



Article

# Open Business Model of Eco-Innovation for Sustainability Development: Implications for the Open-Innovation Dynamics of Slovakia

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**Abstract:** The paper presents the results of a survey aimed at evaluating the attitudes of Slovak respondents toward eco-innovation purchasing power supplied on the Slovak market to propose an open business model that would support such purchasing power to increase sustainability. The primary method applied in the research was the Kano model, by which we determined the attitudes of the respondents to the issue. Based on the findings and using the analytical-synthetic method, we subsequently processed a proposal for a business model for implementation of ecological innovation in Slovakia. This model used innovative marketing communication tools to increase interest in eco-innovation and products, and created a learning algorithm to influence customers' shopping behaviors. As a result of the research, we assumed that the main obstacles to increasing demand for eco-innovation and products were inexperience, cost, and lack of information held by respondents, and therefore it is necessary to build and improve customer relationships, in which, in addition to traditional forms of marketing, it is inevitable to use various innovative forms of corporate social responsibility to minimize these negatives.



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**Keywords:** ecological innovation; innovation; Slovakia; business model; open innovation

## 1. Introduction

Not only businesses, but also society as a whole, require a broader and more systematic understanding of sustainability challenges and the ways in which they can play a role when solving such challenges. Profitable innovations appear to be the strongest opportunity in sustainable models. They are becoming an essential element of innovative business models that lead to sustainability. They are based on expanding core assets and capabilities to solve significant environmental and social challenges in their local context. They create new sources of value and a competitive advantage for a business in this way.

According to Young and Gerard [1], the full potential value of sustainable business innovation will only be achieved if the new business model incorporates metrics that examine people's attitudes within the whole supply chain into the company's networks and ecosystems to expand impacts and benefits.

In the transformation to a sustainable economic future, the various types of innovations have prominent roles to play [2]. Current research has identified ecological innovations as a key engine of economic growth, competitiveness, and employment [3]. A number of studies from different perspectives have addressed this issue. The trends and potential of the business models include applications for specific products and services and their aspects with regard to different environmental challenges [4–8], or they characterize business models in a hybrid form. The same attention is paid to this issue in Slovakia, but there has been no comprehensive study resulting in the design of a business model for the implementation of eco-innovation.

Therefore, the aim of this paper was to propose an open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia, based on an examination of attitudes in society using the Kano model.

The Kano model has been used widely to identify customer-service quality requirements and improve customer satisfaction [9,10]. Although the Kano model has been used widely, the implementation of the Kano model in an open-innovation business model for ecological innovation in Slovakia is in its beginning stages.

## 2. Literature Review

The business model should be dynamic due to the constantly changing environment. Anthony [11] described the evolution of innovation as the transition of the innovation subject from the individual innovator to enterprises and the transition of the object of innovation from technological innovation to business model innovation. Osterwalder and Pigneur [12] described the business model as a basic principle of creating, retaining, and exchanging values.

According to a study by Matzler et al. [13], the business model represents a white space in the market, or an empty space in the consumer's mind. A product's logic must be in line with the location, whereas the product must utilize its uniqueness and deal with the marketing logic in terms of what must be done to sell the product. An alternative representation of business models using activities, decisions, and consequences was offered by Casadesus-Masanell and Ricart [14]. Their business model explained the value-creation process, as well as the potential to respond to competitors' decisions or identify problem areas, by describing flexibility in fields of corporate policy, resources, and management decisions.

Open business models present the potential to create and exchange the most efficient value in a postindustrial environment, and are characterized by a development in which innovation costs are reduced by retaining the value created through external resources. Revenues increase by providing value in the form of licenses or sales of created value, deinvesting, or decoupling [15].

The trends and potential in the business model innovation area include applications for mobile devices, social-network aspects, and user-generated services, in which part of the value supplied is created by consumers themselves [4]. Frenken [5] characterized business models in a hybrid form in the version of Internet platforms operated for B2B and B2C entities.

The importance of complementary products that a company provides was emphasized by Amit and Zott [16]. They underlined the significance of complementary products, the linking of which allows a company to fully use the potential of the business model and realize revenue from the entire chain of consumer experiences. A significant benefit of business models is mainly found in visualizations using the Canvas business model, which allows users to easily and instinctively display the business model and clearly provide innovations. Canvas presents a business model using nine basic elements: customer segments, supplied value, channels, customer relationships, revenue flows, key resources, key activities, key partners, and cost structure [12].

The possibilities for the innovation of a business model can be found in a new activity (content), a new interconnection of activities (structure), or in a change in the entity performing a given activity (control). Novelty as a measure of activity-system innovation can be expressed using a new transaction structure, the content of transactions or new participants, or customer confinement and the creation of barriers to exit associated with a change in provider (loyalty program, dominant design, trust, customization), as well as network externalities, complementary goods that increase the value of the product and the dependence among the components of the business model, and especially the synergy effect and economies of scale [17].

Lindgart et al. and Young and Gerard [1,18] identified the seven most common mistakes associated with the innovation of a business model:

1. Inflated portfolio: when a company attempts to implement badly coordinated innovations all at once across all levels of the company.
2. Inability to grow: after the start of the project and after the fall of the initial enthusiasm, the project loses attention and resources and fails to grow.
3. Pet: a project that failed, but is still kept alive by the company.
4. Isolated effort: arises when an innovation has been created by an autonomous team with a weak connection to the rest of the business, which prevents it from gaining sufficient resources and trust.
5. Fixation to the idea constantly creating ideas, but without the ability to implement them.
6. Self-centeredness: focusing on innovating internal needs and processes at the expense of customer needs.
7. Historical prejudices: attributing too much weight to models from the past.

