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ARTICLE

Modeling the Process of Idea Generation for Designing Sustainable Services in the Agriculture Sector

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ABSTRACT

The emergence of new services requires a lot of effort, and most of all, creativity. The business longs for innovation in all fields, including the agricultural business. Moreover, the development of sustainable services in agriculture is even more important to enable a response to climate change, meet customers' demands for ecology, and comply with government regulations for sustainable farming. There is no specific model for organizing the idea generation process for modeling sustainable services, or the existing models do not fully satisfy the businesses looking for the idea generation guidelines in sustainable farming. Therefore, all these factors underscore the need for a specific model to develop sustainable services in agriculture. Based on research on designing sustainable services, the modelling process of idea generation, and the model of the idea generation process for designing sustainable services in the agricultural sector was developed and presented in this article. The article explains the process of creating a model in the field of sustainability and conducts research on its implementation involving companies operating in the sustainable agriculture sector. The steps of the model application are explained in detail. As the study shows, the model of the idea generation process can be widely used not only for modeling sustainable services in agriculture, but also in a broad spectrum of service design.

Keywords: Idea Generation; Modelling a Process of Design; Sustainable Services; The Sector of Agriculture

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1. Introduction

Agriculture is a vital sector of the global economy. Sustainability in the agriculture sector has lately become an issue to develop, engage, and follow. By modeling and implementing new sustainable services and innovations successfully, companies have the opportunity not only to improve their own viability but also to gain new markets oriented towards environmental and social health, prospering economies, or to make a positive impact on ecology. Therefore, the contribution of agricultural services can make the improvement of production more effective, following the more socialized models of sustainability, and help individual farmers overcome the constraints. More effective resource management can be achieved with the help of sustainable agricultural practices [1]. Building on this, it is evident that collaborative agricultural service mechanisms have a significant impact on economic resilience. Sustainable services can enhance productivity and optimize farming operations. This economic development can be the foundation for sustainable agricultural advancement [2]. Addressing the complexities in service delivery operations, cooperative relations between service providers and farmers can improve resource allocation and overall operational efficiency in agriculture [3].

After examining the agricultural makerspaces, it was revealed that social and ecological sustainability not only increase the operational efficiency but also are the key activators of innovation strategies [4]. Similarly, climate-smart agricultural practices could combine advanced technologies with restructured organizational models [5]. This perspective aligns with the insights that in order to maximize the sustainable use of agricultural landscapes, knowledge and integration of ecosystem services is of great importance. This alignment of technological advancements with ecological value recognition can facilitate more holistic, sustainable outcomes [6]. Lastly, in order to cultivate an environment conducive, sustainable, and inclusive of innovative farming practices, the social networks among farmers, service providers, and agricultural communities are vital [7].

Even though innovation is not an easy process for businesses to conduct, the sustainable one requires even more knowledge, expertise, creativity and compliance with the newest tendencies and regulations. Therefore, the problem addressed in the article is the lack of models and frameworks for the idea generation process in modeling sustainable services in agriculture. The emergence of an idea generation model would greatly benefit representatives of agriculture in successfully developing new sustainable services. To suggest the necessary solutions, this article aims to research, develop, and present the idea generation model necessary for creating new sustainable services.

Based on the requirements for creating an idea generation model for sustainable agriculture services, the developed model provides specific stages to help generate ideas for modeling the sustainable services.

2. Materials and Methods

Increasing competition in the business sector, especially in the agricultural field, dictates the need to seek and implement innovations. The most successful way to compete effectively is to improve customer satisfaction. Therefore, the introduction of innovative services that effectively solve specific agricultural problems will tend to be viable. The article emphasizes the focus on the customer to be the "source of service innovation ideas". Still, the involvement of the product users and agricultural staff depends on the stage of generating ideas under the suggested model, which includes gathering information, receiving ideas, and other stages. New product development should be a continuous, long-term-oriented process. In the recent decade, significant attention has been given to the sustainability of services and production, obliging businesses not only to run activities with a sustainability focus but also to follow new regulations issued by governments in many countries. Thus, this new tendency requires agricultural services to be not only practical but also sustainable.

Nevertheless, businesses face the problem related to the fact that both science and practice lack an instrument to help generate business ideas. The creation of this kind of instrument would greatly help the persons of interest create sustainable services. The article aims to provide a model allowing all kinds of agricultural businesses to gen-

erate sustainable ideas in order to become both sustainable and competitive in the nowadays market.

