers of the processing of private data and the security of their transactions should be underlined. On a second level, particular attention should be paid to the management of costs associated with deliveries or transparency in pricing. However, consumers do not express concern about the extension of delivery times, possibly due to a greater understanding of the situation generated by the pandemic.

The results also enable governments to design infrastructure and regulatory policies to provide technological support and legal protection for the development of online commerce. It should be considered that certain actions should be carried out at the European or global level. E-business involves overcoming physical and geographic barriers, so new regulations are required to provide guarantees to companies and consumers in different countries. The European Union can provide a frame of reference in this respect.

5. Conclusions

Mobility restrictions and social distancing have been the main tools that governments have used to combat the Covid-19 pandemic. This situation has led to an accelerated implementation of e-commerce that requires a new approach for both governments and the business environment.

The new situation needs to be studied from different perspectives. At the governmental level, it is crucial to know the level of development of e-commerce in different countries in relation to their counterparts in a European context. Establishing comparisons between countries would allow the different European organizations to apply policies to promote the least developed areas. At the business level, it is essential to understand the demands and concerns of consumers in their use of e-commerce from an overall perspective.

Regardless of the pandemic period, e-commerce is now a new reality that must be confronted, and companies that fail to grasp this challenge will risk not gaining potential market share. However, this cannot lead to a maximization of production because it does

not optimize the balance between eco-systems. The productive system, even after traumatic events, can react better when it has a greater number of sales channels and a number of shared and non-dedicated resources.

The results of the analysis provide a clear answer to the research questions behind this study. In particular, in response to RQ1, a different behavior of European countries toward the issue of cyber-security emerges. Based on the scenarios considered, The Netherlands, Sweden and Denmark can be considered virtuous, while Austria, Poland, Portugal, Greece, Cyprus, Bulgaria and Romania are in a less performing situation. This shows that, compared to the target values proposed by Eurostat, countries have very different perceptions of the e-commerce experience. Finally, in response to RQ2, the results make it very clear that the big challenge for e-commerce after the pandemic period is to include cyber-security and sustainability in its processes, because this is what European citizens and consumers are asking for. A more efficient and secure supply and delivery chain not only helps to reduce the environmental impact, but also makes the system more resilient. A resilient supply chain can only become a factor of competitive advantage for operators that can communicate in a more transparent way to their customers a real value proposition.

This study also has some limitations that may be resolved through further research:

- The Eurostat database provides a powerful tool for the analysis of time series. However, despite the detailed process of data mining and validation, the dataset is only partially complete for the aims of this study. The lack of data for Italy and France, which are important European countries where e-commerce plays an important role in purchasing processes, represents a limitation.
- The set of questions proposed to the experts allowed us to explore some aspects related to the problems and barriers that characterize Internet purchases, but it is necessary to move from a macro to a micro analysis considering different sectors in order to obtain more specific data.
- The results of the analysis are stakeholder-dependent because consumer behaviors varies significantly depending on the socio-cultural segment to which they belong.

E-commerce is set to grow, and this puts pressure on policy makers to favor choices that balance growth with sustainability.

References

1. Calzada, J.; Tselekounis, M. Net Neutrality in a hyperlinked Internet economy. *Int. J. Ind. Organ.* **2018**, *59*, 190–221. [CrossRef]
2. Treiblmaier, H.; Mirkovski, K.; Lowry, P.B.; Zacharia, Z.G. The physical internet as a new supply chain paradigm: A systematic literature review and a comprehensive framework. *Int. J. Logist. Manag.* **2020**, *31*, 239–287. [CrossRef]
3. Etemadi, N.; Van Gelder, P.; Strozzi, F. An ISM Modeling of Barriers for Blockchain/Distributed Ledger Technology Adoption in Supply Chains towards Cybersecurity. *Sustainability* **2021**, *13*, 4672. [CrossRef]
4. Dupont, B.; Lusthaus, J. Countering Distrust in Illicit Online Networks: The Dispute Resolution Strategies of Cybercriminals. *Soc. Sci. Comput. Rev.* **2021**. [CrossRef]
5. Benz, M.; Chatterjee, D. Calculated risk? A cybersecurity evaluation tool for SMEs. *Bus. Horiz.* **2020**, *63*, 531–540. [CrossRef]

6.   Girsang, M.J.; Candiwan; Hendayani, R.; Ganesan, Y. Can Information Security, Privacy and Satisfaction Influence The E-Commerce Consumer Trust? In Proceedings of the 2020 8th International Conference on Information and Communication Technology (ICoICT), Yogyakarta, Indonesia, 24–26 June 2020; pp. 1–7.