Open-innovation models are closely associated with the open-innovation phenomenon. Open innovation has been defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation”. While the initial works were mostly aimed at research and development processes, many research areas arose from this perspective. The logical foundations of the field of open innovation are based on the innovating organization’s need to establish links that are external to the organization [19]. The concept’s original representative—the need for open-innovation cycles—has become increasingly fundamental, if not inevitable. In postindustrial society, knowledge has become a key resource [20,21], so relying solely on internal innovation processes is virtually impossible. Thus, open innovation is the logical result of dramatic social, technological, and environmental change. Open innovation is based on these various research streams according to spatial, structural, user, supplier, leveraging, process, tool, institutional, and cultural perspectives.

The spatial perspective leads to research on the globalization of innovation. Open innovation is easier since research, technology, and product development have become more global in a connected world. The physical proximity of regional centers of excellence allows a company to increase its absorption capacity, thus promoting access to competencies, knowledge, and greatest talents of the world without the need to employ them. One of the main drivers of the internationalization of R&D is access to resources. New information and communication technologies make virtual R&D teams and decentralized innovation processes possible [22,23].

According to the structural perspective, the division of labor has increased with innovation. There has been a strong trend toward more outsourcing of R&D and alliances [24]. Industries’ value chains are becoming more disaggregated. Cost reduction and greater specialization due to more complex technologies and product systems are the drivers of this trend. Open-innovation approaches are not just focusing on short-term, customer-oriented business unit research activities, and thus they compensate for central R&D units.

In the user perspective, users are integrated into the innovation process to utilize the freedom available in its early phases to understand potential customers’ latent requirements and integrate users’ hidden application knowledge. This research field on innovation’s downstream side began by involving lead users in the innovation process, the availability of toolkits, and the idea of mass customization, including the quasi-political concept of democratizing the innovation process [25–27]. User innovation is among open innovation’s best-researched fields.

In the supplier perspective, the downstream side of innovation has been less intensively researched, but it has a strong impact on innovation. Early integration of suppliers into the innovation process can meaningfully increase innovation performance in most industries [24,28,29].

According to the leveraging perspective, research and practice are instead focused on the existing market and business. Existing research competencies and intellectual property’s multiplication into new market fields have been often neglected, despite their potential to create new revenue streams. The involvement of business model thinking seems to

be decisive. Created technology and intellectual property's external commercialization present a future field with high potential [1,2,15,30,31].

In the process perspective, there are three core processes in opening up the innovation process: outside-in, inside-out, and coupled [15,31]. These processes sometimes complement each other, although the outside-in process usually dominates.

In the tool perspective, opening up the innovation process requires a set of instruments. These tools allow customers to create or configure their own product using toolkits. They also allow companies to integrate external problem solvers or idea developers through websites.

In the institutional perspective, open innovation can be considered a private-collective innovation model.

Instead of the private investment model of innovation characterized by temporary monopoly profits presented by Schumpeter, the free disclosure of inventions, findings, discoveries, and knowledge is a defining feature of the open-innovation model.

Spillovers of proprietary knowledge occur regularly by means of compensation or without compensation [2,19,32–34].

In the cultural perspective, opening up the innovation process begins with a mindset. The key role of the not-invented syndrome was a starting point within the field. Creating a culture that values outside competence and know-how is crucial in open-innovation practice. This culture is influenced by many factors: in addition to being influenced by the values of the company, it is also influenced by concrete artifacts such as incentive systems, management information systems, communication platforms, project decision criteria, and supplier evaluation lists and their handling. The research should draw more from the psychological field to better understand the impact of all those aspects on open-innovation culture.

Although we find it useful to identify these different research streams, it is not yet known whether any others will emerge or whether two or more of them will converge. Consequently, this list should only be considered as a provisional list [2,19,32].

The paradox of open innovation lies in the conflict between the practical desire to use the benefits of open innovation and concern regarding the risk that others will misappropriate them. Stakeholder theory and recent developments in value creation through stakeholder engagement can assist with reconciliation of this inherent structural risk. The limitations of existing open-innovation typologies are identified, and a process-based model of open innovation is proposed. Then, the model is expanded to include stakeholder engagement. After integration of stakeholder engagement, open-innovation processes can be understood to generate benefits beyond the limits of obtaining specific information from external experts. The stakeholder engagement in the open-innovation model allows for a greater understanding and easier acceptance of risks inherent to the open-innovation process [35].

The practical origin of the open-innovation concept highlights a structural tension. The methodology of openness implies an inherent lack of control, both of the processes themselves and of the potential results [36]. Participants in open-innovation processes risk the intentional and unintentional loss of the results of their efforts to other participants in the network they have created [37]. As the very nature of the open-innovation process itself creates this paradox, the resulting tensions are structural and pervasive.

Open innovation can be described as the combination of two differently directed processes: inbound and outbound. The inbound process presents insourcing of external knowledge through licensing, spinning, acquisition, and collaboration alongside the value chain (cooperation with customers, suppliers, competitors, and other institutions to pursue ideas), which can be utilized in the process of new product development [38]. The outbound process involves the external utilization of internal knowledge [2].

Stakeholder theory [39,40], especially recent work dealing with the significance of stakeholder engagement, is applied to develop the model that addresses this inherent conflict in open-innovation processes. Consideration of the social, organizational, and ethical

benefits of relevant stakeholders' engagement improves the concept of open innovation, helping to move beyond its solely practice-based origins.

