Triggering Collective Action for Bio-Energy Supply Chain Through Contract Schemes

Giorgio SCHIFANI^, Giuseppina MIGLIORE^§, Francesco CARACCIOLO*, Pietro ROMEO^, Luigi CEMBALO*, Gianni CICIA*

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Abstract

This paper discusses contractual features to manage and coordinate a hypothetical bio-energy supply chain. The present study focuses on farmers operating in two Regions of Italy, namely Sicily and Campania, somewhat representative of areas with high potential of investments in new bioenergy supply value chain. Farmers were asked to choose whether to participate or not in a collective investment regulated by contract schemes. Monetary trade-offs were then computed among contract attributes. A specific questionnaire was submitted to a sample of farmers selected on the basis of their potential capability of investments. A stated preference modelling approach was implemented so that farmers could make a choice between alternative contracts reporting varying attribute levels. If energy-producing companies are paying attention to biofuel production aiming at a diversification of their activities, results show that farmers' participation needs to be managed through contracts that take care of investment length, warranty on investment return, and risk management.

Keywords: Algal biomass, Choice Modelling, Biofuel

Résumé

Cette étude a pour objectif de parcourir les caractéristiques contractuelles pour la gestion et la coordination d'une chaîne potentielle d'approvisionnement de bioénergie. L'attention est focalisée sur un ensemble d'agriculteurs qui travaillent dans deux régions italiennes, à savoir la Sicile et la Campanie. Ces deux régions sont considérées comme étant assez représentatives des zones à fort potentiel d'investissement dans la nouvelle chaîne de production de bioénergie. On a laissé le choix aux agriculteurs de participer à un investissement collectif réglementé par des régimes contractuels. Les arbitrages monétaires entre les différents attributs du contrat ont successivement été calculés. Un questionnaire spécifique a été soumis à un échantillon d'agriculteurs sélectionnés sur la base de leur potentiel d'investissement. Une approche de modélisation des préférences déclarées a été utilisée afin que les agriculteurs choisissent entre les contrats alternatifs représentant plusieurs niveaux d'attributs. Si d'un côté les entreprises de production d'énergie s'intéressent de près à la production de biocarburants pour la diversification de leurs activités, les résultats montrent que la participation des agriculteurs doit être gérée par des contrats qui prennent en compte la longueur de l'investissement, l'assurance sur le rendement et la gestion des risques.

Mots-clés : biomasse algale, modélisation des choix, biocarburant

Introduction

The topic of an agro-energy supply chain development has recently gained relevance both in the academic and managerial-political debate (Seuring and Muller, 2008; Cembalo et al., 2014), mainly in terms of how to foster and manage integration along the chain. A definition of chain integration relates to a process of progressive dependence among different actors that share common investments, coordination of activities, and processes of learning and innovation (Handfield and Nichols, 1999; Hugos, 2003). Most chains are based on agreements (formal or informal contracts) between two or more stakeholders.

Integration through cooperation is often associated to sustainable use of the natural resources at the base of the agro-energy chain (McCarthy et al., 2004; van Dam et al., 2010; Scarlat and Dallemand, 2011). Better and more sustainable management of common resources is achieved when the rules concerning the use of common resources are defined by involving economic subjects who are in a situation of interdependence (Ostrom, 2000; Ostrom, 2010; Ostrom and Walker, 2003).

Stakeholders operating in such chains are focused, for instance, on the use of common investments, often together with the production of other agricultural goods (Pellerin and Taylor, 2008). In this context, how to combine relational and contractual aspects remains still difficult to address (Meinzen-Dick et al., 2004). The role of partnerships alliances results to be a priority.

Two main dynamics can be identified in a collective alliance. First, the majority of agro-energy firms keep engaging forms of traditional integration like, for example, contracts and use of coordination, both formal and informal, participating to industrial clusters. Second, these firms are increasingly conscious of the environmental effects of alternative energy production. However, how to manage such effects is still controversial among stakeholders.

It seems evident that a model of a common business, which links firm investments to social welfare and environmental quality, needs new forms of chain organisation, mainly through organisational and contractual innovation (Freeman, 2010).