First, it must be stated that the modelling of the idea generation process for designing sustainable services in the agriculture sector varies in its approaches due to the need to integrate sustainability issues into the process. These result in the merging of specific requirements for the effective modeling of sustainable services. Below are the insights of scholars on systematizing the best practices of sustainable innovation and the requirements for idea design models.

The research methods encompass scientific literature analysis and the development of a new service assessment model. The collected information was used to develop a process model for generating ideas in sustainable service design for agriculture. The following section provides the requirements for designing the idea generation model.

2.1. Requirements for the Modeling Process of Idea Generation for Sustainable Service Innovation in Agriculture

To create a model useful for generating ideas for designing services specifically for sustainable agriculture, it is essential to determine the requirements for the model in the field. Research shows that for sustainable agriculture policies to be effective in some regions, they must be participatory and tailored to the specific local environment [8]. Therefore, the model should identify some particular difficulties or problems the community members/customers face. This means the co-designing process engages stakeholders to contribute to the problem definition process, leading to innovation. Nevertheless, the inclusion of community members, NGOs, government institutions, academics, and multi-actor platforms helps build strong ecosystems and promote accountability, which is an inseparable factor of sustainability [9]. Participation of these parties in the idea generation process is vital in all stages. Especially in determining the need to solve a particular problem in sustainable agriculture. As practice shows, not all the identified issues or difficulties of the customers may be considered for a solution. Therefore, the model needs to implement a phase of selecting the right problems to address while designing the sustainable service.

What is more, a technological advancement plays a pivotal role in promoting sustainable agricultural development. Other researchers claim that the farming practices should be built on a scientific, technological and environmentally responsible background thus making it more effectively productive. Solutions such as precision agriculture mechanization and smart irrigation not only increase productivity but also strive for environmental goals [10]. To help model the ideation process, digital technologies (e.g., remote sensing, large-scale data analytics, and algorithmic systems) can be applied in the decision-making process. The computational tools applied may propose hybrid ideation frameworks that combine machine-based pattern recognition with human contextual insights. Other data-driven methodologies include text mining, topic modeling, network analysis, and other text-based datasets (CRISP-IM, CRISP-DM), particularly the demonstration of measurable outcomes [11]. All these help detect ideas from various data sources for the sustainable ideation stages [12–14]. They help understand, analyze, and follow the ecological and socio-economic dynamics and greatly help estimate the implementation and feasibility of ideas in the idea generation process. **Table 1** summarizes the requirements for the modelling process.

In order to choose the right method for idea generation, the criteria for the latter method must be set first. Depending on the situation and conditions, the most relevant criteria in sustainable agriculture usually involve the usage of resources for the process of idea generation. Consequently, an idea generation method must be chosen. Therefore, methodologies such as design thinking, value mapping, and others are highly suitable in the sustainable idea generation stage for creating the value that is socially inclusive, ecologically viable, and responds to stakeholder needs [15]. This value ideation technique can be used in the idea generation stage of the model and is suitable for identifying creativity at multiple levels [16]. Another essential requirement for the model is alignment with the agricultural innovation governance systems [17]. Thus, the farmer has to be aware of the legal regulations and policies to be followed while delivering the sustainable services [18]. The mentioned dimensions must also be integrated into the model creation framework when setting the proper criteria to determine the best method for idea generation.

Table 1. Requirements for the modelling process of idea generation for designing sustainable services in agriculture.

A Model Must Comply With	Description	The Authors Justifying The Theory With Their Research
Integration of creativity and sustainability	The modeling process must structurally embed stages that surface multi-stakeholder values, express and adopt ecological, social, and economic benefits.	Geissdoerfer et al (2016) [15], Dentchev et al (2023) [16], Hafish and Famiola (2024) [9], Khwidzhili and worth (2017) [8]
Governance and knowledge system considerations	Models must include dimensions representing institutional structures, advisory networks, and extension services to ensure practical feasibility and uptake.	Boon et al (2021) [17], Masi et al (2022) [18], Zhang et al (2023) [10]
Information-driven and machine-supported ideation	The model should integrate modules for data collection, analytical processing, and pattern recognition to guide idea discovery, blending qualitative co-design insights with quantitative trend identification.	Ayele & Juell -Skielse, (2022) [12], Ayele (2021) [13], Tsoumas et al (2022) [14]
Dynamic capabilities and modular sustainable business modeling	Models must delineate sense-seize-transform cycles and include cognitive evaluations of business model alternatives that incorporate ecological and service dimensions.	Oliveira -Dias et al (2022) [19], De Lauwere et al (2025) [20]
Barriers and enablers: feasibility and desirability factors for modelling sustainable services	The modeling process must include early-stage filters to assess idea compatibility, acceptance likelihood, resource requirements, and perceived ease—all within both desirability (farmers' motivations) and feasibility (technical/institutional) dimensions.	Rizzo (2023) [21]

