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The Role of the Social Licence to Operate in the Emerging Bioeconomy—A Case Study of Short-Rotation Coppice Poplar in Slovakia

Christine Pichler [1], Daniela Fürtner [2,*], Franziska Hesser [1], Peter Schwarzbauer [2] and Lea Maria Ranacher [1]

1 Wood K Plus—Competence Centre for Wood Composites and Wood Chemistry, Kompetenzzentrum Holz GmbH, Altenberger Straße 69, 4040 Linz, Austria

2 Institute of Marketing and Innovation, Department of Economics and Social Sciences, University of Natural Resources and Life Sciences Vienna, Feistmantelstraße 4, 1180 Vienna, Austria

* Correspondence: daniela.fuertner@boku.ac.at

Abstract: Wood plays a key role in the endeavours of the EU to establish a circular bioeconomy based on renewable biological resources. Today, forestry on its own cannot sustainably satisfy the demand for woody biomass. Short-Rotation Coppice (SRC) represents a possible alternative production system where fast-growing tree species are cultivated on agricultural land. Thus far, lacking engagement from farmers and public opposition against other bioenergy projects have hindered the expansion of SRC. At the same time, society does not consider wood unconditionally sustainable anymore. The Social License to Operate (SLO) describes the dynamic relationship between industries, their communities, and other stakeholders. The present study adapted a quantitative SLO model based on integrative socio-psychological relationship modelling and applied it to a case study in Slovakia. The roles of trust, fairness, impact assessment, and governance hold for the establishment of social acceptance were analysed with Structural Equation Modelling (SEM). The model revealed the perception of individual benefits as the strongest predictor for social acceptance. The average level of social acceptance was found to be between "Acceptance" and "Approval". The results thus show that SRC currently must not face societal pressure in Slovakia. However, the SLO is not static and must be constantly re-evaluated.

Keywords: land use change; social justice; short-rotation poplar (SRP); dendromass; sustainable development

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1. Introduction

Short-Rotation Coppice (SRC) represents a relatively new, not widely spread form of land management, where fast-growing tree species are cultivated on agricultural land [1]. Currently, SRC is mainly used as biomass for the energy sector [2]. However, originally in the 1970s, interest in SRC was high because a shortage in pulp wood for the production of paper and cardboard was anticipated and biomass from SRC was considered as an alternative feedstock [3]. Recently, the demand for woody biomass has increased and cannot be sustainably satisfied by forestry on its own anymore [4]. SRC therefore represents a fast-growing, suitable alternative to traditional wood sources.

At the same time, the forest-based sector must face the consequences of climate change and the resulting political and societal aspirations towards a bioeconomy [5]. Contrary to the current economic system, which is based on fossil resources, a bioeconomy aspires to a more sustainable system based on renewable biological resources [6]. The EU wants to achieve this by developing innovations in all three dimensions of sustainability: environmental, economic and social [7]. As a part of this strategy, the Public-Private Partnership (PPP) consortium Dendromass4Europe (D4EU) received funding to establish SRC-based value chains for four new bio-based materials in Eastern Europe, with the upstream processes of its first project being situated in western Slovakia. Therefore, the goal is to create cascading value chains, where the dendromass is utilized in multiple material use phases before the final step of energy extraction [8].

Research on SRC focuses mainly on its economic or ecological properties [4,9,10], as well as on its technical implementation [11], and it seldomly covers Eastern Europe [12]. In addition, research on value chains with SRC feedstocks for material use is also scarce and yet to be conducted [13]. The relatively low engagement of Slovak farmers in SRC operations [14] and public opposition against other projects related to landscape changes or bioenergy [15,16] suggest a necessity to focus on the perception of all stakeholders involved to ensure the successful establishment of these value chains and to reach their social acceptance [17]. One approach to evaluate social acceptance is represented by the concept of the social licence to operate (SLO), which refers to the ongoing acceptance of business operations by its stakeholders, local communities, and the broader public [18]. In Australia, the forestry industry has been confronted with a declining SLO for the management of plantations and native forests in recent decades, which ultimately lead to consequences in the operating environment and for business practices [19]. Although social acceptance is also crucial in other operations associated with land use changes [15], it is less understood what constitutes a SLO and how it can be achieved within other fields than the mining industry [20]. However, an inadequate level of the SLO can affect market access for products and result in additional legislation and governing activities of industries, not least protests and legal or industrial action, which also impact business operations in general [19]. The present study aims to fill this research gap by adapting a quantitative SLO model based on integrative socio-psychological relationship modelling—first created by [21] and further developed in other studies [22,23]—and to apply it to SRC-based value chains.

The following research question will be addressed:

What are the main drivers to earn and maintain a SLO within SRC-based value chains in Slovakia?

2. Conceptual Background

2.1. What Is the Social License to Operate?

The concept of the SLO was first established in the mining industry in the late 1990s as a response to many mining companies experiencing financial losses through community resistance [17]. Growing public pressure showed that expectations about industry performances were changing. Companies had to face criticism and social rejection of projects that had successfully undergone formal or legislated evaluation processes and fulfilled regulatory requirements [24]. However, shifts in societal values and their impacts on industry caused by an emerging public interest in environmental and social problems linked to resource extraction are not exclusive to this industry sector [25]. Especially since the mid-2000s, the concept of the SLO has moved beyond its initial application in the mining industry and has since been applied to a variety of different industries [17]. Fundamentally, every company needs permission from governments, communities and other stakeholders to do business [26]. Essentially, a SLO is a list of demands and expectations for the form of business operations that multiple local stakeholders and the broader civil society request [27]. The SLO does not represent a legal licence issued by a governing authority. It must therefore be re-evaluated over time since societal expectations are constantly changing and evolving [28]. On the other hand, firms also expect certain actions from communities, but typically these are not as clear or explicit. The SLO reflects the quality and strength of the relationship between an industry and a community of stakeholders [25]. Preserving the SLO requires constant implementation of business activities that secure a positive relationship with the local community and other stakeholders [20]. There is still an ongoing debate about a clear definition for the SLO [29]. The SLO indicates the community's perceptions of the acceptability of a company and its local operations [30]. While many companies adopt the SLO because it secures their interests, others use it for establishing commitment to norms and values when expanding their activities to emerging economies [31].