The goal of open innovation and an open business model should be to vitalize the Schumpeterian dynamics of the open-innovation economic system. The dynamics increase will be equivalent to developing economic performance in quantity or quality. The open innovation subeconomy system that is based on SMEs and startups should be increased by motivating technology or knowledge distribution and an open-innovation relationship with large businesses. On the contrary, large businesses should grow by motivating technology, knowledge creation, and an open-innovation relationship with SMEs and social firms. Then, the social innovation subeconomy system that is based on social entrepreneurs' collaboration innovation should be increased by motivating technology or knowledge consumption and an open-innovation relationship with big business and SMEs by using the Business Model Design Compass [41].

The era of open innovation has just begun. A major move toward a new paradigm has already started. Open innovation provides a novel explanation for these anomalies in developing an alternative approach to innovation. Nowadays, open innovation has changed its status from a research interest to a mainstream research area. This real paradigm change is irreversible in terms of its long-term impact.

Investments made by companies in research and development activities, as well as the environmental conditions that foster the development of capabilities on a regional and national level, are among the key determinants of open-innovation practices [42].

Nowadays, society is making new climate commitments and expanding responsible activities that represent a new era of business in which maintaining a competitive advantage requires companies to transform their business models into sustainable ones through the implementation of eco-innovation. The number of environmental problems, as well as competitiveness challenges within the global economy, have increased awareness of the necessity to change and renew existing technological production and social behavioral patterns. This awareness may produce innovative responses, gradually leading to sustainability [1,2,43,44].

In a broader sense, ecological innovation can be defined as all measures of relevant involved persons who develop new ideas, behaviors, products, and processes and then apply or introduce them, and who contribute to a reduction in environmental burdens or to ecologically specified sustainability targets [44,45]. Effective management of both innovation and environmental issues supposes that a company with higher-quality innovation takes better care of the environment. Eiadat et al. [6] and Zhen [46] identified the equality and mutual benefit that arise from the relationship between eco-innovation and the performance of a business.

Picazo-Tadeo et al. [7] and Fare et al. [47] stated that a change in environmental performance is reflected in the results of proportional eco-efficiency change, as well as in environmental technical change. Eco-innovation can serve as a tool for companies with the intention to transform environmental constraints into opportunities to reduce costs, obtain a better reputation, and take advantage of new markets [1,2,7,48,49].

### 3. Materials and Methods

To meet the determined goal (to propose an open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia), this study focused on evaluating the attitudes of Slovak respondents toward eco-innovation purchasing power supplied on the Slovak market in order to propose an open business model that would support such purchasing power to increase sustainability.

Our proposal for the business model was based on the research methodology by Young and Gerard [1]. We developed four steps to propose a sustainable business model through innovation:

1. We mapped the social issues and stakeholders in the examined area.

2. We mapped the dynamics of stakeholders and environmental and social issues that limit or hamper the examined area.
3. We mapped the development trends in the examined area.
4. Based on the results of the mapping, we identified the space for innovation opportunities or strategic-intervention points, among which we included the following (see Table 1).

Since the business model is a model expression of logical relationships through which the organization (society) creates (added) value for customers and revenues for itself, it is necessary to identify customer attitudes toward the problem. We used the Kano model [9] as the primary method for examining the attitudes of Slovak respondents toward identified innovation opportunities. Based on the identified innovation opportunities or strategic intervention points of the researched issue (further examined parameters), we formed a Kano questionnaire in which, for each identified requirement, we compiled one positively formulated statement and one negatively formulated statement, to which Slovak respondents had the opportunity to respond during the survey on a Likert scale. The Kano questionnaire was conducted online from September to December 2021. A total of 2000 respondents were asked to participate in the research, and the return rate for the questionnaires was 86.4%. The sample thus consisted of 1728 respondents, so the minimum number of respondents (667) was reached. The minimum number was calculated with respect to the sample-size calculation, with the average permanent population in Slovakia gained from the data presented by the Statistical Office of the Slovak Republic (5,449,652 inhabitants as of 30 June 2021 [52]). The sample was calculated at a 99% confidence level and a margin of error of 5%. The survey was mainly completed by women (51.74% of responses); men represented 48.26%. The largest share of respondents (28.13%) were 18 to 30 years old, then 31 to 50 years old (25.29%), 51 to 60 years old (22.74%), and finally respondents over 61 years (23.84%).

Based on the completed Kano questionnaires, a database was processed. The individual answers to the positively and negatively asked questions (statements) were evaluated separately for each parameter using the cross rule of the Kano model (Table 2).

Through a cross rule, we determined the attitudes of Slovak respondents toward the examined parameters as: attractive (A), one-dimensional (O), mandatory (M), indifferent (I), reverse (R), or questionable (Q) requirements, which were characterized as follows:

- Attractive requirements (A): the impact of these on customer satisfaction is clear; these are requirements that the customer does not expect. If they are not met, customers do not indicate their dissatisfaction.
- One-dimensional requirements (O): fulfillment of these leads to satisfaction, and in case of nonfulfillment, to customers' dissatisfaction. As the rate of compliance with these requirements increases, so does customer satisfaction.
- Mandatory requirements (M): obvious and automatically expected from the customer's point of view. It is possible to mark them as basic, and this means that failure to meet them causes customer dissatisfaction. Identifying them is very important, because customers are easily aware of their absence, and this will be reflected in their maximum dissatisfaction.
- Indifferent requirements (I): these do not affect customer satisfaction or dissatisfaction in any way. Customers do not care whether these requirements are met or not because they are not decisive for them.
- Reverse requirements (R): these represent requirements whose higher compliance rate causes greater customer dissatisfaction.

In addition to the defined 5 requirements, it was possible to meet another category of requirements: questionable requirements (Q) [10].