In the analyzed innovative and sustainable context, due to a rapidly changing environment, companies need to develop an organizational capacity to rapidly transform business models, mobilize resources, and identify opportunities [19]. Therefore, the business models need to be oriented towards ecosystem services, and farmers should embed the capabilities to perceive the advantages and compatibility of sustainable services compared to traditional farming. Moreover, the high complexity of the model, its cost, and inflexible design might become barriers, causing the rejection of innovative models [20,21]. Thus, the model needs to estimate the feasibility of the idea.

Covering all the requirements discussed above, the model should be easily applicable, based on multiple criteria, and offer various approaches and techniques for idea generation, considering the problems, conditions, and resources involved.

2.2. Model of the Idea Generation Process for Designing Sustainable Services in Agriculture

Based on the analyzed requirements, a model for idea generation in designing sustainable services was developed **(Figure 1).** The application of the model is suitable for solving problems in sustainable services in the agriculture sector.

The developed model encompasses the stages of identifying the problem, determining the need for a solution, establishing the necessary criteria for selecting the appropriate method of idea generation, followed by the process of generating ideas under the chosen method and estimating the feasibility of the sustainable idea for implementation. A more detailed presentation and justification for implementing it are given in the Results and Discussion section of this article.

3. Results and Discussion

The proposed model of idea generation for designing sustainable services suggests identifying the difficulties or problems that customers, local communities, or other parties involved face. The consumer feedback surveys, consumer interviews, and interviews with sales staff are the primary sources of problems and difficulties to consider. Based on these, the company can assume and project the demand for sustainable services in agriculture.

Below is the multidimensional framework for identifying needs in sustainable agricultural services (**Table 2**).

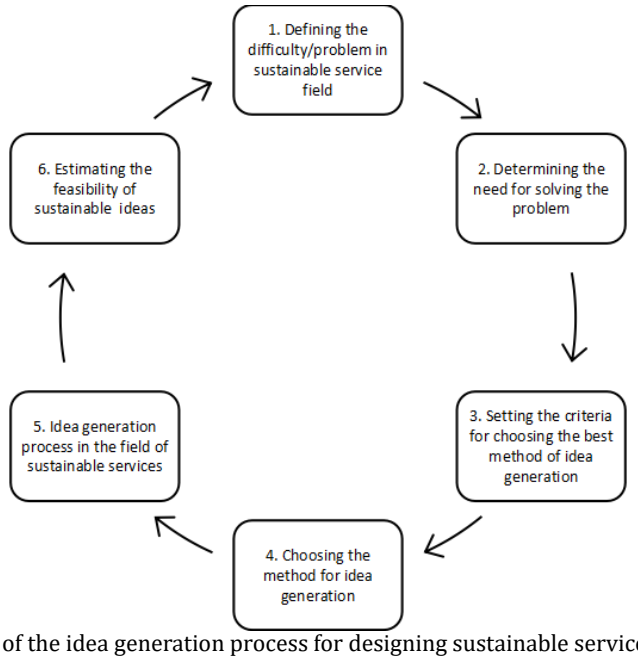

Figure 1. Model of the idea generation process for designing sustainable services in agriculture.

Table 2. A multidimensional framework for identifying needs in sustainable agricultural services.

Theme	Description	Key References
Psychological and socio-economic factors	Perceived benefits, attitudes, control, education, and networks that shape farmer needs.	Rosário et al (2022) [22], Begho et al (2022) [23]
Service system qualities	Accessibility, relevance, and the quality of process and outcomes that influence farmer satisfaction and demand.	Kenfack Essougong et al (2023) [24]
Customer voice methodologies (QFD)	Methods for capturing end-user preferences to align service design with quality requirements.	Wicaksono & Illés (2022) [25]
Technology alignment	Ensuring that digital and precision agriculture tools align with farmers' capacities, cost factors, and consumer values.	Castellini (2025) [26], Mushi et al (2025) [27]
Stakeholder co-creation	Participatory certification and CSA (Community Supported Agriculture) approaches that incorporate shared values and network dynamics in service design.	Takagi et al (2024) [28]