This paper aims to assess whether the conditions exist for promoting an agro-energy supply chain through a collective action (Ostrom et al., 1999). The effectiveness of the collective action depends, in fact, on the formal or informal

*Department of Agricultural Sciences, Agricultural Economics and Policy Group, University of Naples Federico II, Italy.
^Department of Agricultural and Forest Sciences, Agricultural Economics and Policy Group, University of Palermo, Italy
§Corresponding author: giuseppina.migliore@unipa.it

norms that may be embedded also in contract schemes (Poteete and Ostrom, 2004).

Results of the empirical strategy conducted through the submission of a questionnaire tackles these issues considering the specific case study of a collective contract that fosters a collective action to promote, though hypothetically, an agro-energy investment chain (biodiesel production by means of algal biomass). In particular, it considers the issues related to farmers decision-making process on whether to join or not a collective investment, analysing the trade-offs they are willing to make over the attributes of the collective contracts. It is worth underlying that a collective contract is necessary in order to make the investment profitable. To this end, a group of farmers needs to agree to be part of the collective contract and build up the investment needed.

A case study has been conducted in Southern Italy. We implemented a stated preference model to investigate farmers' preferences about collective contracts. Based on a literature review and three focus groups with stakeholders in two Italian regions (Sicily and Campania), four attributes were implemented in the choice set: 1. Investment length, corresponding to the number of years the proposed investment lasts. Levels ranged from 15 to 20 years; 2. Investment degree of riskiness, corresponding to five profiles of risk ranging from low (long run return of 9%) to high (long run return of 20%). This attribute was presented linking high returns to high degree of risk. On the contrary, lower degree of risk was linked to a lower long run return. It was presented as assured by contracting an insurance whose cost is equal to the difference in terms of long run returns among profiles; 3. Capital invested warranted, corresponding to an option that safeguards the capital invested. Such option was provided by public/private companies and/or by banks. Level, for this attribute, was either present or absent; 4. Management, that is the possibility, for the investors, to take part in the entrepreneurial decisions taken in monthly meetings. Levels, also for this attribute, were either present or absent.

The choice of a stated preference method was necessary because no actual contracting behaviour was available to observe (Roe et al., 2004; Cembalo et al., 2016). In a choice experiment, based on an efficient experimental design, respondents are asked to choose between alternative collective contracts with varying attribute levels to start biodiesel production. Choice experiments have gained relatively wide attention in the agricultural economics literature. To the best of our knowledge, only few studies have implemented this methodological approach to the analysis of farmers' attitude towards collective contracts, that is still an unknown area of farmer preferences (Lajili *et al*., 1997; Abebe *et al*., 2013; Cembalo *et al*., 2014). Results of this study will indicate the relevance of attributes of the contract in influencing the farmers willingness to join agro-energy supply chain.

The reminder of the paper is as follows. Paragraph one reports on the supply chain presented in the choice experiment and briefly describes the rationale behind the sample of farms selected for the study. Paragraph two describes data and methodology implemented. In paragraph three results are presented in detail, while in paragraph four some concluding remarks are outlined.

1. Supply chain and sample of farms

In this section a brief presentation of the supply chain considered is presented together with the rationale behind the choice of type of farms of the sample. The supply chain is based on microalgae cultivation for biodiesel and food/feed supplements production. The main characteristics are the following:

- the algae species implemented is the *Phaeodactylum tricornutum*;
- the production area, occupied by the plant, is 1,500 square meters. Based on our preliminary analysis, this area is considered optimal for the achievement of a first level of economy of scale. However, the total production area implemented is 2,000 square meters;
- the production of high quality algae biomass has been achieved by using advanced technologies in photo-bioreactors. The latter are composed by vertical glass tubes, and protected by a greenhouse to ensure both the optimal control of algae growing conditions (11 months a year) and high productivity per unit area.

The biodiesel system encompasses also a little biorefinery. The biorefinery utilises the oil produced by algae biomass along with the bioethanol from the giant reed biomass (*Arundo donax*) or sulla biomass (*Hedysarum coronarium*).