**Table 1.** Characteristics of researched attributes ([50,51] and authors).

Examined Parameter	Characteristics of the Examined Attitudes of Slovak Respondents
<b>Experience with eco-innovation of products</b>	The user experience represents all aspects of a user’s interaction with a product, service, or company that compile the perception of the whole by a user. Customer experience represents people’s emotions associated with a product, service, or system use. Experience points to experiential, expressive, logical, and important aspects of human interaction, but also practical aspects. We can also say that this concept is subjective, because it is a separate perception and idea with respect to the system. The user experience is dynamic because it is constantly changing over time due to the changing circumstances and new changes.
<b>Costs of eco-innovation and products</b>	The cost value for the customer can be characterized as the ratio between the perceived benefits and the costs that result from owning the product, while the amount of benefits must exceed the costs incurred that the customer is willing to pay.
<b>Maintenance of eco-innovation and products</b>	Needs and costs related to the maintenance of eco-innovations and products from the customer’s point of view, increasing the total maintenance costs during use and other disposable costs for maintenance needs.
<b>Zero emissions</b>	Ecological innovation can be defined broadly as all measures of relevant subjects that develop new ideas, behaviors, products, and processes and then apply or introduce them, and that contribute to a reduction in environmental burdens or to ecologically specified sustainability targets. Reductions in waste, zero emissions and energy consumption for waste management, reduced consumption of raw materials, etc.
<b>Wider equipment and accessories for eco-innovation and products</b>	Possibilities to extend the basic model of eco-innovation and products with a wider range of equipment and accessories without increasing the total cost.
<b>Purchase of eco-innovations and products</b>	The possibility of buying alternative products that represent customer value but do not represent eco-innovation, or a product that represents a significant economic effect without an ecological effect, or a less effective alternative to the ecological effect.
<b>Sales promotion of eco-innovation</b>	Financial services and business support, sales subsidies, etc.
<b>Sharing economy</b>	Rental options, sharing-based business models, pay-as-you-go business models, product/service leasing, functional sales, industrial symbiosis in which products/services and secondary raw materials are shared.
<b>Repair</b>	Possibilities of using services and repairs, or business models offering lifetime warranties and product repairs as part of after-sales services.
<b>Reuse</b>	Possibilities of using and buying used products, using or building Internet platforms and cooperation markets, revising old products, or reuse of packaging.
<b>Reproduction</b>	Products based on improvement and more efficient use of recycling technologies and new systems for waste (collection, sorting, etc.).
<b>Design</b>	Products that are designed to allow repairs, reuse, or reproduction or recycling, or products that are standard.
<b>Availability of information on eco-innovation</b>	Information on eco-innovation and products, which can be defined as the relationship between humans and the information environment. It includes the creation, communication, expansion, and use of information to regulate information processes and the mutual adaptation of humans and the information environment. Human and information environment relationships can influence human activities, values, communities, and the tools used to communicate and organize professional information.
<b>Brands</b>	The idea in the mind of the public of what properties, qualities, or values they associate with the brand. The brand is not just a word or a name, but at the same time it is a bearer of values, emotions, and individuality. The brand promises that the product meets a set of features, guaranteed features, and services.

**Table 1.** *Cont.*

Examined Parameter	Characteristics of the Examined Attitudes of Slovak Respondents
<b>Smart solutions</b>	Opportunities to implicitly use smart specialization technology solutions for resource efficiency and the search for new sustainable production methods aimed at creating a dynamic, open, and inclusive innovative society as one of the prerequisites for improving the quality of life, as well as through research support and innovation in environmental areas, including adaptation to climate change.
<b>Extended warranty</b>	Extended warranty options consisting of extending the free repair service of certain products beyond the scope of the legal warranty; understood as a service that provides a free service necessary to eliminate any product defects caused by defective materials or manufacturing defects that occur during common use, which occur and are enforced during the term of the extended warranty. Legally, the free service is governed by the repair regulations.
<b>Lower operating costs</b>	Needs and costs related to the operation of eco-innovations and products from the customer's point of view, reducing total operating costs during use and other disposable costs for operational needs.
<b>Improving the life quality of society</b>	Environmental quality is a means of supporting the sustainable and efficient use of natural resources, environmental infrastructure, and adaptation to climate change or mitigation measures.

**Table 2.** Kano model for evaluation of consumer requirements [9].

		Answer to the Dysfunctional Question				
		Like	Acceptable	No Feeling	Must-Be	Do Not Like
Answer to the Functional Question	Like	Q	A	A	A	O
	Acceptable	R	I	I	I	M
	No Feeling	R	I	I	I	M
	Must-Be	R	I	I	I	M
	Do Not Like	R	R	R	R	Q

Subsequently, based on the results of the Kano model, which characterized the attitudes of Slovak respondents to the issue of eco-innovation and sustainability [53], an open business model of eco-innovation was proposed using the analytical-synthetic method as an opportunity to strengthen sustainability development in Slovakia. A significant benefit of the proposed business model was the visualization of the basic elements of the model, including customer segments, supplied value, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structure. These can be characterized as follows:

1. The supplied values describe services and products that solve problems and meet the needs of clients. It is the most beneficial if the values differ in the market from similar products and services. Values can be expressed quantitatively or qualitatively.
2. Key activities describe the most important steps to realize intentions.
3. Key resources help realize the plan. They are not just machines, but also people, finance, knowledge, and material.
4. Partners help to optimize operations and minimize risks. Typically, these are partners who are part of sales channels.
5. Customer segments focus their efforts on narrower groups of potential customers. After all, the exact same product will not be supplied to anyone. There will be differences among user groups that can be used commercially. Market segmentation allows the adjustment of the strategy used in making the product, its marketing, and its features.
6. Channels define the ways in which products or services are made available to clients. Channels will affect features, traffic management, and support, as well as invoicing.
7. The relationship with the client describes how the clients use the product and how it helps them. Will they be met in person? Or will there be self-service? A community may be required, and additional products or services may be needed to support the relationship.
8. The cost structure describes whether the business plan is cost-driven or value-driven.
9. Income flows [54,55].

