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How to select and evaluate collective agroindustrial projects: Proposal for an analysis methodology

William Sbrama Perressim and Mário Otávio Batalha

Department of Production Engineering, Federal University of São Carlos (UFSCar), São Carlos, Brazil
williamcapi@hotmail.com; dmob@ufscar.br

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ABSTRACT

Agroindustrial projects developed by agroindustrial collective actions play a relevant social and economic role. However, cases of failure are frequent. This work proposes a model for the evaluation and selection of projects developed by cooperatives and rural associations, considering their particularities. The method is based on a conceptual framework developed after a literature review, later validated by a panel of experts. The model was applied to six real projects located in the State of São Paulo, Brazil. The results confirmed the technical feasibility of applying the method, allowing an ex ante and accurate prediction of which projects would have the greatest chance of success.

***Keywords**: Collective actions; performance; agroindustrial; investment project; feasibility,*

1 Introduction

A majority of rural development policies around the world are based on supporting the development of collective actions intermediated by associations and cooperatives of small farmers (Ochieng et al., 2018). These collective initiatives, represented in this article by productive projects aimed at the production, processing, and marketing of agricultural products, have as their main objective the creation of more favorable conditions for sustained social and economic insertion of rural producers in societies (Hellin et al., 2009; Dumitru et al., 2022).

This context does not hide the undeniable difficulties linked to the analysis, implementation and management of these projects (Francesconi and Wouterse, 2015). Cases of failure and unsuccessful initiatives are recurrently cited in the literature, especially in developing countries (Michalek et al., 2018). When these initiatives do not turn out to be total failures, they often fail to achieve the desired results (Islam et al., 2011; Nilsson, 2018). Explanations of the success of small producers' agricultural cooperative projects are still quite limited. There are many questions still open, requiring more applied research. (Grashuis, 2020).

The waste of resources resulting from the implementation of unsuccessful initiatives is often caused by inadequate selection of supported projects. The financial techniques of project analysis usually applied are inefficient for measuring the real feasibility and risks involved in collective agroindustrial projects (Batalha, 2021; Andoseh et al., 2014; Simoes et al., 2015; Secor and Boland, 2017).

A literature review did not identify any decision support models aimed at the selection and evaluation of projects that take into account the set of characteristics that particularize the projects implemented from rural collective actions (Latynskiy and Berger 2016; Donovan et al., 2017). In general, previous studies have focused on observing the benefits of development projects provided to associated producers, and not the conditions that ensure the sustainability of the business (Sultana et al., 2020).

Most of the studies on the subject are dedicated to investigating productive projects on the African continent (Shiferaw et al., 2011; Paumgarten et al., 2012; Coulibaly-Lingani et al., 2014; Orsi et al., 2017). Revealing the importance of investigating and testing considering other regions, as developed by Amiquero et al, (2023).

The application of classical methods of economic-financial feasibility analysis reported in these studies, when it exists, is limited, and the performance evaluation presented provides little information about the criteria and parameters that guided the analyses and approval of the implementation of the projects. Most studies have used a limited number of determinants of success for specific projects.

To contribute to addressing these gaps, this article proposes a model for evaluating and selecting projects developed by rural cooperatives and associations. The model incorporates a series of determinants that affect the success or failure of these initiatives. The application results in the calculation of a project success probability index (PSPI). This index makes it possible, not only to evaluate projects individually, but also to rank them in order of probability of success.

2 Materials and methods

The methodological steps followed for the execution of the research were: (a) construction of the conceptual framework; (b) consultation with a panel of experts for the weighting of the determinants of project success; (c) measurement of the level of determinants and characterization of the projects; and, finally, (d) calculation and analysis of the results of the application of the project success probability index (PSPI).

2.1 Conceptual framework

A systematic literature review supported the proposal of the conceptual framework. Systematic literature reviews stand out as an appropriate technique when researchers aim to recognize and evaluate the intellectual knowledge already existing on a topic (Tranfield et al., 2003).

The objective posed in the adopted research protocol was to "identify the factors, determinants and conditions that impact the performance of agroindustrial collective actions." From a set of keywords and synonyms for the constructs "agroindustrial," "collective action," and "performance," an initial selection was made in the Scopus, Web of Science and SciELO databases. The data were processed in spreadsheet sand State of the Art through Systematic Reviews (StArt) software.

This search resulted in 1,134 articles, which were submitted to filters that included successive reading of (a) the title abstracts, and keywords; (b) introduction and conclusion; and (c) the complete article. In the end, 60 studies were selected and used in the construction of the proposed model.

The theoretical structure of the model, which is described in more detailed below, is made up of 24 determinants grouped into 5 factors that condition the performance of agroindustrial projects developed from collective actions. The analytical model proposed starts from elements already described in the literature and incorporates new elements of analysis.

2.2 Panel and weighting of determinants

To measure the importance of each factor and determinant for the performance of productive initiatives, we used the Simple Multi-Attribute Rating Technique (SMART) multicriteria method (Velasquez and Hester, 2013; Siregar et al. 2015).

A total of 20 experts was consulted in person, by using a structured questionnaire applied in interviews conducted between September and November 2019. Professionals with extensive experience in the proposition, evaluation, and implementation of collective agroindustrial projects who are linked to recognized organizations such as universities and development agencies were selected. These experts assigned weights to these factors and determinants according to the importance they would have for the success of projects.

2.3 Level of determinants and classification structure

Besides quantification of the determinants' weight (see section 2.2), the PSPI construction demands the evaluation of the intensity or level at which each determinant is found in analyzed projects. The construction of the model adopted measurement scales that allow the standardization of results (Hill and Hill, 2008). The level of presence of each determinant receives a maximum value of "1" and a minimum value of "0", with intermediate values in between. This procedure ensures that the 24 determinants that form the proposed model have the same scale.

To test the model's sensitivity, the experts were asked to indicate three projects that they considered successful and three that they thought had not achieved their intended objectives. The proposed model was applied to these six projects. All projects were proposed and implemented by cooperatives or associations formed by small and medium-sized rural producers in the state of São Paulo, Brazil.