Thus, the main problems in organizing sustainable agricultural services are finding the balance between environmental sustainability and economic viability, maintaining the quality of sustainable services, which can greatly influence customer loyalty, and the latter being the driver of service innovations. A notable interconnectedness is observed between economic growth, social equity, and environmental health. Mapping the quality attributes that consumers value in the agricultural business and relating them to customer preferences may shape the upstream design of sustainable services. To continue, determining the need for solving a particular difficulty or problem, as well as improving a sustainably problematic issue received from the sources in the first stage, is the next step of the ideation cycle. In this stage, only the specific difficulties or problems are selected that under the prioritization of the representative in agriculture are meaningful and purposeful to deal with.

In the next stage, multiple criteria must be set for choosing the right idea generation method to be employed. These may involve criteria related to timing, duration of idea generation, the problem complexity, quality or quantity of ideas, the sample, facilitation, resources specific conditions needed, as well as the level of sustainability of the problem solved.

The fourth stage involves creative methods for idea generation. These may include e.g., brainstorming. This method allows a free-flow of ideas on any topic, and is based on quantity over quality. With some further methods, the majority of brainstormed ideas can be refined. Mind mapping allows elaboration of one idea developing it into a mind-map where the connections between the

sub-ideas can be seen. The SCAMPER method catalyzes innovation by specifying what to substitute, combine, adapt, modify, put to another use, eliminate and reverse. A silent idea generation in the Brain-writing method allows 6 participants to write 3 ideas in 5 minutes, then pass their ideas to other participants for additional insights. Design thinking, being a very popular human-centered idea generation method, covers 5 steps: Empathize, Define, Ideate, Prototype, Test. Crazy 8s is a rapid idea generation method, where participants fold the paper into 8 sections, and write or draw ideas in 8 minutes. Six Thinking Hats is a role-playing method, where each hat represents a different emotion. The method is useful in discussing idea suitability too. Role storming technique helps to come out of a habitual pattern of thinking as participants role-play different personas and generate ideas from their perspectives. Morphological analysis is a structural method that breaks the problem into different aspects, discusses possible variations, and puts them into novel solutions. Finally, the tenth most popular method used might be the Random Word/Stimulus Technique. It suggests an entirely unrelated word to call new associations and creative ideas.

The next phase presented in the model is the idea generation process itself. Using the chosen methods, representatives of the agricultural business generate ideas for solving particular problems and select them for the next stage of idea generation.

The final stage of feasibility assessment encompasses the critical selection of ideas to be realized, based on the company's resources, capabilities, regional climate conditions, consumer demand, and sustainable projects, among other factors. If no specific idea is approved at this stage or some amendments need to be made, the ideation process starts from the beginning.

To verify the practical application of the model, a survey was conducted. Two thousand five hundred sixty-seven customers were interviewed in 11 supermarkets of Kaunas city in April and May 2025. The main supermarkets of chain stores, including Maxima, IKI, NORFA, and Šilas, were chosen as the major locations to collect data. The customers were asked five questions related to difficulty accessing sustainable services of the agriculture sector. The questions were as follows (**Table 3**): 1. Do you have enough information about ecological products and services? 2. Are you satisfied with the selection of eco-friendly foods and products in supermarkets? 3. Do you consider there is a difficulty in buying ecological food production at the time and places convenient for you? 4. Are you interested in acquiring ecological products and services? 5. Are you satisfied with the prices of ecological products and services?

Table 3. Analysis of the generalized survey results on customer opinion regarding the accessibility of sustainable products and services.

	Statement	Percentage of Positive Answers
1.	Customers have enough information about ecological products and services.	86.8%
2.	Customers are satisfied with the selection of eco-friendly foods and products in supermarkets.	62.3%
3.	Customers find it easy to acquire ecological food production and sustainable services at the time and places convenient for them.	57.5%
4.	Customers are interested in acquiring ecological products and services.	90.1%
5.	Customers are satisfied with the prices of ecological products and services.	76.5%

Thus, analysis of the survey results showed that most of the customers are primarily interested in the ecological production (90.1% of the respondents) and have sufficient information on the ecological products and services (86.8%), they can also afford the prices for the ecological products (76.5% of the respondents), but the assortment in the supermarkets is not satisfactory (62.3%). Moreover, the biggest problem appeared to be a low possibility of accessing ecological foods and services in many parts of the city at a time convenient for them (57.5% of the respondents)(**Table 3**).