2.2. The Social Licence of Short-Rotation Coppice in Slovakia

Coppice management has a long tradition in Europe and is described as the oldest form of sustainable forest management [1]. However, in recent history many coppice forests were either transformed into high forests, or the areas were deserted [32]. Three different types of coppice stands can be distinguished: conventional coppice, short-rotation forestry and SRC. In contrast to the other forms, SRC is established on agricultural land and has a relatively short rotation period, which is, depending on the planted species, usually between one and five years [2]. Although SRC is more productive per area than natural forests in Europe [33], it still represents a niche sector, with its focus being on biomass production for energy generation [34]. Despite its rising profitability, only a few farmers have been converting to SRC in the EU [4]. This is also the case in Slovakia, where only a small share of the agricultural land area is used to cultivate SRC. The theoretical potential for SRC on agricultural land is estimated to be 45,000 ha, of which, in 2018, only 150 ha were used [14]. Slovak law requires the consent of the landowner before engaging in SRC, which aggravates the situation for farmers since 90% of the agricultural land in Slovakia is leased [35]. Furthermore, considering that land registration in Slovakia is a rather complicated process, conflicts between landowners tend to arise [36]. Slovakia has limited arable and agricultural land areas, 23% of which are in protected areas, and their overall area is decreasing [37]. Since Slovak law permits growing SRC only on marginal agricultural soils of classes 5-9, conflicts with food and fodder production are avoided [12]. However, this restriction is not always ideal, since soil classification may be flawed [38] and the biomass yield on these soils may not always be profitable [39]. If only marginal agricultural land not situated in protected areas is addressed, the potential for SRC cultivation in Slovakia is reduced to 23,000 ha [40].

No research on the SLO directly linked to SRC exists to the authors' knowledge. Yet, the concept has been adapted to related sectors like forestry [16,24,25], the pulp and paper industry [27], agriculture [41–43], and to alternative energy production systems [44]. The following section will examine some insights from these fields, which are relevant for SRC plantations.

A study compared the understanding and the application of the SLO in four different energy industries: (1) the mining industry, (2) the wind power industry, (3) the geothermal energy generation industry, and (4) the carbon dioxide capture and storage industry. The authors argue that all these industries share the capacity to impact local stakeholders directly through landscape modifications [44]. This aspect also relates to SRC operations, since they represent significant landscape changes as well [45]. Another study analysed the importance of social acceptance in renewable energy projects, which concluded that when compared to conventional power plants, renewable energy generation is smaller-scaled, which enlarges the importance of decisions on site selection. This also relates to the fact that, due to renewable energy generation being more decentralized, it is more visible and closer to the end-consumers, thus creating more tension with local communities. Furthermore, the extraction of fossil resources (e.g., coal) takes place underground, making it also less perceptible to the general public [46]. These problems also arise when bioenergy is addressed [47]. The long period before the cultivation of SRC turns a profit when compared to other agricultural operations is also problematic, since local communities are often confronted with deciding between short-term costs and long-term benefits of energy projects [3].

A further study compared the SLO of the mining industry to its application in forestry and found that, although these two sectors vary in many aspects, their methods of managing and recognizing the environmental and social impacts of their operations are alike. The necessity to develop specific strategies for addressing indigenous and local rights has become apparent in both fields [25]. Yet, although the forestry industries have learned to identify and mitigate risks in economic and environmental contexts, socio-political risks have often received less attention [19]. The views of what constitutes trust and social acceptance may differ depending on the social, cultural or political background of communities [25]. However, social acceptance does not only depend on cultural differences, but also on the values individuals hold [12], which can still differ among communities of the same cultural background [46]. The forest-based industries in North America have already used the concept of the SLO in 1999 to analyse the relationships with their stakeholders and to present projects for resolving matters of concern to civil society [48]. Today, the forest-based sector is faced with complex problems, like the intensification of forest management and the establishment of new practices or technologies [16]. This is also of importance for SRC-based operations. A study about the compliance of farmers with cultivating SRC in Slovakia found that some farmers were nervous about cultivating SRC crops, since this new practice was not in line with their beliefs. Among other factors, they were concerned about risking food security, the ethical component of prioritizing profit, and their reputation [12]. While it is apparent that nowadays the forest-based sector must satisfy society's growing expectations of its social and environmental performance [24], the mining industry had to face similar problems previously [21]. In Australia, the mining industry represents a so-called mature industry. It has been extracting resources since the late eighteenth century and is still of great significance for the Australian economy [44]. This refers also to the fact that the importance of prioritizing community relations is already recognized as a crucial part of managing risks and opportunities in the mining industry [49]. Furthermore, the activities of both sectors were faced with disapproval from civil society [19]. The SLO concept can therefore help to examine how community expectations interact with the acceptance of resource management [21].

3. Materials and Methods

3.1. Case Study

D4EU is a project that started in 2017 and has a runtime of five years [8]. It is part of the PPP "Bio-Based Industries Joint Undertaking", which was founded in 2014 and was set up as one of the pillars of the Bioeconomy strategy of the EU [50]. PPPs aim to coordinate public and private resources towards the achievement of shared objectives. Although the actors' underlying motivations differ in general, cooperative planning and execution of activities are meant to lead to a beneficial outcome for everyone involved [51]. The main goal of D4EU is to create efficient bio-based value chains for four new bio-based materials: functionally adapted lightweight boards for furniture production, eco-fungicidal moulded fibre parts for packaging production, bark-enriched wood plastic composite (WPC) profiles and bark-enriched WPC granulates [52].