The selected projects were developed under the Sustainable Rural Development Project Microbacias II - Market Access. This was a program funded by the World Bank in partnership with the government of the State of São Paulo (Brazil) with a budget of US$130 million (CDRS, 2020). The enterprises investigated are characterized in Table 1 below.

Table 1.
Characterization of the investigated projects

Enterprise	Legal form	Members	Activities	Investment project
A	Cooperative	22	Vegetable production and commercialization	Agroindustry for food processing
B	Association	63	Coffee production and commercialization	Agroindustry for processing certified coffee
C	Association	70	Production and commercialization of vegetables and fruit	Logistics and commercialization structure
D	Cooperative	120	Production and commercialization of fruits and vegetables	Agroindustry for food processing
E	Cooperative	32	Production and commercialization of vegetables and fruit	Packing house and distribution logistics
F	Association	33	Fruit and vegetable production in organic system	Packing house and distribution logistics

The proposed model gives a central role to the economic-financial viability of the investment projects being analyzed. Economic-financial viability was a prerequisite for projects to advance in the evaluation process by the funding agency. As illustrated in Figure 1, projects that were not economically viable were required to be reformulated or discarded. Only those that were approved at this stage advanced to the next evaluation stages. For this article, the economic-financial evaluation stage was omitted because the six projects analyzed had already gone through an economic evaluation process by technicians accredited by the World Bank for this process.

The release of resources for the projects only occurred if the projects were viable from the economic and financial point of view. The failure of some of the evaluated projects showed that the application of financial and economic criteria was not enough to guarantee the success of the approved projects. Figure 1 illustrates the selection process, which consisted of the feasibility assessment and the PSPI ranking.

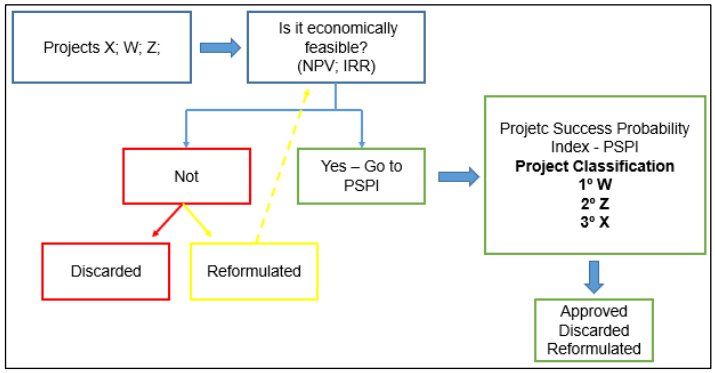

Figure 1. Ranking and selection framework.

In the present study, the economic and financial viability of the evaluated projects (X; Y; Z) was tested. If the result did not indicate viability, the project could be discarded or reformulated, and if it did, it advanced to the PSPI analysis. If the project was reformulated, it had to be evaluated again for economic viability. The PSPI was then calculated for each economically viable project. Each project was given a value between 0 and 1, allowing them to be ranked. Finally, aided by this ranking, decision-makers can select projects, discard them, or indicate the need for reformulation of the proposals.

It is important to note that the proposed model is intended for ex ante application, that is, it should be applied prior to project implementation. However, for the present study, the proposed model was applied to a portfolio of already-implemented projects (ex post) to test its assumptions. Ex ante application would imply that the projects investigated were followed from their selection to their implementation, a condition that can last several years in a real-world context and that would exceed the time available for this study.

2.4 Project success probability index (PSPI)

The project success probability index (PSPI) is based on a combination of the importance (weight) of the success factors and drivers and their presence or intensity in the evaluated projects. The combination is accomplished by use of the multi-attribute value function in its additive form, represented by the expression (Gomes and Gomes, 2019):

$$u(a) = \sum_{j=1}^{n} K_j U_j(a)$$

Where $U_i(a)$ indicates the value function, also called the utility function, of the alternative *a* according to the *j* attribute, and K_i represents the weight or scale constant. For the calculation, the product of multiplying the level (U_i) of presence by the weight (K_i) of each determinant is calculated individually, and then the sum of the set constitutes the final score. The PSPI yields a score between "0" and "1," following the pattern "the higher the better." A project's chances of success will be greater the closer its PSPI is to 1.

In addition to proposing and applying the PSPI to the project portfolio, the research empirically tested the accuracy of the results. To this end, it was verified whether the level of chances of success indicated by the calculated index was related to the actual results achieved by the organizations analyzed. The result indicators for the enterprises are presented in Table 2. It is important to note that the performance indicators can be applied to any marketing and production project, regardless of the agricultural chain in question. This option aims to increase the possibilities for adopting and applying the proposed model.

The projects analyzed in this research were evaluated and financed in the context of a World Bank rural development project implemented by the government of the State of São Paulo, Brazil. The research had access to the commercialization plans and economic-financial viability analysis of each project. The success of the projects could be gauged by comparing the content of the funding projects presented for approval with their actual achievements after, on average, a little more than 4 years of operation. As will be seen later, this comparison was used to evaluate the predictive capacity of the proposed model.

Table 2.
Performance indicators

Performance Indicator	Calculation
Income generation in relation to the PI	Current income / Expected income by PI
Producers participating in the organization	Number of participating producers / Number of associated producers
Participating producers in relation to the PI	Number of participating producers / Number of producers expected by the PI
Employment generation in relation to the PI	Number of jobs generated / Number of jobs expected by the IP
Asset capacity utilization	Respondent's indication
Increase of the producer's income	Respondent's indication
PI = Investment Project submitted for financing approval;	

3 Presentation and discussion of results

The results of the study are divided into four sections. First, the conceptual framework developed is presented, then the result of assigning weights to the determinants of the model. Then, the result of applying the PSPI to six real-world cases is presented. Finally, discussion and testing of the model's ability to predict project success is presented.

3.1 Conceptual framework

As stated earlier, a systematic review of the literature identified 5 factors and 24 determinants that affect the performance of collective production initiatives. Table 3 presents the distribution of the determinants, from the factors, and some identified studies.