Within the basic elements of the design of the open business model, the results of the Kano model were incorporated to satisfy the requirements of Slovak customers in ecological innovations. They represent their perceived value, and satisfy them in the form of services. Other follow-up aspects of the open business model were added to the complexity by means of the inductive–deductive method.

**4. Results**

The following Table 3 shows the complex results of the attitudes of the interviewed Slovak respondents toward ecological product innovations.

**Table 3.** Attitudes of Slovak respondents toward examined parameters through the Kano model.

Examined Parameter	M		A		O		I		Q		R		Attitude
	Abundance		Abundance		Abundance		Abundance		Abundance		Abundance		
	Absolute	Relative											
Experience with eco-product innovations	189	10.94	241	13.95	54	3.13	782	45.25	5	0.29	457	26.45	I
Costs of eco-innovation and eco-product solutions	98	5.67	127	7.35	164	9.49	52	3.01	3	0.17	1284	74.31	R
Maintenance of eco-innovation and products	167	9.66	275	15.91	975	56.42	197	11.40	15	0.87	99	5.73	O
Zero emissions	153	8.85	456	26.39	865	50.06	195	11.28	0	0.00	59	3.41	O
Wider equipment and accessories for eco-innovation and products	312	18.06	864	50.00	248	14.35	294	17.01	1	0.06	9	0.52	A
Purchase of eco-innovations and ecological product alternatives	87	5.03	156	9.03	204	11.81	486	28.13	3	0.17	792	45.83	R
Sales promotion of eco-innovation	389	22.51	867	50.17	172	9.95	197	11.40	2	0.12	101	5.84	A
Sharing economy	245	14.18	546	31.60	384	22.22	348	20.14	5	0.29	200	11.57	A
Repair	195	11.28	604	34.95	293	16.96	245	14.18	11	0.64	380	21.99	A
Reuse	145	8.39	251	14.53	284	16.44	912	52.78	2	0.12	134	7.75	I
Reproduction	151	8.74	276	15.97	302	17.48	845	48.90	35	2.03	119	6.89	I
Design	149	8.62	309	17.88	495	28.65	612	35.42	85	4.92	78	4.51	I
Availability of information on eco-innovation	194	11.23	217	12.56	234	13.54	345	19.97	0	0.00	738	42.71	R
Brands	294	17.01	765	44.27	184	10.65	245	14.18	1	0.06	239	13.83	A
Smart solutions	389	22.51	524	30.32	172	9.95	542	31.37	2	0.12	99	5.73	I
Extended warranty	341	19.73	694	40.16	254	14.70	367	21.24	25	1.45	47	2.72	A
Lower operating costs	254	14.70	804	46.53	205	11.86	214	12.38	13	0.75	238	13.77	A
Improving the life quality of society	326	18.87	311	18.00	277	16.03	727	42.07	1	0.06	86	4.98	I

Based on the results of the Kano model, we reached the following conclusions. The positive experience of Slovak respondents with eco-innovations was low, as they showed that the examined attribute of experience did not influence them. Reuse, reproduction, design, and smart product solutions also did not have an impact on the attitudes of Slovak respondents. The impact of eco-innovation and products on improving the quality of life of the society also did not affect the purchasing decisions of Slovak respondents.

On the contrary, Slovak respondents had a reverse attitude toward costs associated with their purchases, which they perceived as higher compared to the classic product models. Therefore, they largely preferred alternative products to ecological ones. This may have been partly caused by the lack of information regarding the environmental friendliness of these products, as they also perceived this awareness in a reverse manner.

Other research attributes, such as wider equipment and accessories, sales for promotion of ecological products, sharing economics, product repair, brands, extended warranties, and lower operating costs were attractive to the Slovak respondents. They also perceived zero emissions and the maintenance and operation of such products as positive, as they had a one-dimensional attitude toward them. This meant that they represented requirements, the fulfillment of which led to customer satisfaction, while their nonfulfillment caused dissatisfaction. As the rate of compliance with these requirements increased, so did customer satisfaction.

During the analysis, it was found that eco-innovation and products did not affect Slovak respondents, as they had a reverse attitude toward them. However, services related to eco-innovation were attractive to them, as well as the benefits associated with their purchases.

Based on the results of the Kano model in evaluating the attitudes of Slovak respondents toward eco-innovation and products, we subsequently proposed the open business model using an analytical synthesis of knowledge regarding open innovation models, eco-innovation, and their perception, as well as sustainable ecological innovations as an opportunity to strengthen the development of sustainability in Slovakia, based on an examination of attitudes in the society (see the following Figure 1).

The results, presented in the form of an open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia, suggested that these structures had extensive business processes. Particular attention should be paid to the value of eco-innovation as perceived by customers. As stated by Young and Gerard [1], the full potential innovation value of a sustainable business model will only be achieved if the new business model incorporates metrics that examine people's attitudes in society to expand impacts and benefits.

Other important attributes of the business model include a key system partner, as presented by Turon [55], including the government, regional governments, municipalities, or other business partners. Attention must be paid to key activities, resources, distribution channels, CRM, and cost and revenue streams, especially in terms of open innovation. It is a matter of pointing out the possibilities and opportunities of strengthening the development of sustainability in Slovakia through the development of the implementation of ecological innovations in society by open cooperation with local and regional governments, schools, universities, etc.

The elements of the proposed model were designed to be used in various areas of operation in a company, and at the same time, each factor increased the openness of the business model.