With its operations, D4EU aims to create new agricultural jobs and additional income for farmers. Installation of plantations, their upkeep, protection, harvesting, further processing and transport create new long-term employment, while generated income remains with local farmers and entrepreneurs that are directly or indirectly linked to the value chains [8]. The development of such regional wood-based value chains can result in higher living standards and a better carbon balance [53]. SRC utilizations can also reduce abandonment of agricultural land in rural areas [54] and potentially also reduce the trend of rural depopulation in some regions of Slovakia [55]. These efforts are supposed to benefit the local population, so it is of importance to understand their system of values to reach public acceptance and farmers' engagement in SRC [12].

3.2. Statistical Path Model

There exists an ongoing debate about the possibilities of measuring the SLO [29]. Recently, quantitative analyses of the SLO have been modelled and are gaining popularity, since other models were not successful in their empirical validation [56]. This study is based on such a quantitative model, which has previously been developed [21] to measure the SLO based on social and psychological intergroup relations [21], and was subsequently further developed and extended [22,23]. The aim of this model is to find a consistent and well-defined measurement tool to assist industries, communities, and governments in understanding the requirements for a SLO and what is needed to establish functioning relationships between stakeholders [21]. Overall, it aspires to create a better outcome for all stakeholders involved [25]. The main drivers for social acceptance within this model are: (1) balance of benefits over impacts, (2) procedural fairness, (3) distributional fairness, (4) governance capacity, and (5) trust in industry [22]. Following the study of [23], an experimental survey design was developed. Since mining operations differ significantly from SRC, it was necessary to adapt the assessment of these drivers to the case study.

3.2.1. Balance of Benefits over Impacts

In the model by [22], the overall balance of perceived benefits over impacts was measured by assessing the individual perception of the respondents in six different categories. Figure 1 shows the adapted categories for the present study, where dashed categories were newly added to the evaluation. The effect of these categories on social acceptance can be positive or negative. The original study also assessed benefits from infrastructure developments and the resulting impacts of rising costs of living. The establishment of a newly founded mining site oftentimes requires infrastructure expansions. This involves not only road construction but also housing for workers to avoid a shortage in housing or increasing costs of living [44,49]. Since D4EU's poplar plantation sites are established on already existing agricultural land, no construction of additional housing facilities is needed [8]. Therefore, and due to the smaller scope of the project, infrastructure changes are not considered relevant, especially since the involved facilities are decentralized and dispersed.

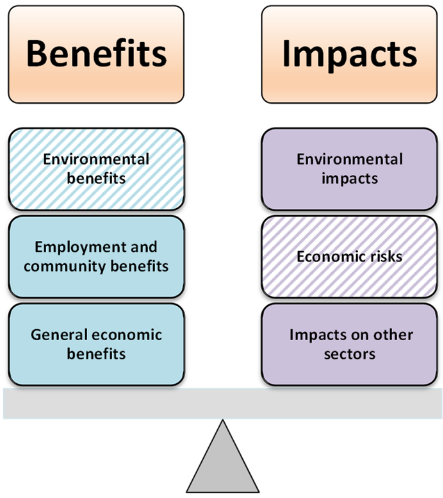

Figure 1. Adapted categories for the assessment of balance of perceived benefits over impacts (dashed categories have been newly added) (modified based on [22]).

Environmental Benefits and Impacts

Changes in farm management influence local landscapes and community relationships [57]. SRC plantations are associated with both positive and negative changes to the local natural environment and the local landscape [3,45,58]. From an aesthetic point of view, SRC plantations do not differ significantly from other arable crops in the first years of their installation. However, when they develop into a multiple-meter-high thicket, the potential for conflicts with the image of traditional rural landscapes rises [59]. A further problem is the rapid visual change when the plantation is harvested [45]. However, it has been argued that the land-use change itself is of less importance than its perceived value [60]. In this context, plantations are linked to an ambiguous public opinion as well as relatively low public acceptance. Furthermore, both positive and negative consequences for biodiversity have been identified [58]. Overall, the scientific consensus is that although SRC is ecologically advantageous to intensive agricultural land use [37], uncultivated grasslands or forests show higher levels of biodiversity [2]. A preliminary evaluation of D4EU's operations after its first two years also revealed positive impacts on biodiversity when they were established on prior arable land [58]. The impact on the environment depends highly on management practices [61]. Relevant factors for the environmental impact of SRC include: the choice of harvesting technology [11], the use of fertilizers or herbicides, as well as irrigation methods [61], transportation [62], and the use of non-chemical weeding measures like disking [58]. Environmental benefits include a high potential for carbon storage [3], the reduction of soil erosion and nutrient leaching [37] and the regeneration of soils contaminated with heavy metals [37,63]. On the other hand, environmental concerns include water depletion [61], the possibility of soil degradation and a potential loss of biodiversity [64].

Employment, Community and General Economic Benefits

Perceived economic benefits of SRC include the possibility to mitigate rural depopulation by creating additional long-term collaborations between landowners and farmers [8,55], creation of new employment [12], farm diversification [3] and the generation of additional income from land unsuited for food or feed production [37]. Furthermore, local farmers and landowners are to benefit from D4EU's project, and the region is meant to profit economically overall from this project with the aim to keep the value added with the local population [12].

Economic Risks

SRC plantations are also associated with general uncertainties regarding their economic performance [33]. This stems from relatively high investment costs [65], price volatility of the dendromass [66], loss of flexibility through fixed land use [4], relatively low biomass yield on marginal soils [39] and difficulties in optimizing harvesting and transportation techniques [11]. In general, the engagement in innovative processes and value chains offers many economic opportunities, but it is also characterized by a certain degree of risk [59].