The proposed framework was developed by considering empirical models already found in the literature, such as Shiferaw et al., (2011), Fischer and Qaim (2014), Gyau et al., (2014), Dal belo leite et al., (2014) and Donovan et al., (2017), in addition to incorporating new propositions. The factor "management, operation, and finance" included in previous models was not explicitly recognized. The determinants of this factor have almost always been evaluated in a dispersed way, for example, in the governance analyses of organizations. Furthermore, most models have investigated a limited number of determinants, not achieving the comprehensive view allowed by the 24 factors included in the proposed model. Figure 2 presents the conceptual framework of the study. The proposed model has therefore incorporated classic determinants of the success of collective rural projects. This is the case, for example, of the importance of technical assistance (Kola et al. 2014) and marketing capabilities (Stefani et al. 2017).

The framework assumes that project performance is a function of the quality of the factor "local infrastructure" (F1) and the determinants that make it up. The "individual characteristics" (F2) of the producers, such as education, can contribute to improving or limiting results. The combination of these producers gives rise to the factor "group characteristics" (F3). Projects are developed by enterprises, with their own conditions, which makes it necessary to consider the factor "management, operation, and finances" (F4). Finally, since we are dealing with collective businesses, it is imperative to consider the factor "trust, commitment, and participation" (F5), with its determinants of great relevance for the performance of businesses and collective governance.

3.2 The calibration of the model variables by experts

The individual importance of the factors in the success of projects was judged by a panel of experts. Table 3 presents the weight (W) of each factor (F1; F2; F3; F4; F5), and then the distribution of the determinants and their weight (P), organized according to the overall classification (OC), from the highest (1º) weight to the lowest (24º). The SMART method was used in assignment in this process.

It is relevant to point out that the sum of the three factors with the highest weight (F5; F4; F3) accounts for more than 70% of the chances of business success. This finding makes evident the need for attention and better managerial controls for these factors and their determinants.

Table 3.
Factors and determinants

Factor	Determinant	Authors
Local infrastructure	Access to technical assistance and support services	Agrawal 2001; Oerlemans and Assouline 2004; Kola et al. 2014; Donovan et al. 2017;
	Guaranteed access to water, energy, telephony and Internet	Knickel et al. 2008; Hajjar et al. 2011; Paumgarten et al. 2012; Latynskiy and Berger 2016;
	Quality of local roads and bridges	Coulibaly-Lingani et al. 2014;
	Distance to the consumer market	Knickel et al. 2008; Coulibaly-Lingani et al. 2014; Kola et al. 2014;
Individual characteristics	Educational level of the farmers	Place et al. 2004; Barham and Chitemi 2009; Lopes et al. 2015; Stefani et al. 2017;
	Experience and practical knowledge of agricultural activities	Markelova et al. 2009; Mills et al. 2011; Gouët and Van Paassen 2012; Latynskiy and Berger 2016;
	Income level and social condition	Shiferaw et al. 2008; Markelova et al. 2009; Wangel and Blomkvist 2013; Degrande et al. 2014;
Characteristics of the group	Conflicts, differences and internal disputes	Lyon 2003; Wangel and Blomkvist 2013; Ragasa and Golan 2014; Baynes et al. 2015;
	Opportunistic attitudes of producers	Ragasa and Golan 2014; Werthmann 2015; Bassi and Carestiato 2016; Sisay et al. 2017;
	Legal form of the group	Hajjar et al. 2011; Baynes et al. 2015; Landolt and Haller 2015; Jelsma et al. 2017;
	Leadership of the organization and project	Kaganzi et al. 2009; Islam et al. 2011; Schöll et al. 2016; Tierling and Schimidt 2017;
	Organization's relationship network	Pretty and Ward 2001; Kaganzi et al. 2009; Turner et al. 2013; Herbel et al. 2015; Liang et al. 2015;
	Group size	Markelova and Mwangi 2010; Shiferaw et al. 2011; Lopes et al. 2015; Tierling and Schimidt 2017;
Management, operation and finance	Management capacity	Coppock and Desta 2013;Corsi et la. 2017; Donovan et al. 2017; Stefani et al. 2017;
	Commercial capacity	Shiferaw et al. 2011; Ragasa and Golan 2014; Corsi et al. 2017; Orsi et al. 2017;
	Technical and production capacity	Shiferaw et al. 2008; Markelova et al. 2009; Newbery et al. 2013; Latynskiy and Berger 2016;
	Foundation time and activity of the organization	Place et al. 2004; Barham and Chitemi 2009; Francesconi and Wouterse 2015; Lopes et al. 2015;
	Financial condition	Hajjar et al. 2011; Islam et al. 2011; Fischer and Qaim 2014; Donovan et al. 2017;
	Enterprise infrastructure	Gouët and Van Paassen 2012; Turner et al. 2013; Corsi et al. 2017; Stefani et al. 2017;
Trust, Commitment and Participation	Collective and transparent decisions	Mills et al. 2011;Landolt and Haller 2015; Bassi and Carestiato 2016; Jelsma et al. 2017;
	Participation of associates in activities	McRoberts et al. 2013; Newbery et al. 2013; Uetake 2015; Liang et al. 2015; Sisay et al. 2017;
	Trust within the organization	Rubens and Heras 2012; Werthmann 2015; Schöll et al. 2016; Tadesse and Kassie 2017;
	Cohesion and involvement among associates	Barham and Chitemi 2009; Paumgarten et al. 2012; Call and Jagger 2017; Tierling and Schimidt 2017;
	Presence of collective structures and activities	Jones 2004; Lamprinopoulou et al. 2006; Markelova et al. 2009; Latynskiy and Berger 2016;

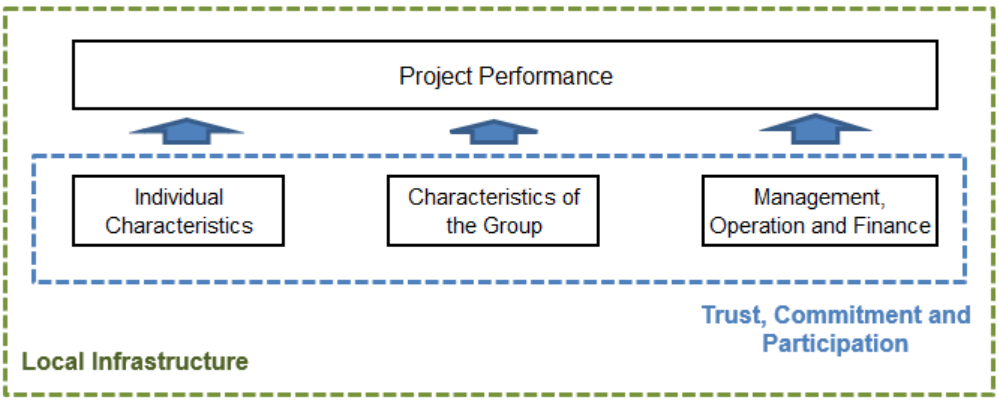

Figure 2. Conceptual framework for performance of collective agroindustrial projects