Key partners	Key activities	The value of eco - innovation	CRM	Customers
Suppliers and manufacturers of eco-products Software vendor Business partners Schools, universities, and research Self-government Investors Local authorities Innovation system Government Regional governments Self-government	Subsidies Satisfaction surveys Marketing Sustainability management Eco-innovation management Platform management Customer service and support - repair - maintenance - and others Reuse Repetitive production Eco-design Viral marketing Open innovations creating Customer-oriented quality management Smart innovation Education and raising awareness of eco-innovation	Wider equipment, accessories Environmental friendliness Extended warranty Lower operating costs Zero emissions Maintenance Repair Other services Availability 24/7 for some eco-innovations Products visible in sustainability to improve the quality of citizens life to provide healthy, eco and accessible products	24/7 customer service Customer offices Special supplies for premium customers Easy-to use systems An affordable ecological product Eco-friendly solution Eco-lifestyle Creating ecological communities of users	Common customer Occasional customers Business customers Eco-enthusiasts A wide group of application users Sharing users Competition customers
	<b>Key resources</b>		<b>Distribution channels</b>	
	Research & Development IT platform, social platforms, and applications Users Innovative business services Affiliation to the eco-products and services Staff Localization Data generated by users' collection		Specialized stores Website Application Social media Invitations and promo codes Other	
<b>Costs</b>		<b>Income flows</b>		
Platforms' maintenance and its infrastructures Maintenance Physical infrastructure cost Personal cost Marketing costs Management cost Intellectual property fee Research and development costs		Eco products sale Usage fees Deposits Recycling fees Repair fees Maintenance fees Other fees Possible additional income		

Figure 1. Proposal of an open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia.

In summarizing the findings, we can state that there was a discrepancy between the requirements of Slovak customers and private (as well as public) benefits, which Kemp et al. [56] called the problem of double externality, which is typical for eco-innovation and products (a discrepancy between the private and public benefits). According to the results of the Kano model, for Slovak respondents, the issue of eco-innovation was to some extent attractive from the point of view of societal interest, but at the same time, they had opportunity attitudes toward it. To solve the problem of double externality (inherent in eco-innovation), it is necessary to create enhanced customer value to develop the market-pull effects. A central challenge in the strategic management of a sustainability-oriented business model is an alternative business logic that creates public value for the customer and retains part of this value for both the public and the society, or the public and the customer, which could lead to greater willingness to pay or increase demand. Networking within an open-innovation model is one effective way to facilitate open innovation [57]. By combining internal and external competencies and knowledge, both in R&D and marketing, the multinational life sciences and performance materials create space for open innovation within the Business Model Design Compass [41,58].

The role of the business model was to supply innovative value proposals for eco-innovation and to overcome the main barriers of ecological sustainability strategies in a competitive way by using innovative marketing tools while considering the key resources of innovation activity management. An open-innovation model that links emerging specializations can provide useful information regarding areas in which cooperation of high-tech companies, venture capital firms, and other institutions could be strengthened to accelerate product development and support innovation [59,60]. Open innovation adds an essential component to the traditional innovation approaches, and it accelerates the collective learning of value creation. We can create a more sustainable future by harnessing these dimensions and collaborative potential [61].

For Slovak customers, the main value of eco-innovations and ecological product solutions lies mainly in wider equipment, accessories for environmental friendliness, extended warranties, lower operating costs, zero emissions, maintenance, repair, and other services, as well as 24/7 availability for some eco-innovations, products visible in sustainability, improving the quality of citizens' lives, and providing healthy and accessible eco-products, depending on the specific product. These values of eco-innovations and products mostly represent attractive attributes or follow up on attractively perceived attributes as services, according to our analysis using the Kano model (wider equipment, accessories for environmental friendliness (A), extended warranties (A), lower operating costs (A), zero emissions (O), maintenance (O), repair (A), other services depending on the specific product (A), and attractive attitude of Slovak respondents: these represent value for the customer in the open business model). An important factor in the provided value is the quality management of eco-innovations and products, as well as related services, which influence the growth of sales efficiency through a suitably chosen learning algorithm [62].

The distribution channels of manufacturers of these products or specialized branded stores are positively perceived by customers due to the possibility of having a sense of expertise and specialization for a given type of product. Therefore, within the distribution channels, it is necessary to focus on specializing shops, websites, applications, social media, invitations, and promo codes. This is important to maintain constant contact with customers and monitor their satisfaction with the quality of eco-innovation and products in order to focus on their rapid improvement through open innovation.

It is essential to address the segment of customers who are regular users, occasional users, business customers, eco-enthusiasts, and a wide group of users and sharing users, who are important to inform of eco-innovations and products and create learning algorithms to influence their purchasing behaviors [62]. It is necessary to monitor their attitudes toward the issue of innovation and the supplied values to meet their needs [63], so we evaluated their degree of involvement in an open-innovation system through the Kano model.

As a result of the research, we assumed that the main obstacles to increasing demand for eco-innovation and products are the inexperience, cost, and lack of information held by respondents. According to the Kano model, Slovak respondents had the opposite attitude toward the purchase costs of eco-innovation and eco-product solutions. Therefore, it is necessary to build and improve customer relationships, in which, in addition to traditional forms of marketing, it is inevitable to use various innovative forms of corporate social responsibility to minimize this negative– (the opposite attitude). Experiential marketing is one of the innovative forms of marketing that provides customers with the missing experience. The purpose of experiential marketing is to create a pleasant customer experience with each consumption, and thus attract them to make another purchase. The first experience must be positive [64].

