

Article

Sustainable Business Models—Crisis and Rebound Based on Hungarian Research Experience

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Abstract: Sustainable business models can help us move beyond the current consumer society and integrate sustainability into our lifestyles. The COVID-19 crisis was a strong test of sustainability for these models. In our study, we assessed which business models are highly dependent on the economic cycle and are highly embedded in consumer society. We conducted our research at the height of the second wave of the pandemic and asked university students about changes in their consumption patterns and their expectations for the future. We carried out cluster analysis on our sample of 622 respondents. We were interested in the extent to which participation in certain business models could be associated with the rebound effect that could be predicted after the epidemic. The stronger this effect, the more embedded a sustainable business model is in consumer society and the less able it is to reduce its environmental impacts in the long term. We found that resource efficiency, the sharing economy, and digitalization fall into this category. Participation in sufficiency and stewardship-based business models predicted much less rebound impact. These models showed more clearly the sustainability characteristics of sustainable business models.

Keywords: sustainable business models; COVID-19; rebound effect

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1. Introduction

Since the sustainability challenge [1,2] is obvious for an increasing part of the society—including policy makers and consumers—there is an increasing variety of business models (BMs) intending to address this [3]. Sustainable business models (SBMs) are diverse; some of them are only facelifting mainstream ones, while others follow a more radical approach. Some of them get widely spread faster, while others remain in the lab phase [4].

This proliferation of SBMs was hit by the COVID-19 crisis starting early 2020, totally reshaping the scene [5]. Some SBMs (related to frugality or the amateur economy at times of lockdowns) had a stronger momentum and may have had positive environmental and social impacts in the short run, while others (for example related to the sharing economy in the field of mobility [6]) were hit heavily. The overall impact of the COVID-19 crisis on sustainability and SBMs is still unclear. A further question is whether the potential sustainability benefits related to the crisis can be maintained or are they subjects of partial or total rebound. (For example, when lockdowns and restrictions are totally over, will SBMs lose their attractiveness?)

This paper intends to contribute to the better understanding of how SBMs were impacted by the COVID-19 crisis and whether these impacts are expected to be maintained in the longer run.

The structure of this paper is as follows: Section 2 provides a review of the concept of SBMs and how these were impacted by the COVID-19 crisis and can be the subjects of the rebound effect after it. Section 3 introduces the empirical survey of consumers

measuring the changes of acceptance of different SBMs during the pandemic and their expectations afterwards. Section 4 summarizes and discusses the results, while Section 5 concludes.

2. Literature Review

2.1. The Concept of Sustainable Business Models

There are many examples of the formulation of BMs in prior literature, a good overview of which is provided by Bocken et al. and Bocken and Short [3,4]. They describe BMs as tools that, in addition to helping us understand how a company works, can be used for analysis, comparison, benchmarking, management, communication, and innovation; it can also be used to understand how a company defines its competitive strategy through the provision of a product or service to the market, how it determines its price and costs, how it differentiates itself from other companies, and how it integrates its own value chain into a value network [3]. One of the most frequently used definitions of a BM was provided by Teece, who defined BMs as "... the design or architecture of the value creation, delivery and capture mechanisms employed" (p.179). Teece's main conclusion is that if a business model is to provide a competitive advantage, it must meet the specific needs of customers. The design and implementation of a good business model, according to his concept, involves an assessment of internal factors, as well as external factors, relating to customers or suppliers and the wider business environment [7].

The BMs can be interpreted in five dimensions: transaction mechanisms, interchangeable objects, activities, actors, and governance settings. The new market configurations are now derived from user data collection and analysis. The ability to acquire and retain customers is no longer the result of a good business model; it is through this that the viabilities of the BMs are assessed. BMs offer a key conceptual advance in the classical management approach to explaining how a firm creates and uses value. One of the most important advances is the idea that the BM is a system of activities that crosses firm boundaries [8]. Schaltegger et al. identified the role of business model innovations as key to the sustainability transition [9]. BMs were classified by Bocken and Short into two broad categories: sustainable (SBMs) and unsustainable business models [4].