As shown in Table 4, the highest weight was attributed to the determinant "experience and practical knowledge of agricultural activities," with a weight of 0.081, that is, more than 8% of the performance of the enterprise would be a function of this determinant. It is expected that more experience and higher levels of technical knowledge imply better productive results (Paumgarten et al., 2012).

Table 4.
Weight of factors and determinants.

Factor	W	OC	Factor	W	OC
Local infrastructure - F1	0,125	5º	Management, operation and finance - F4	0,234	2º
Individual characteristics - F2	0,171	4º	Trust, Commitment and Participation - F5	0,271	1º
Characteristics of the group - F3	0,199	3º			
Determinant	**W**	**OC**	**Determinant**	**W**	**OC**
Experience and practical knowledge of agricultural activities	0,081	1º	Income level and social condition	0,039	13º
Participation of associates in activities	0,066	2º	Access to technical assistance and support services	0,038	14º
Management capacity	0,064	3º	Financial condition	0,036	15º
Trust within the organization	0,062	4º	Organization's relationship network	0,034	16º
Collective and transparent decisions	0,057	5º	Presence of collective structures and activities	0,030	17º
Cohesion and involvement among associates	0,055	6º	Distance to the consumer market	0,029	18º
Leadership of the organization and project	0,051	7º	Group size	0,025	19º
Educational level of the farmers	0,051	8º	Enterprise infrastructure	0,025	20º
Technical and production capacity	0,047	9º	Opportunistic attitudes of producers	0,024	21º
Commercial capacity	0,046	10º	Legal form of the group	0,024	22º
Conflicts, differences and internal disputes	0,041	11º	Quality of local roads and bridges	0,019	23º
Guaranteed access to water, energy, telephony and Internet	0,039	12º	Foundation time and activity of the organization	0,016	24º

In the second position of importance, "participation of members in activities" stands out with a weight of 0.066. This result corroborates a study by Lopes et. al., (2015). This author emphasized that the participation of farmers in activities, commitments, and goals are of fundamental importance for the viability and long-term sustainability of collective action.

"Management capacity" earned 0.064 points, occupying the third position. The positive effect of management on small collective rural enterprises has been widely discussed in the literature (Hajjar et al., 2011; Coppock and Desta 2013; Donovan et al., 2017), and empirical support for that relationship has been found.

"Trust within the organization," one of the elements of social capital, is essential to ensure the efficiency of the collective rural business. The specialists placed this determinant in the fourth position with a weight of 0.062. It is known that trust aids cooperation (Pretty and Ward 2001), reduces conflicts peculiar to collective governance, and increases willingness for joint action (Tadesse and Kassie, 2017). The results Jia and Xu (2015), when evaluating rural communities in China, indicated that trust is positively related to the formation and performance of rural cooperatives.

Collective governance requires the presence of "collective and transparent decisions." The experts assigned to this determinant a weight of 0.057, which places it in the fifth position. Several authors have point out the same idea (Shiferaw et al. 2011; Uetake 2014; Baynes et al., 2015) recognizing that the presence of collective and transparent decisions should contribute to better outcomes.

"Cohesion and involvement among associates," with a weight of 0.055, occupies the sixth position. For the experts, as well as in the literature, as the level of cohesion increases, the possibility of better results for collective enterprises also rises (Oerlemans and Assouline 2004; Markelova et al., 2009).

3.3 Case studies for calculating the project success probability index (PSPI) in real-world situations

Table 5 presents the performance found on each factor (P), the percentage achieved (P%) considering the maximum expected (Max), the PSPI, and the ranking within the portfolio of projects. The performance of the 24 determinants of the model for each project and the composition of the PSPI are presented in the Appendix.

Table 5.
PSPI performance of the projects

Project		**A**		**B**		**C**	
Factor	**Max**	**P**	**P %**	**P**	**P%**	**P**	**P%**
F1 - Local infrastructure	0,125	0,0760	60,92%	0,0879	70,53%	0,0779	62,51%
F2 - Individual characteristics	0,171	0,1116	65,27%	0,1595	93,30%	0,1208	70,65%
F3 - Characteristics of the group	0,199	0,1235	62,00%	0,1694	85,02%	0,1093	54,86%
F4 - Management, operation and finance	0,234	0,0957	40,92%	0,2104	89,94%	0,1195	51,08%
F5- Trust, commitment and participation	0,271	0,1802	66,45%	0,2109	77,78%	0,1613	59,49%
PSPI * / Classification	**1,000**	**0,5870**	**6º**	**0,8382**	**1º**	**0,5889**	**5º**
Project		**D**		**E**		**F**	
Factor	**Max**	**P**	**P %**	**P**	**P%**	**P**	**P%**
F1 - Local infrastructure	0,125	0,0835	66,94%	0,0818	65,64%	0,0766	61,44%
F2 - Individual characteristics	0,171	0,1088	63,62%	0,1390	81,29%	0,1492	87,30%
F3 - Characteristics of the group	0,199	0,1489	74,76%	0,1506	75,60%	0,1453	72,93%
F4 - Management, operation and finance	0,234	0,1566	66,92%	0,1855	79,29%	0,1685	72,01%
F5- Trust, commitment and participation	0,271	0,1688	62,24%	0,2158	79,56%	0,2348	86,58%
PSPI * / Classification	**1,000**	**0,6665**	**4º**	**0,7727**	**3º**	**0,7744**	**2º**
(0 ≤ PSPI ≥ 1); (0 ≤ P ≥ Máx)							

Project A presented a PSPI of 0.5870 occupying the lowest position (6º) in the portfolio. The F4 factor had the lowest level, performing at only 40.92% of what was expected (Max). The deficit is exemplified by the poor level of the determinants that make up the factor, such as "technical and productive capacity" with only 0.02, and "commercial capacity" with 0.19 It is essential to recognize that technical and commercial failures and limitations contribute to the inefficiency of businesses, and consequently reduce their viability.