There are also blogs and forums associated with the experiential marketing method, on which users can express their views on products. Therefore, blogs and forums are one of the key activities of the open business model. At present, the system is less focused on customers and more on internal processes of making the production more ecological, which the customer segment in Slovakia did not appreciate sufficiently (reuse, reproduction, etc). Slovak respondents perceived them indifferently (I). When building a relationship with customers, it is appropriate to focus on the system of services that are preferred, and therefore they present a suitable alternative to the use of traditional forms of marketing communication. Experiential marketing should be used in conjunction with the organization of marketing events in which a company allows customers to gain the necessary experience and information to decide on the purchase of eco-innovations and product. This form is called event marketing in the scientific literature. According to Šindler [65], event marketing represents “planning, staging, and organizing extraordinary experiences within corporate communication. The aim of these experiences is to evoke psychological and emotional stimuli mediated by the organization of various events, which also support the company’s image and products”.

Due to the large amount of information provided at one time, another solution when building relationships with customers is associated with promotional materials in the form of brochures with detailed information on the ecology of innovation processed through another innovative form: white-paper marketing. The intentions of a white paper are to support the selected product and its innovation, methodology, and technology, which should influence the decisions of current or future customers. If the white paper is well written, it provides advice, but usually reminds customers how complex the technical issues are and explains that the company is an ideal partner for cooperation. The marketing goal of this method is to prove professional skills, but it is necessary to be careful that it does not become a cheap sales promotion. Its spread can be achieved quickly and effectively by advertising on the Internet in the form of PPC campaigns or PR articles published on Internet servers [66]. Therefore, as part of building a relationship with customers, we proposed to implement 24/7 customer service, customer offices, special offers for premium customers, easy-to-use systems, affordable ecological products, eco-friendly solutions, eco-lifestyles, and creation of user eco-communities. In this method, it is important to highlight the positives of eco-innovation and eco-product solutions that provide value to customers.

Based on the above, the key activities needed to create the value of eco-innovation and products within the forming of a distribution channel and building a relationship with customers include: subsidies, satisfaction surveys, marketing, sustainability management, eco-innovation management, platform management, customer service and support, repair, maintenance, reuse, repetitive production, eco-design, viral marketing, creating open innovations, customer-oriented quality, management, smart innovation, education, and raising awareness of eco-innovation. However, respondents perceived support from the state in the form of subsidies (support for the sale of eco-innovations and products was attractive to Slovak respondents) as the most attractive element, and is another key activity to support sustainability through eco-innovation and products in Slovakia. By optimally setting the key activities, it is possible to use these products more efficiently

for sustainability in Slovakia and to increase the demand for these products. These are intended to contribute to creating value for customers and to improve their awareness of that value for them and society [67], and to create learning algorithms to influence their shopping behaviors [62].

Key resources for the open-innovation model are very important in terms of potential inputs, policy implementation, and cooperation within the open-innovation system. These resources represent commitments at different stages of the innovation process [58] in the implementation of key activities and the value of the open-innovation model.

Key partners for the implementation of the proposed activities and sourcing are suppliers and manufacturers of eco-products, software vendors, business partners, schools, universities and research facilities, self-government, investors, local authorities, regional governments, innovation systems, and support organizations aimed at promoting an environmental approach. They play an important role in the proposed model, and we wanted to highlight the importance of an open approach and public partnership [68].

In terms of the cost structure, the model highlighted the costs that may be incurred in the case of implementing open innovations. Before realizing the changes, companies should analyze them with respect to their resources and decide what level of innovation the organization can afford. Research by Greco and Nguyen et al. indicated that companies that have implemented open innovations have not suffered from this budget [69].

## 5. Discussion

The issue of sustainable development and various green initiatives and concepts focused on green growth and the green economy are currently among the prioritized political topics. Sustainable development and green initiatives are closely linked. Green initiatives do not have the ambition to replace sustainable development, but serve as tools to achieve it. Environmental protection is a precondition for economic and social development and part of a sustainable development strategy [70]. Eco-innovation plays a key role in the transition to a sustainable economy [71]. For this reason, in addition to other issues, this research focused on the scientific discussion of eco-innovation in the context of the new open-innovation paradigm and the design of an open business model for eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia.

Based on the results of the Kano model, and subsequently on the expression of an open business model, we can state that the main model in the implementation of ecological innovations was the Slovak problem of externality, which is typical for eco-innovations and products, as stated by Kemp et al. [53].

Therefore, we began with customer-oriented models to design innovations to develop the market effect. According to Salampasis et al. [72], open innovations need to be implemented from the perspective of the human dimension, because the human dimension is made up of a cognitive and motivational space that forms an individual level. For that reason, we focused on the requirements identified through the Kano model as attractive or one-dimensional when identifying value for customers within the design of the open business model. The need to analyze and define market conditions for business model development was also emphasized in the works of Chesbrough [33], Rigby and Zook [73], and Eyring et al. [74]. Trott and Hartmann [75] mentioned that the analysis of market conditions represents benefits for increasing the openness of the business model. These benefits and strengths have been noted and discussed since the 1960s, especially in terms of R&D cooperation.

We also implemented the results of the Kano model in an open-innovation model when characterizing the customer segment, distribution channels, and the building of relationships with customers. In this area, we attempted to design individual elements of the open-innovation model to eliminate mainly their conflicting attitudes toward the problem. Contradictory attitudes toward innovation in the deployment phase should be supported by innovative methodologies supporting innovation marketing, as stated by Trommsdorff and Steihoff [76], even though we know the customer values, because

innovation failure ranges from 4 to 90%, depending on the business and methodology measurement. Therefore, it is appropriate to introduce a two-way flow of knowledge to meet the eco-innovation needs of the adopters, which are then transformed into a flow of funds for society: revenue from the sale of innovations [77]. It is important to emphasize here that the open business model in this area deals with innovation with market understanding and response [78]. Involvement in eco-innovation in the interests of sustainability requires an environment that leads to collective creativity: open innovation. Despite the opportunities offered by eco-innovation, implementations confront a variety of challenges and threats related to internal, external, and bilateral factors [79].