Impacts on Other Sectors

There is an ongoing debate about transforming agricultural land into land used for biomass production, which is also referred to as the food vs. fuel debate. This conflict is more relevant for energy crops that could also be used for food production, such as sugar cane or oil crops, than for non-food crops [47]. However, the energy versus material debate of wood-based products has been described as the correspondent problem in the forest-based sector [67]. D4EU aims to create a feedstock for value chains and thermal combustion of biomass is planned to only be conducted in cascading processes—when no other utilization of the material is still realisable—and only marginal soils are used [40]. Yet, conflicts between the agricultural sector and SRC plantations may still occur due to the limited availability of land in general [37] and the resulting competition for land [3]. Although the extent of this potential conflict is reduced due to SRC plantations being only allowed on marginal soils unsuited for food or feed production [8,37], errors in soil classification cannot be ignored [38]. A similar question concerns the impact of SRC on wood-based products. Although the availability of sustainable timber has recently been decreasing [68] while the demand for woody biomass grows [33], and alternative feedstocks for wood can relieve pressure on forests [68], an impact on the demand for existing wood-based products can still not be precluded. In the present study, participants were thus asked to state their opinion about conflicts with sectors related to D4EU's operations: the agricultural sector as well as the wood-processing and wood-manufacturing industries.

3.2.2. Procedural Fairness

In agricultural value chains, distributive and procedural fairness are closely intertwined [51]. Although different interpretations of fairness exist, it is associated with "the aversion to inequity" in most scientific models [69]. In this model, procedural fairness is defined as the individual stakeholder's perception of whether they have a legitimate voice in a decision-making process [22]. Research on the SLO has shown that the more involved a stakeholder feels in such a process, the more likely it will be accepted [21]. Procedural fairness influences the commitment to value chain activities as well [51].

3.2.3. Distributional Fairness

Within sustainable forest management, distributional fairness has been described as the "acceptance of forestry operations" [70] (p. 2). It refers to the perception of whether the created value is distributed fairly across all involved stakeholder groups [22] and is therefore based on the outcomes of a value chain [51]. It refers to the allocation of benefits and costs for all parties involved. This is often depicted as a sliced pie, where the size of each slice reflects the individual's share of the total pie [71]. The even balance of investments and rewards of the involved stakeholders is therefore considered a just distribution [72].

3.2.4. Governance

Since the mid-2000s, the term "new governance" has been described as a form of governing with a focus on collaboration between government and non-government actors from both the private sector and civil society [73]. The inclusion of multiple actors in governing activities enables dynamic adaptation to local conditions, the capture of added value, the legitimacy and transparency of policies and the empowerment of local communities [74,75]. In theory, the coordination of private organizations through PPPs is beneficial to less powerful stakeholders, which are, in an agricultural context, often farmers. In agricultural value chains, PPPs offer opportunities for smallholders, e.g., through investments in infrastructure, knowledge transfer, or the development of human capital [51]. Nonetheless, the motivation of private organizations may not always align with farmers' interests, which can potentially hinder the possibilities for creating common good in a social and political context [76]. Yet, governmental structures are still dominant in the agricultural sector. In agricultural value chains, firms and farmers are regulated by national government. They either constrain or enable farmers through their institutions, infrastructure, and legal framework. This affects activities in trade, resource availability, and access to information, and can potentially create the aggregation of products [51]. Concerning sustainability aspects, governments are believed to oftentimes prioritize economic interests over social or environmental interests [31]. Monitoring governance activities is also considered a key component for their success [74].

3.2.5. Trust in Industry

Research has shown that trust in industry is necessary for its social acceptance [77]. Trust has been described as comprising the following three items: to act in the best interests of society, to act responsibly and to do what is right [22]. Farmers' willingness to engage in the value-chain creation of agricultural products depends on the degree of trust they hold in their value-chain partners [51], with trust being a precondition for cooperation [74]. In agricultural value-chain management, these relationships are described as strategic alliances [78]. Historically, farmers have instead been in arm's-length relationships with buyers, which facilitates suspicion to engage in new value chain activities based on collaboration [51,79]. This is especially important in SRC-based value chains due to their longer time horizon and resulting extended contract periods when compared to other agricultural crops [33]. These factors aggravate the need for trust [25].

3.2.6. Social Acceptance

A study found that, although social acceptance is a frequently used term in practical policy literature, distinct definitions are seldom found [46]. A systematically conducted literature review analysed social acceptance within the field of land use changes and found no scientific consensus about its definition either. Rather, a variety of definitions, which often show inconsistencies, ambiguity and even contradictions when being compared, exist [15]. Acceptance on the community level has a time dimension, meaning that it changes as a project progresses [46]. In the original model, social acceptance is evaluated with the “Pyramid Model”, in which the SLO is acquired in stages, reflecting the way the community treats a company [22]. Here, four stages are distinguished: “Withholding”, “Acceptance”, “Approval” and “Psychological Identification” [30]. The process of moving from one stage to the next reflects an improving relationship, resulting from an increased social capital. The second stage, “Acceptance”, represents the community’s disposition to let "an operation continue although suspicions and objections are still present” [56]. This stage is described as a probation period for the company, where it is constantly under public surveillance. A company’s accountability, transparency, consistency, and responsiveness to the community’s concerns determine whether it can move to the “Approval” stage or not. This stage is defined by the absence of socio-political risk for a company [20]. The community’s emotional state shifts towards favourability and contentedness [30], and criticism of the project is rejected [20]. When trust is consolidated over time, the SLO rises to the level of “Psychological Identification” [56]. Here, the community has decided to fully trust a company and is willing to take responsibility for its success [31], and perceives its own successfulness in the future to rely on the company’s success [20].

3.3. Survey Participants

Since D4EU operates in multiple regions in Slovakia within a maximum distance of 200 km from the city of Malacky, for this study, people resident in Slovakia were surveyed. On the one hand, this was due to their accessibility, and on the other hand, local residents have been described as key elements in the process of granting the SLO [16,17,25]. Participants received a letter of information about SRC and about the project D4EU prior to the survey. The survey was conducted with the open-source online statistical web app LimeSurvey. Within a time frame of three months, 155 persons answered the questionnaire, of which 39 were completed, with 1 respondent answering all questions except for the last page of the questionnaire concerning demographics. A total of 19 people chose the English version of the study, while 21 answered in Slovak.