In line with the original framework of eight archetypes of sustainable business models [3], the extended model classifies archetypes according to the main types of innovation: technological, social, and organizational. In addition, an 'inclusive value creation' archetype is added, reflecting the increasing number of peer-to-peer and sharing models [10]. In SBM research, there is an increased emphasis on the investigation of circular models [11]. The concept of SBMs focuses on social and ecological value rather than economic value [3]. Lüdecke-Freund et al. proposed the synthesis and classification of patterns for SBM types based on the classification of 45 SBM patterns. These patterns were classified into 11 groups along the ecological, social, and economic dimensions of sustainability and examined for their contribution to value creation [12].

Alonso-Martinez et al. provided empirical evidence and a critical assessment of the relationship between SBMs and sustainability performance. Their study concluded that not all SBMs provide high sustainability performance and identifies the importance of sustainability as an integrated concept [13]. Lozano also proposed a more holistic, systemic approach and a definition of more sustainable business models, integrating organizational approaches, enterprise systems, stakeholders, and sustainability dimensions [14].

In the next section, following the threefold division of Bocken et al. [3], we examine the impact of COVID-19 on SBMs.

2.2. Sustainable Business Models during and after the COVID-19 Crisis

2.2.1. Technological Models

One might think that the COVID-19 crisis has diverted attention from other major problems, such as the climate crisis. Research suggests that the opposite has happened in many cases. The COVID-19 crisis has underscored and highlighted concerns about climate change and may even lead to a change in values that could reinforce the case for sustainable business models.

The COVID-19 crisis has brought the biggest changes to social models, but it has also affected the economic conditions of technology-related business models. Tchetchik et al. [15] found that low-intensity recyclers increased their recycling rate. Consumption rates also fell, which many want to maintain after the crisis. Richert et al. [16] found that waste disposal, as well as waste collection, increased during the pandemic. This can be attributable to the increased amount of time spent at home. These results show that crisis can play a significant role in achieving behavior change by triggering threat perception and coping strategies that are predisposed to behavior change. Sustainable business models are seen by some as a way out of the crises-triggered recession. Karakosta et al. [17] showed that investments in energy efficiency and renewable resources can help tackle the consequences of the crisis.

In some cases, COVID-19 had controversial effects on sustainability perspectives. According to Qi et al. [18], the COVID-19 crisis increased consumers' intentions to buy sustainable food, while the gap between intentions and behaviors was widening due to issues of unavailability, price, and panic related to food. Ferregina and Zola [19] found that most of the society wants to see an increase in social spending, and the crisis narratives that support austerity do not necessarily match the general perception. The results of an online study by Kesenheimer, and Greitemeyer [20] with 370 participants showed that materialistic values decreased during the lockdown. In contrast, the number of pro-environmental actions decreased during the lockdown and then increased back to baseline levels after the restrictions were eased.

Harmful emissions levels fell as an environmental gift effect of the crisis. However, Davis et al. [21] detected an emission rebound after the lockdown. Zaman et al. [22] also expected a rebound in terms of energy consumption. Most consumer studies looked at consumer behavior during the COVID-19 period without asking about changes in consumer perceptions compared to the pre-crisis period. They also did not ask about the extent to which consumers plan to compensate, and possibly overcompensate, for their consumptions lost during the crisis.

As can be seen, there has been some scattered literature on the impact of the crisis on some sustainable business models, but no study has yet been carried out that provides a comprehensive analysis of the impacts on all the archetypes of business models. There has also been no comprehensive study on the relationship of business models to the rebound effect; to what extent do consumers want to compensate for reduced consumption under COVID-19? Which types of sustainable business models can strengthen or weaken and associate positively or negatively with rebound effects? In our research, we tried to fill these research gaps.

2.2.2. Social Model

Human health and ethical issues are becoming increasingly important in the context of the pandemic. The use and spread of plant-based diets, insect-based foods, and farmed meat should be further promoted to reduce epidemic risks and ensure a sustainable future. In addition, farmed meat has many additional benefits in terms of environmental impact, ethical issues, and food safety [23]. de Medeiros et al. [24] identified consumers' emotions about the adoption of user-oriented product-service systems (PSS) and the impact of COVID-19 on such emotions using pre- and post-global warming samples. Results showed that positive emotions were generally more strongly associated with the process

of adopting user-oriented PSS. It was found that consumers shifted from positive to more negative emotions during the pandemic.