On the other hand, Project B, with an PSPI of 0.8382 points, received the best evaluation (1º). The results show that of the five factors, four performed better than 75% of what was expected. Of these, F2 reached 0.1595 or 93.30%, with "experience and practical knowledge" and "income level" reaching the maximum level (Appendix). Absence of financial and social constraints will contribute to outcome of businesses (Markelova et al., 2009). For more information on the other projects, it is suggested that you read Appendix.

3.4 PSPI's ability to predict project success

The application of the PSPI allowed the ranking of the evaluated investment projects. It was possible, from the ranking created by the PSPI, to classify the projects according to their probability of success. As presented in Table 6, according to success potential, Project B in the portfolio was classified as the one with the highest chance of success, followed by projects F, E, D, C, and A.

Table 6.
PSPI classification and performance indicators.

Classification	**1º**	**2º**	**3º**	**4º**	**5º**	**6º**
Project	**B**	**F**	**E**	**D**	**C**	**A**
PSPI	**0,8382**	**0,7744**	**0,7727**	**0,6665**	**0,5889**	**0,5870**
Income generation in relation to the PI*	102,31%	108,17%	30,96%	55,05%	8,31%	15,78%
Producers participating in the organization	100,00%	100,00%	68,75%	16,67%	42,86%	45,45%
Participating producers in relation to the PI*	175,00%	183,33%	66,67%	66,67%	65,22%	47,62%
Employment generation in relation to the PI*	150,00%	300,00%	100,00%	85,71%	0,00%	20,00%
Asset capacity utilization	100,00%	100,00%	100,00%	20,00%	2,00%	0,00%
Increase of the producer's income	46,67%	56,67%	30,00%	6,67%	0,00%	0,00%
** PI = Investment Project submitted for financing approval.*						

The predictive ability of the model was checked by comparing: the calculated PSPI values; the situation of the projects when the survey was conducted; and what was proposed when the funding was approved. The study selected six performance indicators (see Table 6) that reflected the criteria that were used in the analysis of proposals that were awarded World Bank funding. If the approved project provided for the creation of 100 jobs and the 100 jobs were measured by the field research, the success rate on this item would be 100%.

For "income generation in relation to the investment project," two results were notable: Project A reached 102.31% of the expected income; and Project F reached 108.17%, and they attained the highest and second highest PSPI, respectively. The organizations were efficient in reaching the projected income, and this condition definitely involves the presence of satisfactory levels of the determinants of success. In contrast, the two projects with the lowest PSPI, Project C and Project A, achieved only 8.31% and 15.78% of the income, respectively, showing failures and inefficiencies that originated in unsatisfactory levels of the determinants.

The indicator "producers participating in the organization" represents the percentage of associated producers that effectively participated in collective sales, in relation to the total number of members. Three projects (D, C, A) had less than 50% of members participating in collective sales, with initiative D standing out with a little more than 16.00%. This result denotes the low economic attractiveness of the organizations, due to various limitations. The 1º and 2º projects (B, F), on the other hand, stood out for getting high percentages of participation by their members.

"Increase in producer's income" measures the direct economic benefit to the members after the implementation of the project. The projection indicated by the PSPI, as for the other indicators, was confirmed for this indicator. The three lowest ranked projects (D, C, A) were not efficient in generating additional income for farmers, with the last two not increasing at all. For the projects in the first three positions, the increment was significantly positive: 46.67% in Project B and 56.67% for F.

"Participating producers in relation to the investment project," "employment generation in relation to the investment project," and "asset utilized capacity" all showed better performance in the enterprises with higher PSPIs (see Table 6). The findings for the 6 projects demonstrate that the projects with the highest PSPI also presented the best performances, while the smallest PSPI stand out due to their low performance for the evaluated indicators, evidencing the accuracy of the model.

4 Final considerations

The elaboration and implementation of sustainable agroindustrial projects developed from collective actions are admittedly challenging tasks. The literature has shown that, up to the present, there has been no model for the evaluation and selection of agroindustrial collective projects and ventures that stands out for its use or level of acceptability. The specialists we consulted were unanimous in recognizing the nonexistence of methods and tools with a reasonable level of efficiency for the evaluation of these projects.

The proposed model innovates in relation to the usual practices applied in the analysis of collective rural investment projects. The proposal allows the consideration the economic-financial viability of initiatives and contributes to advances in evaluating the probability of success with the application of the project success probability index (PSPI). By using empirical expert experiences to determine the weight of a broad set of success determinants identified in the literature, the model allows for the incorporation of the unique characteristics of collective organizations, which have often been overlooked by previous models.

The results showed the predictive capacity of the tool. It allows decision-makers to select projects with greater chances of success. Comparison of the rankings resulting from the application of the PSPI, which can be done ex ante, and ex post rankings of real-world situations, confirmed the accuracy of the predictions allowed by the proposed conceptual model. The findings showed the accuracy of the model, with the ventures with the highest PSPIs also showing the best results.

The application of the model allowed us to verify that the "management, operation, and finance" factor was the main factor responsible for the failure of some of the projects analyzed. This result reinforces the need for rural enterprises to pay attention to the quality of their management. It indicates to decision-makers the importance of evaluating and undertaking measures that favor the managerial capacity of rural organizations.

The PSPI calculation procedures will allow decision-makers to quickly identify which determinants and factors may represent greater obstacles to the success of the projects analyzed. From this analysis, it is possible to propose and carry out corrections to projects that will increase the expectation of success of enterprises. The construction of the model was guided by the standardization of the evaluation process and application of the tool, a condition that allows its application in different economic and social contexts and to any enterprises made up of groups of individuals.