As illustrated in Table 1, 45% of respondents were female, 50% had university-level education and most were younger than 36 years. In addition, 57.5% lived in urban areas, and 35% of participants resided in the Slovak Kraj Travna in Western Slovakia. Participants were furthermore asked whether they had some connection to sectors relevant to the project. Of these, 15% stated agriculture, 10% stated forestry, and 2.5% stated the wood manufacturing or processing industries. 55% had no background in those sectors and 17.5% gave no answer. A total of 80% had at least heard of the term bioeconomy before conducting the survey, 62.5% had at least heard of SRC, and 15% had at least heard of the project D4EU.

3.4. Survey Measures

Participants were asked to answer questions regarding their social acceptance of D4EU’s project and its underlying drivers on 7-point Likert scales (1 = strongly disagree, 4 = not sure, 7 = strongly agree). Reliability was measured with Cronbach’s alpha, which is an intercorrelation coefficient for items that are used to measure a variable of a Likert scale. A value over 0.7 is considered adequate, over 0.8 is good and over 0.9 is excellent [80]. However, in practice, values above 0.6 are also considered sufficient [81]. High values suggest that items are of the same contextual dimension. Values above 0.95, on the other hand, suggest that items are redundant, which distorts their interpretive power [33,80]. To obtain the value for each SLO variable, the mean of the corresponding Likert item was calculated. Since the Cronbach’s alpha for each variable showed reliable scales, the Likert scaled items can be treated as interval scaled data, which justifies the calculation of the arithmetic mean and the standard deviation [82]. More information about the survey measures and the questionnaire can be found in the Supplementary Materials.

Table 1. Description of the sample (N = 39).

Demographic Variable		%
Age group	35 or lower	40
	36–55	35
	Above 56	20
	No answer	5
Gender	Male	42.5
	Female	45
	No answer	12.5
Highest level of education	Compulsory education	2.5
	Maturita	25
	Undergraduate degree	10
	Postgraduate degree	40
	No answer	22.5
Residential Area	Urban area	57.5
	Rural	35
	No answer	7.5
Kraj (province)	Bratislava	5
	Travna	35
	Trenčín	5
	Nitra	17.5
	Žilina	12.5
	Banská Bystrica	2.5
	Prešov	5
	Košice	2.5
	No answer	10
Background	Agriculture	15
	Forestry	10
	Wood industries	2.5
	No background	55
	No answer	17.5

Perceived benefits were measured with eleven items (α = 0.93). Environmental benefits were derived from [3,45]. Employment and community benefits were based on [23,55]. General economic benefits were based on [8,12].

Perceived impacts were measured with twelve items (α = 0.94). Environmental impacts were derived from [3,23,64], economic risks were adapted from [39,59], impacts on other sectors from [22] and possible negative health impacts from [23].

Procedural fairness was measured with six items (α = 0.81). Based on [21], participants were asked whether they felt that their opinions were respected and listened to and whether their thoughts were recognised. Items based on the perception of possibilities to participate in and influence the project were deducted from [51]. The perception of consistency in actions over time raises the level of procedural fairness [78].

Distributional fairness was measured with five items (α = 0.71). Items based on the fairness of the distribution of value creation were adapted from [22] and those concerning the fair share of benefits for the local area were obtained from [23]. The authors of [71] suggest the importance of the perception of benefits for small stakeholders from cooperation with more powerful private companies within PPPs for distributional fairness. A just ratio between rewards and investments among everyone involved in a value chain is considered to raise the level of distributional fairness [51,83].

Governance was measured with nine items (α = 0.85) adapted from [23]. Participants had to state their perception of formal governance (legislation and regulation by national government and the EU as well as PPPs), informal governance and their trust in governance.

Trust in industry was measured with seven items (α = 0.85). Derived from [23], participants were asked to state their level of trust in the involved sectors (agriculture, forestry, wood-processing and manufacturing industries) as well as in the project D4EU itself. Based on [22], it was assessed whether they trusted that these sectors acted in society's best interests, acted responsibly and did the right thing.

Social acceptance was measured by asking the participants about their overall acceptance of the project. The scale was derived from the "Pyramid" model for the rewarding of the SLO, which identifies four levels of the SLO characterised by a rising acceptance: "Withholding", "Acceptance", "Approval" and "Psychological identification" [56]. Participants could also state uncertainty about their level of acceptance towards the project.

3.5. Statistical Path Model

To systematically investigate the independent relationships between the SLO variables, a path analysis model was created with the open-source programming language R and specifically with the lavaan package, which uses structural equation modelling (SEM) [84]. The item scores of the Likert-scaled values were averaged and used as the observed variables of the model. For this purpose, the arithmetic mean of the answers for each category of the SLO variables was calculated. This follows the previous approaches of SLO modelling [21,22].

To assess the global goodness-of-fit of SEM models, so-called fit indices were used. Absolute fit indices describe the fit of the proposed theory with the data and can be used to decide which model best fits the sample data [85]. Common tools are the chi-squared test, the root mean square error of approximation (RMSEA), the goodness-of-fit statistic (GFI), the root mean square residual (RMR) and the standardised root mean square residual (SRMR) [86]. Incremental indices, on the other hand, compare the chi-squared value of a model to the chi-squared value of a baseline model [87]. The normed-fit index (NFI) and the comparative fit index (CFI) are examples of incremental indices [86]. Relying solely on the chi-square value of the model itself is not sufficient, since it only takes the discrepancy between the covariance matrices of the sample and the fitted data into account [85]. Especially for smaller sample sizes, the chi-squared test therefore lacks power and overestimates the fit of a model [86]. At least the model chi-square, the RMSEA, the CFI and the SRMR should be reported for SEM [87]. Since the adapted study [21] also used the NFI for the assessment of their model, this was also considered, but the adjusted non-normed fit index (NNFI) was used, since it is preferable for small sample sizes [86]. The literature suggests that the p-value should be above 0.05, the RMSEA below 0.08, the CFI ≥ 0.9, the SRMR below 0.08 and the NNFI ≥ 0.95 [86,87].