Among social models, a large amount of literature examines the relationship between COVID-19 and the sharing economy. The pandemic is forcing the sharing economy (SE) sector to recalibrate. COVID-19 has forced companies and service providers to think differently about their services, and many are developing strategies to mitigate the effects of COVID-19 [25]. The main short-term impacts of the pandemic on the sharing economy are loss of revenue, the need to adapt, loss of interest, and changes in the relationship between platforms and service providers [26].

Significant short-term changes:

- There has been a significant decrease in international tourism, which has caused strong feedback in the short-term AirBnB accommodation sharing [25].
- As sharing economy platforms operate outside the formal economy, providers of these platforms experienced a lack of support from governments during COVID-19 [27].
- Providers are paying more attention to pandemic hygiene regulations [25,27]; this has manifested itself in fashion sharing websites, which have been equipped with specialized laundry management systems [28].
- Social distancing during the pandemic has led to a significant decrease in the use of shared mobility modes, including private and shared ridesharing and the actual use of transport compared to pre-pandemic use [29].
- COVID-19 has provided a much-needed impetus to trial micro-mobility (scooters, bicycles, and e-scooters) services [30,31], although the directions and reasons for use have changed [32].

Expected rebound:

- Airbnb is focused on long-term stays, and the demand for this has increased recently. People are increasingly looking for holiday rentals closer to home. More long-term renters will mean less noise and more local businesses [25]. Shared accommodation is likely to gain a competitive advantage over the hotel industry if travel restrictions are lifted. As consumers become more mindful of their spending, businesses offering convenience and cheaper alternatives are likely to flourish [33].
- Governments may force sharing platforms to treat contractors (service providers) as employees so that they do not suffer financially in times of crisis [25].
- The use of shared mobility is expected to increase, but not to return fully, to previous levels [29]. People who are unemployed are the most likely to increase their use of bike-sharing. Unemployed people may limit their use of cars or public transport because of the cost and may have more time to cycle [31].
- Food and other delivery services are likely to remain popular in the wake of COVID-19, and although the industry is already moving in this direction, the pandemic could lead to increased automation in the form of self-driving cars and drone delivery. These services do not require personal interaction, although such a transition will destabilize the already precarious relationship between platforms and users [33].

2.2.3. Organizational Models

Ratten [34] integrated transformational entrepreneurship theory with digital platform theory. According to her findings, digital platforms played an important role in keeping farmers connected and increasing the competitiveness of their businesses. Farhoud et al. [35] found that community financing of social enterprises played an important role during the pandemic. They hypothesized that this role will be strengthened and that social enterprises will play a significant role in moving towards a more sustainable post-pandemic future. They expect this sector to be a key player in emergency preparedness and recovery, and crowdfunding is an important support for social enterprises. During the pandemic, the growing phenomenon of crowdfunding for healthcare created new

roles for members of the public as fundraisers and donors of some forms of care. Steward et al.'s (2022) [36] study suggested that the significant success of community funding in this area may reassess the perception of the solution in the health field. Snyder et al. (2022) [37] distinguished three types of crowdfunding campaigns to mitigate the effects of COVID-19. More than a third of the 'utopian' campaigners sought to fund research into vaccine development and other medical interventions. More than half of the "cautious" campaigners sought social funding. The "sceptic" campaigners advocated research into COVID-19 treatments as an alternative to vaccines.

Yip et al. [38], examining eight archetypes of sustainable business models for banks, identified the "digital process substitution" type as one of the technology models. In this model, digital processes replaced traditional, paper-intensive banking services. In the context of the pandemic, the relationship between digitalization and business models became a popular topic for researchers. Prior to the emergence of COVID-19, the challenges of digital transformation were essentially focused on the fourth industrial revolution, linked to the concepts of Industry 4.0, Internet of Things (IoT), and Web 4.0. In the era of COVID-19, the involvement of the whole organization and stakeholders in the process became essential [39].