7.   D'Adamo, I.; Lupi, G. Sustainability and Resilience after COVID-19: A Circular Premium in the Fashion Industry. *Sustainability* **2021**, *13*, 1861. [CrossRef]

8.   D'Adamo, I.; Rosa, P. How do you see infrastructure? Green energy to provide economic growth after COVID-19. *Sustainability* **2020**, *12*, 4738. [CrossRef]

9.   Miceli, A.; Hagen, B.; Riccardi, M.P.; Sotti, F.; Settembre-Blundo, D. Thriving, Not Just Surviving in Changing Times: How Sustainability, Agility and Digitalization Intertwine with Organizational Resilience. *Sustainability* **2021**, *13*, 2052. [CrossRef]

10.   D'Adamo, I.; Falcone, P.M.; Martin, M.; Rosa, P. A sustainable revolution: Let's go sustainable to get our globe cleaner. *Sustainability* **2020**, *12*, 4387. [CrossRef]

11.   Keenan, J.M. COVID, resilience, and the built environment. *Environ. Syst. Decis.* **2020**, *40*, 216–221. [CrossRef]

12.   Huertas-Valdivia, I.; Ferrari, A.M.; Settembre-Blundo, D.; García-Muiña, F.E. Social Life-Cycle Assessment: A Review by Bibliometric Analysis. *Sustainability* **2020**, *12*, 6211. [CrossRef]

13.   Amicarelli, V.; Tricase, C.; Spada, A.; Bux, C. Households' Food Waste Behavior at Local Scale: A Cluster Analysis after the COVID-19 Lockdown. *Sustainability* **2021**, *13*, 3283. [CrossRef]

14.   Grewal, D.; Gauri, D.K.; Roggeveen, A.L.; Sethuraman, R. Strategizing Retailing in the New Technology Era. *J. Retail.* **2021**, *97*, 6–12. [CrossRef]

15.   Lallie, H.S.; Shepherd, L.A.; Nurse, J.R.C.; Erola, A.; Epiphaniou, G.; Maple, C.; Bellekens, X. Cyber security in the age of COVID-19: A timeline and analysis of cyber-crime and cyber-attacks during the pandemic. *Comput. Secur.* **2021**, *105*, 102248. [CrossRef]

16.   Villa, R.; Monzón, A. Mobility Restrictions and E-Commerce: Holistic Balance in Madrid Centre during COVID-19 Lockdown. *Economies* **2021**, *9*, 57. [CrossRef]

17.   Salesforce Salesforce Shopping Index Q1 2021. Available online: https://public.tableau.com/profile/salesforcecommercecloud#!/vizhome/SalesforceShoppingIndex/SalesforceShoppingIndex (accessed on 7 May 2021).

18.   Aggarwal, A.; Rahul, M. The effect of perceived security on consumer purchase intensions in electronic commerce. *Int. J. Public Sect. Perform. Manag.* **2018**, *4*, 1–20. [CrossRef]

19.   Valdez-Juárez, L.E.; Gallardo-Vázquez, D.; Ramos-Escobar, E.A. Online Buyers and Open Innovation: Security, Experience, and Satisfaction. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 37. [CrossRef]

20.   Tran, L.T.T. Managing the effectiveness of e-commerce platforms in a pandemic. *J. Retail. Consum. Serv.* **2021**, *58*, 102287. [CrossRef]

21.   Hallikainen, H.; Laukkanen, T. Trustworthiness in e-commerce: A replication study of competing measures. *J. Bus. Res.* **2021**, *126*, 644–653. [CrossRef]

22.   Jiang, Y.; Lai, P.; Chang, C.-H.; Yuen, K.F.; Li, S.; Wang, X. Sustainable Management for Fresh Food E-Commerce Logistics Services. *Sustainability* **2021**, *13*, 3456. [CrossRef]