Based on the research results, the aim was to prove the application of the idea generation model in designing sustainable services. For the first—problem

identification—stage, a survey was conducted to identify the number of problems the environment-oriented customers face. Accessibility of ecological and sustainable services was recognized as the most common among the respondents. Thus, according to the model, the low accessibility of sustainable services was determined as the most significant need for a solution. To select the most suitable method for idea generation, specific criteria were established. Considering agriculture as the sector generating the lowest income compared to others, and farming activities being time-consuming, the requirements for the method were set. They sound as follows: 1. Requiring low financial resources; 2. Least time-consuming for the idea generation process; 3. Moderately high number of ideas the method provides; 4. Method supporting the sustainable approach; 5. Requiring low capabilities and knowledge on the issue. The criteria for choosing the method are depicted in **Table 4.**

Table 4. Criteria for choosing the method of idea generation.

Criterion	First Line Manager 1	First Line Manager 2	First Line Manager 3	First Line Manager 4	First Line Manager 5	First Line Manager 6	in Total	Significance of Criteria
1. Requires low financial resources;	30	30	20	30	20	15	145	0.24
2. Least time-consuming for the idea generation process;	30	10	20	10	20	30	120	0.2
3. Moderately high number of ideas the method provides;	20	50	35	10	15	20	150	0.25
4. Method supporting the sustainable approach;	10	5	10	20	30	15	90	0.15
5. Requiring low capabilities and knowledge on the issue.	10	5	15	30	15	20	95	0.15
	$\sum =$ 100%	$\sum =$ 100%	$\sum =$ 100%	$\sum =$ 100%	$\sum =$ 100%	$\sum =$ 100%		1

Based on the new service concept assessment[29], the relative importance (significance) of the criteria was determined (1):

$$W_j = \sum_{u=1}^{m} W_{ju}; j = \overline{1,k}, \quad (1)$$

Where: W_j —the sum of all expert estimates according to all criteria; *j-th* criterion *u* expert's estimation; *m*—the, number of experts. The relative importance (significance) η of the requirements is determined by the formula (2):

$$\eta_j = \frac{W_j}{\sum_{j=1}^{k} W_j}; j = \overline{1,k}, \quad (2)$$

The concept that yields the maximum quantity of points is considered the best. At this stage, first-line managers were chosen as experts to evaluate the criteria.

For choosing the proper method for idea generation, the optimal one might be determined using the new service concept assessment[29] (3).

$$P_i = \sum_{j=1}^{18} K_{ij}\eta_j \quad (3)$$

Where: P_i—total value of concept *i;* K_{ij} – the value of concept i assessment according to criterion *j;* η *j*—the importance (significance) of criterion *j*; 5—the number of criteria. The values of the cumulative criterion Ti enable the ranking of concepts. **Table 5** presents the answers of the expert group (first-line managers) using this method, to the greatest extent, meeting the set criteria for idea generation is calculated.

According to the analysis, the most suitable method for the current case and conditions was brainstorming. As the expert session results show (**Table 5**), the brainstorming method met the set criteria to the greatest extent and was ranked as the first among the other 8 alternatives, including the Mind-mapping method, the 5 thinking hats method, SCAMPER, the Brain-writing

method, Crazy 8s method, Role storming method, and the Design thinking method. Based on the SAW (Simple Additive Weighting) multi-criteria decision-making method (which allows assessing various alternatives under the assigned weight for each criterion discussed), the brainstorming method seems to meet several important criteria; therefore can be considered as the simplest and requiring the least resources by the farmers while generating ideas on sustainable services in agriculture.

Thus, the further idea generation process was conducted using the brainstorming method. The brainstorming session generated five main ideas for solving the accessibility problem of sustainable services: establishing a dedicated space for ecological foodstuffs in every supermarket chain, selling foodstuffs online with home deliveries, offering ecological foodstuffs in a special booth adjacent to major supermarkets daily, and delivering to offices and workplaces. After estimating the feasibility of the ideas, one, in particular, was chosen—opening a booth of ecologic foodstuffs next to the major supermarkets, open in convenient hours for the customers.

Table 5. Expert assessment session on choosing the proper method for idea generation.