The study by Priyono et al. [40] found that the transformation path towards digital firms is unique for each individual firm, despite the existence of general strategies at a high level. One of the most pronounced digitalization effects of the COVID-19 pandemic has been the significant increase in the use of digital, information, and communication technologies (ICT) and consequently, in teleworking [41]. Kanda and Kivimaa [42], in examining the long-term consequences of the COVID-19 epidemic, found that more permanent changes are likely to be triggered by the digitalization of work and other everyday activities, thereby reducing mobility needs and overall fossil energy consumption. According to research by Ratten [34], the COVID-19 crisis led to digital platforms being used for a variety of business purposes, including social and community purposes. A summary of the impacts is shown in Table 1.

Table 1. COVID-19 impacts and expected rebound.

SBM Model	COVID Impact	Expected Rebound	References
Energy efficiency	+	yes, [21,22]	[17]
Circular economy	+, increased recycling rate	?	[15,16]
Renewable energy	?	?	
Sharing economy	-/+	yes	[25]
Stewardship	?		[18]
Austerity	+, Consumption rates have fallen	yes	[15] [20]
Values	+	?	
Scale-up	+ digitalisation	?	[43]
PSS	–	?	[24]
consumer health	+	+	[23]
Digitalization	+	+	[42]
Social enterprise	+	+	[35]
crowdfunding	+	+	[36]

3. Methodology and Research Design

The question of our research is: To what extent can we expect a rebound effect in consumption after the crisis that could offset the results achieved with sustainable business models? Can these rebound effects be linked to certain types of business models?

Our survey was conducted during the second wave of the COVID-19 epidemic. By this time, we had already passed the first wave of strict quarantine and curfew. However, several restrictions were in place.

The following measures were in place during the second wave:

- Nightly curfew from 8 p.m. to 5 a.m.
 - Restaurants were only allowed to serve takeaway.
 - Shops were allowed to stay open until 7 pm, and hotels were only allowed to receive business guests.
 - All events were banned, and universities and secondary schools were taught online.
- Our target group was students, who were the most affected by the change. Their consumption patterns, influenced by many of the impacts, have long-term impacts on their ecological footprints.

Due to their age-specific characteristics, university students were one of the groups most vulnerable to these changes. They found it impossible to have fun in the evenings, to study in person, or to travel. The consumption habits of students changed radically, but it was also possible to observe the types of changes they were most willing to make and the ones they would most like to re-establish soon after the crisis.

We designed a 55-question questionnaire to assess how much their participation in sustainable business models, either as consumers or employees, had changed because of the crisis. Responses were asked on a five-point Likert scale; the scale consisted of 'much less' (−2), 'less' (−1), 'similar' (0), 'more' (1) and 'much more' (2). A pilot survey preceded the live survey, with 30 students and 3 researchers testing the questionnaire. The actual survey took place in November 2020, which was the peak of the 2nd COVID-19 wave. The time available for completion was one week, and the survey was conducted online. Due to the epidemic, the possibility of a face-to-face survey was not considered.

After data cleaning, 622 responses were suitable for further analysis. The distribution of the sample was as follows:

- 378 women (61%), 244 men (39%);
- Budapest: 124 (20%), outside Budapest: 498 (80%);
- Education level: undergraduate 429 (69%), master 53, (8%), postgraduate 140 (23%);

In the analysis, we first identified behavioral variables associated with SBM based on the archetypes of Bocken et al. [3]. We then analyzed future expectations, with a particular focus on whether a rebound effect can be expected in a post-COVID-19 world. We hypothesized that changes in different archetypes would not be equally associated with the expected rebound effect. To explore the structures of the changes, we performed a cluster analysis. The questionnaire included several questions on different types of rebound effects: the extent to which the interviewees intended to resume their previous travel habits, purchases, or material consumptions in general after the crisis. The answers to this question and the changes in the Bocken archetypes were clustered. We used the K-means clustering method, which is a kind of partitioning type of clustering method. It is based on an unsupervised machine learning algorithm. K-means clustering is applicable for large datasets and is easy to implement and interpret. We also tested other clustering methods to test the reliability of our results. We also screened our data for outliers, as the method is sensitive to outliers.