23.   Kleisiari, C.; Duquenne, M.-N.; Vlontzos, G. E-Commerce in the Retail Chain Store Market: An Alternative or a Main Trend? *Sustainability* **2021**, *13*, 4392. [CrossRef]

24.   Wang, J.; Gao, X.; Wang, Z. Sustainable Supply Chain Decisions under E-Commerce Platform Marketplace with Competition. *Sustainability* **2021**, *13*, 4162. [CrossRef]

25.   D'Adamo, I.; Gastaldi, M.; Rosa, P. Assessing Environmental and Energetic Indexes in 27 European Countries. *Int. J. Energy Econ. Policy* **2021**, *11*, 417–423. [CrossRef]

26.   Ferrari, A.M.; Volpi, L.; Settembre-Blundo, D.; García-Muiña, F.E. Dynamic life cycle assessment (LCA) integrating life cycle inventory (LCI) and Enterprise resource planning (ERP) in an industry 4.0 environment. *J. Clean. Prod.* **2021**, *286*, 125314. [CrossRef]

27.   Vila, T.D.; González, E.A.; Vila, N.A.; Brea, J.A. Indicators of Website Features in the User Experience of E-Tourism Search and Metasearch Engines. *J. Theor. Appl. Electron. Commer. Res.* **2021**, *16*, 18–36. [CrossRef]

28.   Marović, I.; Perić, M.; Hanak, T. A Multi-Criteria Decision Support Concept for Selecting the Optimal Contractor. *Appl. Sci.* **2021**, *11*, 1660. [CrossRef]

29.   Crecente, F.; Sarabia, M.; del Val, M.T. Sustainable Entrepreneurship in the 2030 Horizon. *Sustainability* **2021**, *13*, 909. [CrossRef]

30.   Ronzon, T.; Piotrowski, S.; Tamosiunas, S.; Dammer, L.; Carus, M.; M'barek, R. Developments of economic growth and employment in bioeconomy sectors across the EU. *Sustainability* **2020**, *12*, 4507. [CrossRef]

31.   Castillo-Giménez, J.; Montañés, A.; Picazo-Tadeo, A.J. Performance and convergence in municipal waste treatment in the European Union. *Waste Manag.* **2019**, *85*, 222–231. [CrossRef]

32.   Gompf, K.; Traverso, M.; Hetterich, J. Using Analytical Hierarchy Process (AHP) to Introduce Weights to Social Life Cycle Assessment of Mobility Services. *Sustainability* **2021**, *13*, 1258. [CrossRef]

33.   Koliouska, C.; Andreopoulou, Z. A Multicriteria Approach for Assessing the Impact of ICT on EU Sustainable Regional Policy. *Sustainability* **2020**, *12*, 4869. [CrossRef]

34.   Al-Qawasmi, J. Selecting a Contextualized Set of Urban Quality of Life Indicators: Results of a Delphi Consensus Procedure. *Sustainability* **2021**, *13*, 4945. [CrossRef]

35. Caruso, G.; Fortuna, F. Mediterranean diet Patterns in the Italian Population: A functional data analysis of Google Trends. In *Decisions and Trends in Social Systems, Innovative and Integrated Approaches of Care Services*; Springer: Cham, Switzerland, 2020; pp. 1–10.
36. Brudermann, T.; Mitterhuber, C.; Posch, A. Agricultural biogas plants—A systematic analysis of strengths, weaknesses, opportunities and threats. *Energy Policy* **2015**, *76*, 107–111. [CrossRef]
37. Falcone, P.M.; Imbert, E. Social life cycle approach as a tool for promoting the market uptake of bio-based products from a consumer perspective. *Sustainability* **2018**, *10*, 1031. [CrossRef]
38. Czeczotko, M.; Górska-Warsewicz, H.; Laskowski, W. Towards Sustainable Private Labels—What is the Consumer Behavior Relating to Private Labels in the UK and Poland? *Sustainability* **2020**, *12*, 6035. [CrossRef]
39. D'Adamo, I.; Gastaldi, M.; Rosa, P. Recycling of end-of-life vehicles: Assessing trends and performances in Europe. *Technol. Forecast. Soc. Chang.* **2020**, *152*, 119887. [CrossRef]