The combination of internal and external competencies and knowledge in the field of research and development and marketing creates a space for open innovation within the Business Model Design Compass [41,58]. Conceptually, it is a more distributed, cooperative, and decentralized approach to innovation, based on the fact that today's useful knowledge is widely distributed, and society does not fully use its resources. By Chesbrough [33], open innovation involving business models has several effects, such as achieving sustainable profitability, stable growth, product personalization, a focus on new business models, and increased agility.

The key challenge to the strategic management of a business model aimed at sustainability and that is eco-innovation-oriented is an alternative business logic that creates public value for the customer and retains some of that value for the public and society or the public and the customer, which could lead to greater willingness to pay or increase demand [57].

Porter [80] presented that such an open business model strategy requires competitive business decisions in which companies must decide what to give up. Kubičková and Benešová [81] stated that the increased pressure on the market is caused by intensifying competition and limited resources. This situation requires the creation of a harmony among business activities, customer value, and the public interest. In this case, it is a matter of creating a unique and valuable position, involving a set of different activities [82] within an open business model focused on key activities, resources, and suppliers.

As reported by Hrabynskyy et al. [83], all companies generally face the same barriers to eco-innovation, and policy makers have a responsibility to address existing constraints in order to correct and implement effective eco-innovation policy methods and tools. Networking within the open-innovation model is one effective way to facilitate open innovation and the implementation of eco-innovation [57]. Open innovation includes working together to accelerate the implementation of innovation and, ultimately, increase value for stakeholders [84,85]. Amer [84] stated that if we want to become green, business models based on an open-innovation paradigm must be followed. We can improve our ability to mitigate environmental problems by sharing knowledge.

The role of the business model is to supply innovative value proposals for eco-innovation and to overcome the main barriers of ecological sustainability strategies in a competitive way using innovative marketing tools while considering the key resources of innovation activity management. An open-innovation model that links emerging specializations provides useful information regarding areas in which cooperation of high-tech companies, venture capital firms, and other institutions could be strengthened to accelerate product development and support innovation [59,60]. Open innovation adds an essential element to the traditional innovation approaches, and it accelerates the collective learning of value creation. Driven by trends toward global knowledge economies, previous research also argued that eco-innovation strategies are crucial to the creation of wealth and new jobs, and to achieve sustainability goals [86].

The presented open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia was in line with current GSCM research in the context of eco-innovation [60,87], which emphasizes supply-chain development strategies, green investments, and government and business sustainability. The GSCM

strategy promotes a high level of cocreation of companies with their partners in the supply chain, and affects performance in terms of operations, innovation, and finance [84,87–89].

We can create a more sustainable future by harnessing these dimensions and collaborative potential [61]. Several previous studies addressed the issue of the business model [55,90–92] that focused on sustainability or different types of innovation, but none addressed eco-innovation for the development of sustainability. Nevertheless, all studies agreed on the need to implement activities within business models that take into account environmental aspects that lead to sustainability.

The very proposal of an open business model of eco-innovation provides an opportunity to strengthen the development of sustainability in Slovakia. It characterizes the potential for better adaptation of eco-innovation and products to customers and consumers, and for strengthening sustainability development.

This prospect implies that manufacturing firms should engage in and implement eco-innovations strategically to realize improvements in economic performance. Janahi et al. [93] mentioned that such strategic considerations motivate present eco-innovation studies to explore drivers (e.g., environmental regulation and policies) for adopting eco-innovation in manufacturing [94,95]. On the other hand, there are studies that emphasized the strategic barriers (e.g., financing) faced in the adoption and diffusion of eco-innovation [96,97].

These ambiguities emphasize the need for a comprehensive overview of strategic considerations for eco-innovation to improve and harmonize strategies at the organizational level with wider national and regional initiatives to support socioeconomic prosperity and sustainable development.

## 6. Conclusions

The research presented in the paper provided both theoretical and practical information in the area of ecological innovation in Slovakia. Based on the results of eco-innovation products, we proposed an open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia. This model used innovative marketing communication tools to increase interest in eco-innovation and products, and created a learning algorithm to influence their shopping behaviors. Through key activities and partners in the field of open innovation, it focused on solving the problem of double externality, which is typical of eco-innovation. To solve the problem of double externality (the discrepancy between the private and public benefits inherent in eco-innovation), we proposed the creation of enhanced customer value to develop the market-pull effects. The central challenge in the strategic management of a sustainability-oriented business model is an alternative business logic that enables the creation of public value for the customer and retains part of this value for society.

In terms of theoretical benefits, this paper presented an overview of the issues of eco-innovation and the open business model, provided information on innovative forms of marketing communications, and characterized the basic aspects of the business model and others. The work filled research gaps in eco-innovation and the open business model.

In terms of practical benefits, this paper presented the results of research aimed at examining the attitudes of Slovak respondents toward eco-innovation, and based on these results, we proposed the presented open business model of eco-innovation as an opportunity to strengthen the development of sustainability in Slovakia.

The results present a synergy of practical research on the attitudes of Slovak respondents and theoretical knowledge of the researched issues.

Despite our efforts to incorporate all relevant data in the paper, some important documents may have been omitted unintentionally, which was the limitation of the study.

In the future, it will be possible to conduct research on specific sectors and types of eco-innovation and compare them.

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