In the next section, we first identify SBM-related behavioral changes because of the crisis. Then, the future expectations are analyzed, with a special focus on whether there will be a rebound effect to be expected in the post-COVID-19 world. This can suggest which sustainable business models are, in fact, less sustainable and very much driven by the economic conjuncture.

4. Results

Technological SBMs assume the less active role of consumers, whose involvements are mainly related to purchasing technological solutions. The shift towards greater

efficiency and energy saving has intensified. Students reported an increase in interest in making energy-efficiency improvements to their homes and buying more durable products. We assumed that the crisis would also have increased interest in making sufficiency-supporting technology investments, such as solar panels or electric cars. However, this was not the case, as few of the students lived in their own households and had control over such decisions.

Social business models require action on behalf of consumers that goes beyond purchasing a more innovative product. They require collaboration between consumers and companies. The required action includes some level of change in consumption habits as well. Thus, the role of consumers is greater in this area.

The results showed that opting for functionality rather than ownership, and especially the sharing economy, is the big loser of the crisis in the short term. Respondents had turned away from using public and shared transportation. Driving, but also biking and walking, had become more widespread. After the crisis, it will be a significant challenge for people to get used to public transport again, which permits less personal space.

In relationship to stewardship, respondents appeared to have become neither more nor less environmentally conscious. This is good news. In a crisis, there is a danger that self-sufficiency and self-interest could also override environmental values.

Sufficiency-related activities, such as maintaining and renovating apartments, making energy-efficiency investments, or buying durable products, became more popular. Using 'old-fashioned' methods or do-it-yourself techniques, however, became popular only with a limited number of students.

Most changes related to the acceptance of SBMs happened within the domain of value systems. The widespread adoption of organizational business models requires consumers to change their values, for example, valuing food more, simplifying, localizing, and avoiding wastage, learning to enjoy time spent at home, etc. These changes are more fundamental than those required by social business models. Even stewardship can be practiced within mainstream consumer society. Value changes that go beyond those that are typical of consumer society are associated with this model.

Organizational models are also associated with the mainstreaming of sustainable business models. One major emerging scalable solution is digitalization. The crisis has strengthened this trend and helped mainstream it into areas with consumer groups where it was less common. For example, home deliveries, the home office, and online education were adopted generally. As digitalization can reduce day-to-day mobility, the sustainability impacts are significant (Figure 1).