Criteria Alternatives	1. Requires Low Financial Resources		2. Least Time-Consuming for the Idea Generation Process		3. Moderately High Number Of Ideas in the Method Provides		4. Method Supporting the Sustainable Approach		5. Requiring Low Capabilities and Knowledge on the Issue		in Total	Rank of Every Alternative
	Significance Score	0.24 Result	Significance Score	0.2 Result	Significance Score	0.25 Result	Significance Score	0.15 Result	Significance Score	0.15 Result		
1. Brainstorming	10,8,9,10,10, 9,9 = 65	15.6	10,9,9,10, 8,9 = 55	11	9,10,10,9, 10,10 = 58	14.5	9,9,8,10, 8,7 = 51	7.65	10,9,10,9, 10 = 48	7.2	55.95	1
2. Mind-mapping	10,10,9,9,8,8 = 54	12.96	8,7,7,6,8,9 = 45	9	10,9,8,10,8,9 = 58	13.5	8,7,8,6,9,8 = 46	6.9	10,8,6,7,10,8 = 49	7.35	49.71	2
3. SCAMPER	9,10,10,8,7 = 44	10.56	8,6,8,9,7,8 = 46	9.2	8,7,8,8,7,6 = 44	11	8,8,7,9,10,6 = 48	7.2	9,8,7,10,8,7 = 49	7.35	45.31	4
4. Brain-writing	8,9,7,7,10,10 = 51	12.24	9,8,9,7,8,7 = 48	9.6	5,5,7,8,6,7 = 38	9.5	8,7,8,6,7,8 = 44	6.6	8,7,6,8,8,9 = 46	6.9	44.84	5
5. Design thinking	10,9,8,9,10,10 = 56	13.44	8,8,7,7,8,6 = 44	8.8	5,6,7,6,8,9 = 41	10.25	7,6,6,8,6,8 = 41	6.15	5,5,6,7,5,8 = 36	5.4	44.04	8
6. Crazy 8s	10,9,8,7,9,9 = 52	12.48	10,10,9,10,9,10 = 58	11.6	6,5,6,7,6,8 = 38	9.5	8,6,6,7,5,8 = 40	6	9,5,8,6,7 = 35	5.25	44.83	6
7. 5 thinking hats	8,9,8,7,9,8 = 49	11,76	6,8,7,6,8,6 = 41	8.2	8,7,8,6,9,10 = 48	12	9,8,9,7,10,8 = 51	7.65	6,5,6,7,8,9 = 41	6.15	45.76	3
8. Role storming	8,9,7,9,8,8 = 49	11,76	8,6,7,6,9,8 = 44	8.8	5,6,8,7,6,8 = 40	10	8,9,7,9,9,8 = 50	7.5	8,6,7,6,8,7 = 42	6.3	44.36	7

The testing of the instrument shows that it can be used not only for generating ideas for designing sustainable services but also for other types of services.

4. Conclusions

1. Development of sustainable services, particularly in the agricultural sector, requires active collaboration among diverse stakeholders, including scientific representatives, local communities, NGOs, and government institutions. Achieving long-term sustainability depends on integrating ecological goals, productivity, and digital innovation. Embedding social, economic, and environmental values into the idea generation process, alongside adaptability, remains a key challenge in developing essential sustainable services. This multifaceted and collaborative approach is vital for advancing sustainable innovation.
2. The presented model helps companies generate ideas when designing new agricultural services based on sustainable approaches. The model enables the identification of difficulties and problems in the field of sustainable services, which is followed by the determination of the specific problem to be solved. Setting criteria necessary to choose the proper method for idea generation helps to select the most effective method for the current situation. The variety of methods suggested differs in terms of timing, resources, and decision-making process; therefore, the multiple criteria methods help in picking the most optimal one. The idea generation stage provides a variety of ideas for solving the identified problem, and the most suitable one

can be chosen in the last idea feasibility estimation stage.

3. The method is proven by research and can be used for designing new services in sustainable agriculture or other fields. It can help to create new services, identifying and prioritizing the problems with existing ones. Creative idea generation methods would allow performing the process of idea generation within the team at a low cost. As environmentally and socially oriented customers play a great role in changing the market tendencies, rapid ideation, change, and adaptation of services using this model can be a great facilitator.

Author Contributions

Each credited author has contributed to the article significantly: R.D. created the methodology and developed a theoretical framework; S.J. analyzed the data and calculated the results. R.D. and S.J. contributed to the design and implementation of the research; R.D. contributed to the design and writing of the manuscript. All authors discussed the results and writing of the manuscript.

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Conflicts of Interest

The authors disclosed no conflict of interest.

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