Following the hypotheses of [22], a SEM model was created where perceived impacts, perceived benefits, governance, procedural fairness and distributional fairness were the exogenous predictors of trust in industry. It was assumed that a high agreement on these SLO variables result in a high level of trust in industry, except for perceived impacts, which negatively influence trust in industry. Trust in industry, perceived benefits, perceived impacts, and governance, on the other hand, were considered as exogenous predictors of social acceptance. Again, all SLO variables except for perceived impacts were hypothesised to positively influence the level of social acceptance. The model is shown in Figure 2.

Trust in industry therefore has a mediating effect on social acceptance. This suggests that procedural fairness and distributional fairness do not influence the level of social acceptance directly, but indirectly via trust in industry. A SEM model with mediation effects (also called a mediation model) is used to describe a relationship between a dependent and an independent variable by including a third explanatory variable, called the "mediator variable" [87]. The independent variable is therefore the main cause of the mediator variable, which eventually results in the dependent variable. Although no direct causal relationship between the dependent and independent variable is hypothesized, the mediator variable explores the nature of the relationship between the dependent and the independent variable [88]. Furthermore, correlations between the five exogenous predictors were assumed, which follows the adapted modelling approach [21]. The relationships between these variables can be positive or negative. A positive relationship suggests that a person who states high agreement for one variable is more likely to also agree with the corresponding variable. For negative relationships, the opposite is the case.

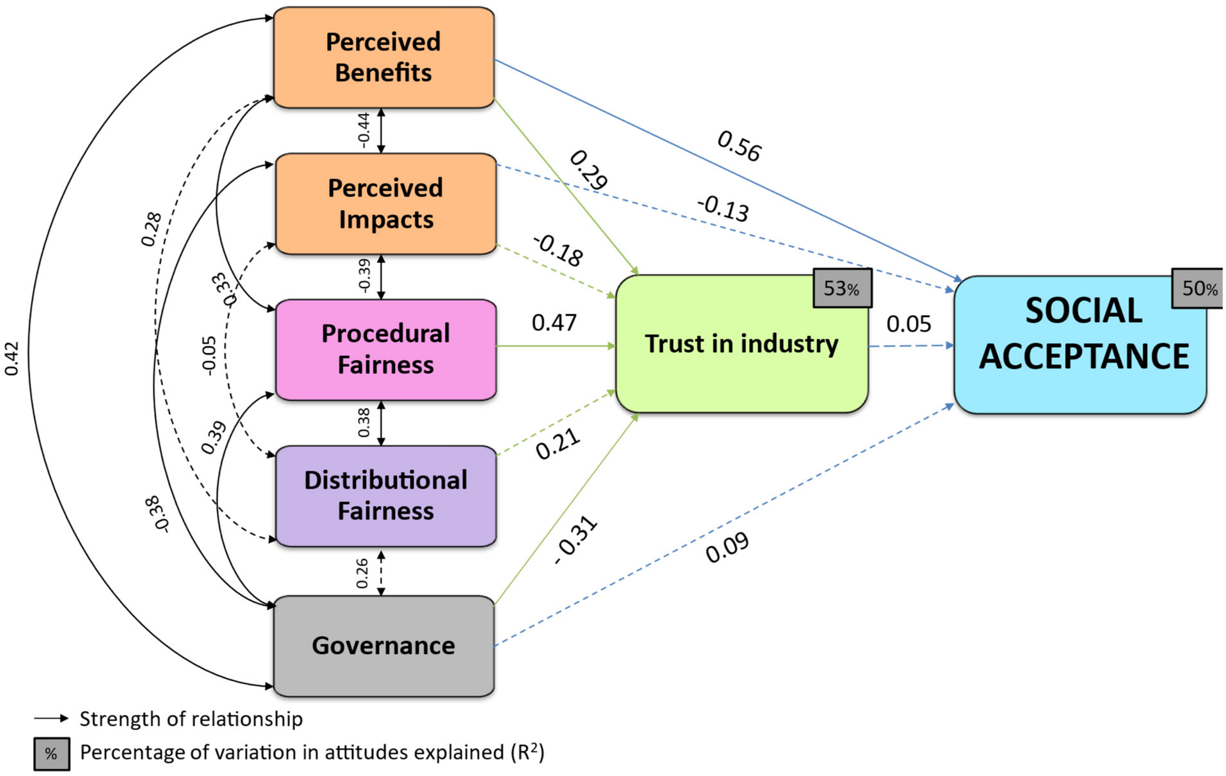

Figure 2. Simple SEM model based on the hypotheses of Moffat et al. (2017) as described in 3.5. Block lines represent statistically significant relationships; dashed lines are not statistically significant at a 95% confidence level. Standardised regression coefficients (beta weights) above the arrows signify the strength of relationship between the SLO variables. Percentages in the grey boxes above the dependent variables represent the variances of the respective variable explained by the model. The SLO variables are colour-coded. The colour of the arrow signifies which dependent variable is explained.

4. Results and Discussion

The sample was not representative of the Slovak population. It was therefore tested whether participants answered significantly differently because of their surveyed demographic characteristics. For this purpose, a Kruskal–Wallis rank sum test was firstly conducted to test for significant differences by education level. Here, the null hypothesis assumes that the location parameters of the distribution of the SLO variables are the same in each group and the alternative hypothesis is that they differ in at least one group [89]. The test showed that the null hypothesis for answers on procedural fairness ($p = 0.01$) must be rejected and that at least one of the education levels answered significantly differently from the others. To further test this circumstance, the groups were aggregated into participants with a university degree (50%) and those without (27.5%). Again, the null hypothesis must be rejected ($p = 0.01$), and the results indicate that respondents with a university degree perceived the processes less fair than those without. While 45% of participants without a university degree believed the processes to be fair (answers above 4 on the Likert scale), this was only the case for 10% of those with a university degree.