Technological				Social				Organizational			
Variable	N	Adj. Mean	Std. Dev.	Variable	N	Adj. Mean	Std. Dev.	Variable	N	Adj. Mean	Std. Dev.
T.1. Material and energy efficiency				S.1. Functionality rather than ownership				O.1. Repurpose (change in values)			
1. I strive to buy energy-saving products.	594	0.34	0.642	17. I try to travel more by public transport.	601	-0.60	1.120	8. I try to buy packaged products as they are safer.	584	0.23	0.957
4. I consider energy efficiency improvements of my home to be important.	562	0.53	0.803	19. I try to drive more by car.	574	0.40	1.048	18. I try to walk or ride a bike more.	603	0.57	1.006
5. I can usually avoid wasting things.	616	0.70	0.895	21. Instead of owning objects, I am satisfied with their use (e.g., borrowing, lending, sharing).	540	-0.28	0.844	31. I try to lead a simple life.	598	0.46	0.767
6. I can keep the energy consumption of my household low.	595	0.00	0.874	22. I usually use a car-sharing service.	271	-0.85	1.114	32. I try to reduce my material consumption.	603	0.68	0.792
7. If I were to buy a vehicle, I would consider environmental aspects to be of key importance.	569	0.33	0.911	23. I usually use a car-pooling service.	285	-0.89	1.031	33. I consider it important to always dress in the latest fashion.	566	-0.44	0.876
28. I try to buy durable products.	609	0.76	0.797	24. I usually use a bicycle-sharing service.	288	-0.87	1.038	34. I value food, I avoid food waste.	617	0.81	0.819
T.2. Circular economy				S.2. Stewardship				35. I try to spend more time with my family members and friends.	617	0.84	0.971
10. I try to renovate and repair my belongings.	597	0.45	0.804	25. I consider it important that the items I procure come from an ethical / socially responsible source.	580	0.26	0.719	37. I travel little for pleasure.	574	0.36	1.246
11. I try to maintain and renovate my apartment (or residence).	579	0.67	0.830	26. I try to get to know about the environmental / social impacts of my purchases.	584	0.28	0.786	38. I try to buy local products (e.g., food).	598	0.43	0.735
13. I am used to buying used products.	541	-0.03	0.945	27. I consider it important that my consumption patterns do not harm biodiversity.	579	0.41	0.696	39. I try to buy domestic products.	601	0.51	0.768
14. I try to find new owners for my worn-out things.	555	0.34	0.885	36. I often help my elderly or needy relatives.	603	0.72	0.862	46. I do voluntary / non-profit activities.	281	-0.46	0.971
				48. When I work, I consider the social usefulness of the activity to be important, in addition to income.	457	0.36	0.757	49. I have a new domestic hobby.	557	0.64	0.915
				50. I pay attention when something is advertised.	566	-0.14	0.889				
T.3. Renewable energy, natural processes				S.3. Sufficiency (reduced consumption, reduced throughput, traditional techniques, intermediate technology)				O.2. Scale-up solutions (digitalization)			
2. I strive to buy certified eco-friendly products.	598	0.41	0.690	12. I have postponed investments because I realized I can still use my old stuff.	579	0.36	0.839	9. I do what I can online.	615	1.21	0.830
3. I strive to buy non-packaged products.	576	0.11	0.905	15. I accumulate a lot, so a lot of things go to waste.	510	-0.40	0.823	40. It is typical that I study at home (even at a temporary residence).	616	1.29	0.826
20. I consider it important that my household/ residence has solar panels.	454	0.08	0.919	16. I am more careful with buying or giving away used things.	555	0.10	0.854	41. It is typical that I study online.	620	1.45	0.795
				29. I try to continue using my items and only replace them when absolutely necessary.	619	0.75	0.801	42. My learning activity is characterized by efficiency.	619	0.24	0.971
				30. I try to use hand-made products.	527	0.13	0.861	43. It is typical that I work from home (even from a temporary residence).	323	0.34	1.202
				47. I consider it important to revive old techniques.	543	0.62	0.901	44. It is typical that I work online.	287	0.15	1.313
								45. My work is characterized by efficiency.	375	0.43	0.902
								51. I find it important to share my lifestyle ideas with others.	565	0.28	0.795
								52. I prefer to shop online (rather than physically).	600	0.73	0.971
								53. I usually use a home delivery service.	597	0.90	0.876
								54. I consider distance learning to be advantageous.	615	-0.06	1.321
								55. I consider digitalization to be important.	616	0.98	0.901

Figure 1. Transformation of consumer acceptance of SBMs based on Bocken et al.'s [3] model between the peak of wave 2 (November 2020) and the pre-COVID-19 period (February 2020).

Beyond the quantitative variables, we also recorded respondents' responses in a qualitative manner and recoded their answers into categories (Table 2). The answers underlined the results of the quantitative analysis.

Table 2. Changes in the lifestyles of consumers in different areas (based on responses to an open-ended question).

Categories	No. of Responses	% of Responses	Typical Answers
Less travel	19	3	more frequent walking more frequent bicycle traffic less often use public transport I will not make unnecessary trips
Local product	14	2	purchase of numerous domestic products

			I try to get most things from domestic small producers/businesses
			environment conscious shopping
			energy saving/efficiency
			repairing things at home instead of buying new ones
Pay more attention to my environment	43	7	low-packing lifestyle
			repairing items
			buying used things
			prepare homemade cleaning items
			saving money
A more frugal, conscious, regular lifestyle	169	27	more frugal lifestyle
			more conscious shopping
			buy fewer clothes
			reducing food overconsumption
			shopping for longer term
			me time
New hobbies	87	14	cooking
			baking bread
			garden work
Hygiene	123	20	hand washing
			hand disinfection
Extra time for others	104	17	spend more time with my family
			quality time
Maintaining Physical distance	25	4	prevent overcrowding
			More exercise
Sports, outdoor activities	93	15	regular training
			playing sports at home
			regular walking
Healthy nutritioin	36	6	healthy eating
			vitamins
			food delivery
Online shopping, home delivery	73	12	card payment
			shopping in webshops
			home office
Online or home study, work	46	7	more effective learning
			Distance learning
			slower life
			more patience
			paying attention to others
Values	102	16	disciplined life
			continuous learning
			kindness
sum	934		