Future research could involve the application of this model in economic and productive contexts different from the one in which it was developed, such as those found in other countries. It can be assumed that such research will require new calibration of determinants and success factors by local experts. Another area for future study could be the development of more adequate performance measures for the determinants, since they present broad characteristics and origins, requiring adjustment and flexibility.

Investigation of more projects could enrich the results, in the sense of making quantitative analyses possible, which can be considered a limitation of the study. The time limit for the research made it impossible to fully follow a process of proposition, evaluation, and implementation, which could require several years of observation, depending on the development programs and the agents involved.

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References

Agrawal, A. (2001) Common property institutions and sustainable governance of resources. *World Development,* **29**: 1649-1672.

Amiquero, K. S., Wubben, E., van Dam, Y., and Trienekens, J. (2023). Success and failure factors in agricultural cooperatives. *International Journal on Food System Dynamics*, **14**(1): 01-21.

Andoseh, S., Bahn, R. and Gu, J. (2014). The case for a real options approach to ex-ante cost-benefit analyses of agricultural research projects. *Food Policy* 44: 218-226.

Barham, J. and Chitemi, C. (2009). Collective action initiatives to improve marketing performance: Lessons from farmer groups in Tanzania. *Food policy,* **34**(1): 53-59.

Bassi, I. and Carestiato, N. (2016). Common property organisations as actors in rural development: a case study of a mountain area in Italy. *International Journal of the Commons,* **10**: 1.

Batalha, M. O. (2021). Gestão e economia dos sistemas agroindustriais: definições, correntes metodológicas e métodos de análise. *Gestão agroindustrial*, **4**: 1-48.

Baynes, J., Herbohn, J., Smith, C., et al. (2015). Key factors which influence the success of community forestry in developing countries. *Global Environmental Change,* **35**: 226-238.

Briggeman, B. C., Jacobs, K. L., Kenkel, P., et al. (2016). Current trends in cooperative finance. *Agricultural Finance Review,* **76**(3): 402-410.

Call, M. and Jagger, P. (2017). Social capital, collective action, and communal grazing lands in Uganda. *International Journal of the Commons,* **11**: 2.

CDRS. (2020). *Coordenadoria de Desenvolvimento Rural Sustentável*. Microbacias II. Retrieved from http://www.cdrs.sp.gov.br/microbacias2/.

Coppock, D. L. and Desta, S. (2013). Collective action, innovation, and wealth generation among settled pastoral women in northern Kenya. *Rangeland Ecology and Management,* **66**(1): 95-105.

Corsi, S., Marchisio, L. V., and Orsi, L. (2017). Connecting smallholder farmers to local markets: Drivers of collective action, land tenure and food security in East Chad. *Land Use Policy*, **68**: 39-47.

Coulibaly-Lingani, P., Tigabu, M., Savadogo, P. et al. (2014). Participatory forest management in Burkina Faso: Members' perception of performance. *Journal of forestry research*, **25***(*3): 637-646.

Dal Belo Leite, J. G., Bijman, J., Van Ittersum, M. K. et al. (2014). Organizações de Produtores, Agricultura Familiar e Conexão com o Mercado: Lições para Cadeias Produtivas de Biodiesel Emergentes no Brasil. *Outlook on Agriculture,* **43**(2): 101–108.

Degrande, A., Gyau, A., Foundjem-Tita, D. et al. (2014). Improving smallholders' participation in tree product value chains: experiences from the Congo Basin. *Forests, Trees and Livelihoods,* **23**: 102-115.

Donovan, J., Blare, T., and Poole, N. (2017). Stuck in a rut: emerging cocoa cooperatives in Peru and the factors that influence their performance. *International Journal of Agricultural Sustainability,* **15**(2): 169-184.

Dumitru, E. A., Micu, M. M., and Sterie, C. M. (2023). The key to the development of agricultural cooperatives in Romania from the perspective of those who run them. *Outlook on Agriculture,* **52**(1): 89–100.

Fischer, E. and Qaim, M. (2014). Smallholder farmers and collective action: What determines the intensity of participation? *Journal of Agricultural Economics,* **65***(*3): 683-702.

Francesconi, G. N. and Wouterse, F. (2015). The health of farmer-based organisations in Ghana: organisational diagnostics and governance implications. *The Journal of Development Studies,* **51**(3): 262-273.

Gomes, L. and Gomes, C. F. S. (2019*). Princípios e Métodos para Tomada de Decisão Enfoque Multicritério*, 6ª Edição. Rio de Janeiro: Atlas.

Gouët, C, and Van Paassen, A. (2012). Smallholder marketing cooperatives and smallholders' market access: lessons learned from the actors involved. *The Journal of Agricultural Education and Extension,* **18***(*4): 369-385.

Grashuis, J. (2020). Agricultural firm survival: The case of farmer cooperatives in the United States. *Agribusiness.* **36**(1): 79-93.

Gyau, A., Franzel, S., Chiatoh, M. et al. (2014). Collective action to improve market access for smallholder producers of agroforestry products: key lessons learned with insights from Cameroon's experience. *Current Opinion in Environmental Sustainability,* **6**: 68-72.

Hajjar, R., Mcgrath, D. G., Kozak, R. A. et al. (2011). Framing community forestry challenges with a broader lens: Case studies from the Brazilian Amazon. *Journal of Environmental Management,* **92**(9): 2159-2169.

Hellin, J., Lundy, M., and Meijer, M. (2009). Farmer organization, collective action and market access in Meso-America. *Food policy,* **34**(1): 16-22.

Herbel, D., Rocchigiani, M., and Ferrier, C. (2015). The role of the social and organisational capital in agricultural co-operatives' development Practical lessons from the CUMA movement. *Journal of Co-Operative Organization and Management,* **3***(*1): 24-31.

Islam, M. M., Gray, D., Reid, J. et al. (2011). Developing sustainable farmer-led extension groups: lessons from a Bangladeshi case study. *The Journal of Agricultural Education and Extension,* **17**(5): 425-443.

Jelsma, I., Slingerland, M., Giller, K. E. et al. (2017). Collective action in a smallholder oil palm production system in Indonesia: The key to sustainable and inclusive smallholder palm oil? *Journal of Rural Studies,* **54**: 198-210.