Next, it was tested whether participants answered differently by region or age, but the Kruskal–Wallis test revealed no differences in the perception of the SLO variables, neither by Kraj nor by age.

To test whether participants answered differently by gender, a Mann–Whitney U test was conducted. This non-parametric test is suitable for comparing two independent groups with small sample sizes (n < 30) [89] and represents a special case of the Kruskal–Wallis rank sum test [80]. The null hypothesis that the distribution was equal for both groups could not be rejected, which means that gender had no statistically significant influence on the perception of any of the SLO variables. The same test was conducted for differences by residential area (urban/rural) and background (agricultural, forestry or wood industries/no background). In both cases, the null hypothesis could not be rejected either. Therefore, neither the area a person has spent most of their life nor a possible background in a related field influenced the agreement to the SLO variables significantly.

The mean and the standard deviation of the SLO variables and their bivariate correlations, which were used as the basis for the SEM model, are shown in Table 2. These were calculated with the Pearson correlation coefficient, which is a measurement for the linear association of two variables. Since these values are correlation measures, no causal relationship must be assumed from significant values. However, they are indicators of the strength of the linear relationship between two independent variables [80].

Table 2. Descriptive Statistics and bivariate Pearson correlations of the SLO variables (N = 40).

	Mean	SD	1	2	3	4	5	6	7
1. Perceived Benefits	4.60	1.00	1						
2. Perceived Impacts	4.00	1.28	−0.44 *	1					
3. Procedural Fairness	3.66	1.00	0.33 *	−0.39	1				
4. Distributional Fairness	3.66	0.80	0.28	−0.05	0.38 *	1			
5. Governance	3.83	0.95	0.42 *	−0.38 *	0.39 *	0.26	1		
6. Trust in Industry	3.91	1.06	0.45 *	−0.38 *	0.60 *	0.40 *	0.11	1	
7. Social Acceptance	3.26	1.21	0.69 *	−0.44 *	0.35 *	0.22	0.39 *	0.37 *	1

* $p < 0.05$.

The global fIt indices for this model suggest an overall good fit, with a non-significant model Chi-squared p-value of 0.87, a RMSEA of 0.00, a SRMR of 0.01, a NNFI of 1.29, and a CFI of 1.00. The model explains 53% of the individual variation in the respondents' trust in industry and 50% of their social acceptance.

4.1. Balance of Benefits over Impacts

Perceived impacts were significantly negatively correlated with all SLO variables except for distributional and procedural fairness, for which no significant correlations could be determined. For perceived benefits, significant correlations were obtained for all SLO variables except for distributional fairness. While perceived benefits had a significant influence on both trust in industry and social acceptance in the model, this was not the case for perceived impacts, which did not significantly influence either of the two dependent variables. However, perceived benefits were the strongest predictor for social acceptance. There are different explanations for this. Although SRC-based operations are characterized by economic uncertainties [33], the most subject to these risks are stakeholders directly involved (e.g., farmers) in the value chains [3]. Since the target group of the present survey were Slovak citizens in general and not directly involved stakeholder groups, these risks might not be as relevant to the general community. Although the majority of respondents had at least heard of SRC before taking part in the survey, it cannot be assumed that they were also aware of economic risks, since this was not part of the information provided before the survey. Similarly, in the study from [23], respondents were probably more aware of environmental impacts and impacts on other sectors, since the negative consequences of mining operations are well known and recognized among the Australian public [90]. Another explanation for the minor role of negative impacts could be due to the fact that, although SRC operations have been connected to negative responses from local communities in the past [3], and adoption by farmers has not been successful thus far [12], D4EU's operations are mainly associated with their benefits and with a positive perception of the EU's bioeconomy strategy.

4.2. Procedural Fairness

Significant bivariate correlations were found between procedural fairness and trust in industry, perceived benefits, distributional fairness, governance, and social acceptance. Procedural fairness was found to be the strongest predictor of trust in the model, indicating that a high perception of procedural fairness positively influences the perception of trust in industry. This corresponds to the model by [21], where procedural fairness was also found to be the most important driving force for trust in industry. It has been argued that the importance of procedural fairness rises with the degree of uncertainty [51]. This is especially the case when innovative business agreements that have only been existing for a short period are compared to already established ones where uncertainty is lower. Other research has shown that procedural fairness is more important in volatile economic processes [91].

4.3. Distributional Fairness

The importance of the perception of distributional fairness for social acceptance as assumed [21] and obtained [22] in the previous SLO models could not be replicated. Significant bivariate correlations were only found between procedural fairness and trust in industry, which were both positive. This could be due to the aforementioned measurement uncertainties concerning the chosen target group. The perception of distributional fairness is affected by feelings of being treated unjustly or justly in comparison with other stakeholders involved [71]. Therefore, the lacking proximity and involvement with D4EU's operations could influence the perception of distributional fairness as well. Feelings of justice on an individual level are strongly connected to emotional reactions, which are stronger the more involved a person feels [92]. Therefore, being a Slovak resident alone might not be a sufficient criterion for the assessment of fairness among stakeholders.