One further main question of this research was how lasting the changes in consumption habits would be as the crisis deescalates. Is there a partial or total rebound effect in terms of the acceptance of SBMs to be expected? The expectations of respondents in this regard are summarized (Table 3).

Table 3. Expectations of respondents related to the post-COVID-19 period.

After the COVID Period	Not at All	Rather Not	Rather Yes	Totally	More Than before (Rebound)	Do Not Know	N
1. I will make up for my deferred purchases	185	232	118	23	1	62	621
2. I will make up for my postponed travel/trips	48	68	222	192	64	27	621

3. I will make up for everything I missed in terms of my material consumption	140	270	115	31	4	61	621
4. I want to maintain my more frugal lifestyle in the long run.	8	32	254	266	32	29	621

The respondents expected a small degree of catching up (or rebound) after the recovery by making up for reduced or postponed purchases, as well as material consumption. It is difficult to say how realistic these expectations are. We also identified a strong desire to make up for travelling that was canceled during the COVID-19 period. This warns us that without proper policy and educational measures, short-term environmental gains may evaporate rapidly after the lockdowns. The respondents also expected to maintain a more frugal lifestyle in the long term.

Although the rebound effect may seem to be minor in general related to the different SBM archetypes after the COVID-19 crisis, in specific cases, it can be significant. To better understand this phenomenon, we carried out a cluster analysis.

As there were too many variables related to the acceptance of different types of SBMs, we created mean variables for the eight different SBM archetypes (by calculating the average values of the adjusted means of variables belonging to the respective archetypes [3]). Then we classified these eight SBM acceptance-related variables pairwise with the variables related to the post-COVID-19 expectations (Figure 1). We used the K-means clustering method with four clusters. The F-test values of the ANOVA (<0.001 in each case) showed that the sample was suitable to use with this method.

In this way we had altogether 32 classifications (eight mean variables for the SBM archetypes * four variables for future expectations). Then, we took one cluster for each case with the highest center value regarding the acceptance of the respective SBM archetype (including the most open respondents towards that archetype) and investigated the future expectations of respondents only within these clusters. Table 4 summarizes the results.

Table 4. Possible rebound effect among respondents mostly open for SBMs of different archetypes.

átlagok	N *	1. Make-Up for Deferred Purchases		N*	2. Make-Up for Postponed Trips		N*	3. Make-Up for Material Consumption		N*	4. Maintainance of Frugal Lifestyles	
		partial rebound (rather yes)—%	total rebound or backfire —%		partial rebound (rather yes)—%	total rebound or backfire —%		partial rebound (rather yes)—%	total rebound or backfire —%		partial rebound (rather yes)—%	total rebound or backfire —%
T1—Resource efficiency	117	80.3%	19.7%	83	2.4%	97.6%	282	0.0%	0.0%	109	0%	0%
T2—Circular economy	102	0.0%	0.0%	151	0.0%	100.0%	61	34.1%	1.6%	115	0%	0%
T3—Renewable energy	95	5.3%	0.0%	179	100.0%	0.0%	170	0.0%	0.0%	155	0%	0%
S1—Functionality vs. Ownership	118	80.5%	19.5%	206	0.0%	100.0%	223	0.0%	0.0%	208	0%	0%
S2—Stewardship	65	1.5%	0.0%	146	100.0%	0.0%	55	76.4%	23.6%	125	0%	0%
S3—Sufficiency	219	0.0%	0.0%	177	100.0%	0.0%	140	0.0%	0.0%	115	0%	0%
O1—Repurpose (Change in values)	69	100.0%	0.0%	134	100.0%	0.0%	270	0.0%	0.0%	220	0%	0%
O2—Scale-up (Digitalization)	75	73.3%	26.7%	130	100.0%	0.0%	135	0.0%	0.0%	108	0%	0%

SBMs may offer many technological solutions. However, techno-optimists, especially in the case of material and energy efficiency, seem to be ready to make up for their purchases when the COVID-19 crisis is over, resulting in at least a partial rebound effect. In

the case of the respondents in the clusters most open for solutions related to circular economy or the transition towards renewable energy, this is less the case.