Jia, S. and Xu, X. (2021). Community-level social capital and agricultural cooperatives: Evidence from Hebei, China. *Agribusiness,* **37**(4): 804-817.

Jones, E. C. (2004). Wealth-based trust and the development of collective action. *World Development,* **32**(4): 691-711.

Kaganzi, E., Ferris, S., Barham, J. et al. (2009). Sustaining linkages to high value markets through collective action in Uganda. *Food Policy,* **34**(1): 23-30.

Knicke, L. K., Zerger, C., Jahn, G. et al. (2008). Limiting and enabling factors of collective farmers' marketing initiatives: results of a comparative analysis of the situation and trends in 10 European countries. *Journal of Hunger and Environmental Nutrition,* **3**: 247-269.

Kola, R., Skreli, E., OsmanI, M., et al. (2014). Farmers' characteristics as determinants of collective action: the case of Greenhouse Producers in Albania. *New Medit,* **13**(2): 20-27.

Lamprinopoulou, C., Tregear, A., and Ness, M. (2006). Agrifood SMEs in Greece: the role of collective action. *British Food Journal,* **8**: 663-676.

Landolt, G. and Haller, T. (2015). Alpine common property institutions under change: Conditions for successful and unsuccessful collective action by alpine farmers in the canton of Grisons, Switzerland. *Human Organization,* **74**(1): 100-111.

Latynskiy, E. and Berger, T. (2016). Networks of rural producer organizations in Uganda: What can be done to make them work better? *World Development,* **78**: 572-586.

Liang, Q., Huang, Z., Lu, H., et al. (2015). Social capital, member participation, and cooperative performance: Evidence from China's Zhejiang. *International Food and Agribusiness Management Review,* **18**: 49-77.

Liang, Q. and Wang, X. (2020). Cooperatives as competitive yardstick in the hog industry?— Evidence from China. *Agribusiness*, **36**(1): 127-145.

Lopes, M., Nesbitt, H., Spyckerelle, L., et al. (2015). Harnessing social capital for maize seed diffusion in Timor-Leste. *Agronomy for Sustainable Development,* **35**(2): 847-855.

Lyon, F. (2003). Community groups and livelihoods in remote rural areas of Ghana: How small-scale farmers sustain collective action. *Community Development Journal,* **38***(*4): 323-331.

Markelova, H., Meinzen-Dick, R., Hellin, J., et al. (2009). Collective action for smallholder market access. *Food Policy,* **34***(*1): 1-7.

Markelova, H. and Mwangi, E. (2010). Collective action for smallholder market access: evidence and implications for Africa. *Review of Policy Research,* **27**(5): 621-640.

Mcroberts, K. C., Nicholson, C. F., Blake, R. W., et al. (2013). Group model building to assess rural dairy cooperative feasibility in south-central Mexico. *International Food and Agribusiness Management Review,* **16***:* 55-98.

Michalek, J., Ciaian, P., and Pokrivcak, J. (2018). The impact of producer organizations on farm performance: The case study of large farms from Slovakia. *Food Policy,* **75**: 80-92.

Mills, J., Gibbon, D., Ingram, J., et al. (2011). Organising collective action for effective environmental management and social learning in Wales. *Journal of Agricultural Education and Extension,* **17**(1): 69-83.

Narrod, C., Roy, D., Okello, J., et al. (2009). Public–private partnerships and collective action in high value fruit and vegetable supply chains. *Food Policy,* **34**(1): 8-15.

Newbery, R., Sauer, J., Gorton, M., et al. (2013). Determinants of the performance of business associations in rural settlements in the United Kingdom: an analysis of members' satisfaction and willingness-to-pay for association survival. *Environment and Planning A,* **45**(4): 967-985.

Nilsson, J. (2018). Governance costs and the problems of large traditional co-operatives. *Outlook on Agriculture,* **47**(2): 87–92.

Ochieng, J., Knerr, B., Owuor, G., et al. (2018). Strengthening collective action to improve marketing performance: evidence from farmer groups in Central Africa. *The Journal of Agricultural Education and Extension,* **24***(*2): 169-189.

Oerlemans, N. and Assouline, G. (2004). Enhancing farmers' networking strategies for sustainable development. *Journal of cleaner production,* **12**(5): 469-478.

Orsi, L., De Noni, I., Corsi, S., et al. (2017). The role of collective action in leveraging farmers' performances: Lessons from sesame seed farmers' collaboration in eastern Chad. *Journal of Rural Studies,* **51**: 93-104.

Paumgarten, F., Kassa, H., Zida, M., et al. (2012). Benefits, challenges, and enabling conditions of collective action to promote sustainable production and marketing of products from Africa's dry forests. *Review of Policy Research,* **29**(2): 229-250.

Place, F., Kariuki, G., Wangila, J., et al. (2004). Assessing the factors underlying differences in achievements of farmer groups: methodological issues and empirical findings from the highlands of Central Kenya. *Agricultural Systems,* **82**(3): 257-272.

Pretty, J. and Ward, H. (2001). Social capital and the environment. *World Development,* **29**(2): 209-227.

Ragasa, C. and Golan, J. (2014). The role of rural producer organizations for agricultural service provision in fragile states. *Agricultural Economics,* **45**(5): 537-553.

Ruben, R. and Heras, J. (2012). Social capital, governance and performance of Ethiopian coffee cooperatives. *Annals of Public and Cooperative Economic,* **83***(*4): 463-484.

Schöll, K., Markemann, A., Megersa, B., et al. (2016). Impact of projects initiating group marketing of smallholder farmers—A case study of pig producer marketing groups in Vietnam. *Journal of Co-operative Organization and Management,* **4**(1): 31-41.

Shiferaw, B., Hellin, J., and Muricho, G. (2011). Improving market access and agricultural productivity growth in Africa: What role for producer organizations and collective action institutions? *Food Security,* **3**(4): 475-489.

Shiferaw, B., Obare, G., and Muricho, G. (2008). Rural market imperfections and the role of institutions in collective action to improve markets for the poor. *Natural Resources Forum,* **32**(1): 25-38.

Simoes, D., Cabral, A. C., and Oliveira, P. A. D. (2015). Citriculture economic and financial evaluation under conditions of uncertainty. *Revista Brasileira de Fruticultura,* **37**(4): 859-869.