4.4. Governance

As hypothesised, significant positive correlations between governance and perceived benefits, procedural fairness and social acceptance were found. However, no significant correlation between governance and distributional fairness could be obtained. This is surprising since the perception of distributional fairness is important for governance activities [25]. Furthermore, the model revealed a negative relationship between the perception of governance on trust in industry. This suggests that participants with a high agreement on the perception of governance measures (e.g., high trust in national government) stated low trust in industry (e.g., trust in the wood-processing and manufacturing industries). This could be because, in contrast to the previous study [23], in which trust in the mining industry was examined, trust in multiple industries was part of the present survey. D4EU is, after all, not part of one singular industry, but spans multiple sectors. This could cause measurement problems, since people that trust the agricultural sector do not have to trust the wood-processing and manufacturing industries or the forest sector as well. However, the Cronbach's alpha was 0.86 for the items on trust in industry, which indicates that the items were of the same contextual dimension, suggesting that people answered coherently within the Likert-scaled items on trust in industry. Issues of the measurement on governance, on the other hand, are possible as well. Similarly, opinions about D4EU, the Slovakian government, the EU and PPPs were obtained within the assessment on governance. However, the Cronbach's alpha did not suggest scaling problems within this category either. The negative effect of governance on trust in industry was only obtained in the SEM model, while the Pearson correlation coefficient was not significant. This could indicate the necessity of improving the model structure to, for example, include further moderating variables in the model [93]. The model revealed no significant influence of governance on social acceptance either.

4.5. Trust in Industry

The bivariate correlations between trust in industry and the other SLO variables did not reveal any unexpected effects. Positive correlations could be determined for perceived benefits, procedural fairness, and distributional fairness, as well as for social acceptance. Negative correlations were obtained for perceived impacts. No significant correlations were found for governance.

Procedural fairness was the main predictor for trust in industry. This endorses previous findings [21] and reflects the fact that, within agricultural value chains, perceived justice is of special importance, since power imbalances between stakeholders across such value chains are oftentimes an issue [78]. As stated above, the negative influence of the perception of governance on trust in industry was not expected.

However, trust in industry did not have a significant influence on social acceptance, which contradicts the main findings of the previous quantitative studies on SLO, where trust in industry was found to be the strongest predictor for social acceptance [22,23]. The result of the adapted SLO model [22] that trust in industry is the main predictor of social acceptance could therefore not be replicated.

4.6. Social Acceptance

Social acceptance was measured on a five-point scale where respondents stated whether they rejected (1), tolerated (2), accepted (3), approved (4) or embraced (5) the project. The answers were derived from the "Pyramid" SLO model [56]. Participants could also state uncertainty about their attitude towards the project and were then not considered for this assessment. The mean for social acceptance among all participants was 3.23, suggesting an average acceptance level between "Acceptation" (3) and "Approval" (4). This endorses the theory that acceptance is the most common state within an SLO [30]. Within this stage, the public is suspicious and constantly inspects business operations [20]. While this is the most common state of the SLO [56], it is only one level above "Withholding" [30]. However, since the SLO is not static and has to be constantly re-evaluated [25], this can change over time. It is therefore recommended to ensure a positive development of stakeholder relationships and to pay close attention to possible changes in the public perception [20] of D4EU's operations — otherwise the SLO is at risk of being revoked [94].

Social acceptance was not predicted as well as trust in industry in the model. A significant influence on social acceptance could only be examined for the perception of benefits. Neither perceived impacts, trust in industry, nor distributional fairness had significant effects. This therefore suggests that the public perception of the benefits of D4EU's operations is the most important driving force for their social acceptance.

5. Limitations of the Results

Granting the SLO is a complex process which involves the approval of many groups and individuals with differing interests [56]. While scholars agree on the fact that the inclusion of all involved stakeholders would be ideal [18,25,94], this criterion is not sufficient since power dynamics between stakeholder groups and differences in their value sets must be considered as well [95]. Oftentimes, local communities are the most accessible and most influential group and are therefore chosen for the assessment of the SLO [25]. While the original study design followed the approach of selecting a representative sample of the Australian population, this was not possible for the present study and therefore a convenience sample was chosen. Therefore, certain parts of the population might be underrepresented in the study.

Since many respondents did not answer the full questionnaire, a relatively small sample size of only 39 complete cases could be obtained. However, a literature review on approaches to define a lower bound for sample size in SEM models concluded that the "Rule of ten" is an often-mentioned term in the literature [96], which states that the sample size should be at least the tenfold of the number of parameters of a SEM model [97]. Since the present model has 26 parameters, the sample size should thus be at least 260. However, the rule of ten is not the only criteria for sample size and has also been criticised. The rule of ten does not distinguish its parameters between exogenous and latent variables and is of less importance when causal relationships are in focus instead of the power of these observed relationships [96]. Since the present model did not include latent variables and causal relationships were in focus, an adequate sample size could thus be below the rule of ten. Furthermore, when causal relationships are the focus of a SEM model, fit indices are of more importance than the sample size [86] and the fit indices for the present model were adequate.

6. Conclusions

Upholding the SLO means that business operations are perceived as socially responsible, legitimate, and trusted by local communities and broader society. Growing societal expectations that businesses should take a more active role in leading positive change requires the development of sustainable relationships between businesses and their surrounding communities, founded in trust and mutual understanding. The establishment of a bioeconomy and the resulting growing need for alternative wood sources thus relies on the SLO. This study contributed to the need for a measurement framework for the SLO by adapting a quantitative model originating from the mining industry to SRC operations in Slovakia.

The study outcomes highlight the importance of procedural fairness as a prerequisite for trust. Industry and governments should cooperate to enable communities to participate in their decision-making processes and respect their concerns and needs. Successful co-existence of business operations and communities also requires a just distribution of value creation to avert exploitation of less powerful groups. The perception of individual value creation was examined by assessing benefits and impacts. D4EU's operations are currently mainly associated with their environmental and socio-economic benefits. Negative impacts were not identified as a significant factor. However, farmers and other stakeholders have thus far been reluctant to engage in SRC-based value chains in Slovakia. Existing asymmetries in the information level between different stakeholder groups should be reduced to build trust and ultimately raise the level of acceptance. It should also be acknowledged that perceptions vary among individuals, whose concerns should not be forgotten even though the results reveal a generally positive recognition of SRC and the EU's bioeconomic strategy. However, since the SLO is a non-static concept, social acceptance can change over time and requires constant monitoring and re-evaluation.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/land11091555/s1, Table S1: Description of survey measures; S2: Questionnaire.

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