5. Conclusions

Advocates of the functionality rather than ownership (e.g., sharing economy) SBM may seem open to consume otherwise, but after the COVID-19 crisis, may tend to maintain their purchases anyway. In case of SBMs based on stewardship (eco-labels for example), there is also at least a partial rebound to be expected among the keenest groups of consumers. (Consumption is important to them, even if it is labelled as ‘sustainable’.) Even in the cases of organizational SBMs, there are signs of at least partial rebound effects.

Among all the directions of potential rebound effects, the desire for postponed travels or trips seems to be the most important field. It is so in all the clusters of the most SBM-minded respondents, but the strongest is, again, within the techno-optimists and sharing economy fans.

Bocken et al. [3], identified eight types of sustainability business models that can be used to move beyond the current consumer society and integrate sustainability into our lifestyles. The COVID-19 crisis was a strong test of sustainability for these models. It has shown the stability or fragility of sustainability as a value in times of crisis and the extent to which we try to return to a consumer society after the crisis. In our study, we assessed which business models are highly dependent on the economic cycle. These models are mainly adapted by consumers who want to compensate for their lost consumption after the pandemic. We found that resource efficiency, the sharing economy, and digitalization fall into this category. Expected rebound effect was very common among respondents strongly engaged with these models. These models are therefore deeply embedded in consumer society, likely to move with it rather than being an alternative to it. Digital transformation is generally expected to reduce environmental impacts. However, the results of this study and some other studies suggest that the reduction in environmental impacts may be less than expected [44]. This finding needs further investigation and testing. Unfortunately, a partial rebound in future consumption was also characteristic of the changing value system. Respondents would like to see at least a partial return to previous consumption patterns.

However, we also found models that have proven to be immune to the fluctuations of the economic cycle, thus making their sustainability more pronounced. These models included sufficiency and stewardship but also commitment to renewable energy and the circular economy. Continued support for these models is crucial, as they do not bring consumer culture back into our values.

6. Discussion

Can the business model be linked to students’ individual consumptions? Can the business model be linked to the individual consumption of students?

The BM provides a theoretical link between individual enterprises and the larger production and consumption system in which the enterprise operates. SBMs identify strategies that reduce the impacts of consumption and thereby promote sustainable consumption [45]. Central to all SBMs is the identification of a value proposition and consumer segment. According to Viciunaite and Alfnes, sustainability-oriented firms need to be aware of consumers’ preferences for social and environmental attributes in order to offer a value proposition that can convince consumers to buy their products [46].

The rebound effect at the macro level is composed of individual consumption actions at the micro level. At the macro level, a rebound effect occurs when a significant proportion of consumers increase their consumption, compared to the previous level. The COVID-19 crisis has helped people reduce their consumptions, explore more traditional consumption patterns, travel less, and spend more time with friends and family. However, this change has been very painful for many people, which already implies a longing

to revert to previous consumption patterns and raises the possibility of a rebound effect. The risk of a rebound effect has been highlighted by several authors.

Although the pandemic offers the potential to improve environmental conditions, it also brings a high risk to produce Jevons' Paradox, i.e., increase environmental burdens rather than decrease them, as initially expected. [47]. Barreiro-Gen et al. [48] and Roja et al. [49] also found a short-run rebound effect in the field of transport.

7. Limitation of Research

The primary data of the survey are from a Hungarian poll. Measures affecting consumer behavior (curfews, closure of restaurants, etc.) in Hungary during the pandemic were similar to those in other EU Member States. Therefore, in our view, the results of the survey are not country-specific, but this has not been investigated at this stage.

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