Siregar, D., ArisandI, D., Usman, A., et al. (2017). Research of simple multi-attribute rating technique for decision support. *Journal of Physics: Conference Series,* **930**: 1.

Sisay, D. T., Verhees, F. J., and Van Trijp, H. C. (2017). The influence of market orientation on firm performance and members' livelihood in Ethiopian seed producer cooperatives. *Agricultural Economics Research, Policy and Practice in Southern Africa,* **56**(4): 366-382.

Stefani, G., Lombardi, G. V., Romano, D., et al. (2017). Grass root collective action for territorially integrated food supply chains: A case study from Tuscany. *International Journal on Food System Dynamics,* **8**(4): 347-362.

Sultana, M., Ahmed, J. U., and Shiratake, Y. (2020). Sustainable conditions of agriculture cooperative with a case study of dairy cooperative of Sirajgonj District in Bangladesh. *Journal of Co-operative Organization and Management,* **8**(1): 100105.

Tadesse, G., & Kassie, G. T. (2017). Measuring trust and commitment in collective actions: Evidence from farmers' marketing organizations in rural Ethiopia. International Journal of Social Economics, 44(7), 980-996.

Tierling, I. M. B. M., and Schmidt, C. M. (2017). Collective Action and Value Creation: A Study in South Corumbataí Producers Association (PR). *Brazilian Journal of Management and Regional Development*, **13**: 2.

Tranfield, D., Denyer, D., and Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management,* **14**(3): 207-222.

Turner, K., Ramsing, N., Wright, S., et al. (2013). Ukraine Horticulture Development Project: the use of incentives to motivate collective action. *Enterprise Development and Microfinance,* **24**(2): 104-117.

Uetake, T. (2015). Agri-environmental resource management by large-scale collective action: Determining KEY success factors. *The Journal of Agricultural Education and Extension,* **21**(4): 309-324.

Velasquez, M. and Hester, P. T. (2013). An analysis of multi-criteria decision making methods, *International Journal of Operations Research,* **10***(*2): 56-66.

Wangel, M. and Blomkvist, H. (2013). Rural Forest Management in Sierra Leone: The Role of Economic (In) Equality in Facilitating Collective Action. *Journal of Development Studies,* **49***(*11): 1564-1578.

Wenningkamp, K. R. and Schmidt, C. M. (2016). Ações Coletivas no Agronegócio: uma análise da produção científica no Brasil a partir de teses e dissertações (1998-2012). *Revista de Economia e Sociologia Rural,* **54**(3): 413-436.

Werthmann, C. (2015). What makes institutional crafting successful? Applying the SES to case studies from India and the greater Mekong Region. *Environmental Science and Policy,* **53**: 165-174.

Wilson, D. S., Ostrom, E., and Cox, M. E. (2013). Generalizing the core design principles for the efficacy of groups. *Journal of Economic Behavior and Organization,* **90**: 21-32.

Appendix

Factor	Determinants	Weight	Project Performance					
			A	B	C	D	E	F
Local infrastructure (F1)	Access to technical assistance and support services	0,038	0,500	0,250	0,250	0,500	0,250	0,750
	Guaranteed access to water, energy, telephony and Internet	0,039	0,850	0,850	0,900	0,675	1,000	0,500
	Quality of local roads and bridges	0,019	0,875	0,875	1,000	0,875	1,000	0,750
	Distance to the consumer market	0,029	0,250	1,000	0,500	0,750	0,500	0,500
	Sum	0,125	0,076	0,088	0,078	0,083	0,082	0,077
Individual characteristics (F2)	Educational level of the farmers	0,051	0,525	0,775	0,700	0,600	0,625	0,700
	Experience and practical knowledge of agricultural activities	0,081	0,806	1,000	0,833	0,750	1,000	1,000
	Income level and social condition	0,039	0,499	1,000	0,448	0,444	0,667	0,833
	Sum	0,171	0,112	0,159	0,121	0,109	0,139	0,149
Characteristics of the group (F3)	Conflicts, differences and internal disputes	0,041	0,667	0,917	0,639	0,583	0,694	0,750
	Opportunistic attitudes of producers	0,024	0,688	0,750	0,583	0,667	0,708	0,563
	Legal form of the group	0,024	1,000	0,500	0,500	1,000	1,000	0,500
	Leadership of the organization and project	0,051	0,833	1,000	0,778	1,000	1,000	1,000
	Organization's relationship network	0,034	0,375	0,750	0,500	0,625	0,875	0,375
	Group size	0,025	0,000	1,000	0,000	0,500	0,000	1,000
	Sum	0,199	0,124	0,169	0,109	0,149	0,151	0,145
Management, operation and finance (F4)	Management capacity	0,064	0,429	0,857	0,429	0,571	0,571	0,571
	Commercial capacity	0,046	0,188	0,750	0,438	0,625	0,750	0,625
	Technical and production capacity	0,047	0,020	0,940	0,150	0,560	0,800	0,560
	Foundation time and activity of the organization	0,016	1,000	1,000	1,000	1,000	1,000	1,000
	Financial condition	0,036	0,667	1,000	0,667	0,667	1,000	1,000
	Enterprise infrastructure	0,025	0,750	1,000	1,000	1,000	1,000	1,000
	Sum	0,234	0,096	0,210	0,120	0,157	0,185	0,168
Trust, Commitment and Participation (F5)	Collective and transparent decisions	0,057	0,750	1,000	0,917	0,833	1,000	0,958
	Participation of associates in activities	0,066	0,528	0,717	0,617	0,361	0,733	0,917
	Trust within the organization	0,062	0,833	0,944	0,528	0,750	0,833	0,861
	Cohesion and involvement among associates	0,055	0,500	0,861	0,500	0,500	0,778	0,778
	Presence of collective structures and activities	0,030	0,750	0,000	0,250	0,750	0,500	0,750
	Sum	0,271	0,180	0,211	0,161	0,169	0,216	0,235
Project Success Probability Index (PSPI)		**1,0000**	**0,5870**	**0,8382**	**0,5889**	**0,6665**	**0,7727**	**0,7744**