The analysis of impacts that this system might have on farm balance sheets was conducted by Cicia et al. (2015) on a previous study on a sample of firms selected from the Farm Accountancy Data Network (FADN). From that study it was possible to select farms that are located in Campania and Sicily regions of Italy. Regarding the first region the area chosen is a district where a great number of medium and large enterprises is present; the possibility of using polluted soils for giant reed cultivation; the favourable climate that makes less onerous the greenhouse conditioning in which the algae are produced. In Sicily, the targeted area covers Palermo, Enna and Ragusa provinces. In these provinces, the sulla is widely grown in rotation with other crops and utilised for fodder production. Moreover, these areas are mainly hilly and characterised by the presence of medium and large livestock-grain farms. The latter are mostly oriented to milk or meat production.

More deeply, in Campania we focused our analysis on dairy buffalo farms, whilst in Sicily the choice is fallen on cattle farms for the production of both milk and meat. Farms are represented in the size classes of 20-50 ha and > 50 ha. For each of the six farm groups profitability indexes

[1] The quantities required are 11,1 tons for giant reed and 9,6 tons for sulla (also known as Italian sainfoin).

were determined by Cicia et al. (2015).

All the firms analysed are well capitalised. This aspect seems to be a prerequisite since algae cultivation requires significant investments. Moreover, since the intensification of production processes leads an increasing of cattle load that nearly reach the legal limits, the diversification of production through algae cultivation is an alternative that does not require further agricultural land. This is mainly true for dairy farms. However, it should be observed that even for medium and large enterprises the possibility to manage such a type of industrial system is not realistic for all of them. Indeed, the investments needed for this system are equal to the average net return of both buffalo farms (average area > 90 ha) and dairy farms (> 110 ha). Consequently, it seems appropriate to assume a joint management of the algae biomass production system in which the participation of farm is commensurate to their economic size.

The evaluation and comparisons carried out have taken into account the technological and market challenges related to the sector as well as its relative risks. Moreover, a further factor considered in the analysis is the return on capital that in this type of farms can exceed 10%.

Undoubtedly, both the production yield and the food supplements price are a source of concern to take into consideration in the estimation. The choice to vary the yield per unit of bioreactors from 36 to 44 g/mq/day is well justified by the hypothesised system, and by the findings observed in the literature (Cicia *et al*., 2015).

The average selling prices for high nutritional algae biomass assumed in our analysis fall in a range of 37-55 €/kg. These values have been identified on the basis of the information gathered from the few systems in Italy and those dislocated in other European countries as well as the findings observed in the technical and scientific literature (Egardt *et al*., 2013). The market trends show higher prices for national products obtained by microalgae grown under optimal conditions.

Lastly, since farm participation to joint management of algae cultivation is related to their economic size, the impact on the net return, in absolute terms, is higher in more capitalised companies. This is the case of large dairy and wine&vine farms.

3. Data and Methods

Data was collected through the administration of a questionnaire with face-to-face interviews. The aim was collecting information to interpret and understand the choice behaviour of farmers concerning the participation in a collective action through a collective contract affiliation. A total of 92 questionnaires was completed concerning large-size farms operating in Sicily and Campania regions: 74 livestock farms and 18 vine and wine farms. As previously stated, the reason to specifically choose these two sectors resides in the pre-requisite of having enough capital capability to invest in this specific sector.

The questionnaire used for data collection comprised, among others, sections regarding farmers' socio-demographic characteristics and farms structural characteristics (Appendix A). Furthermore, the questionnaire included farmers' most recent choices in terms of investments and innovation in their farm and in terms of participation to formal or informal forms of cooperation or contract. Finally, the questionnaire presented the conjoint/choice experiment. Each profile of contract consisted of four different attributes compatible with the agro-energy investment chain (biodiesel production by means of algal biomass): 1. Investment length (from 15 to 20 years); 2. Investment degree of riskiness (from 9% to 20%); 3. Presence or absence of Capital invested warranted; 4. Presence of absence to taking part in the management decisions. Levels of the attribute come from literature review (Cicia *et al*., 2015), three focus groups.

Of all the farmers interviewed, 82 percent are male (84 and 72 percent respectively for livestock and vine and wine farmers), the average age is 45 years, with an average utilized land area of 83 hectares (specifically, 98 hectares for livestock farms and 23 for wine and vine farms). With reference to regional location, all the wine and vine farms are placed in Campania region, while 66 percent of the livestock farmers interviewed are based in Sicily. With regard to previous experience with cooperation, less than 15 percent of the farmers interviewed declared to have previously participated to other initiatives. Finally, with regard to the farmers' propensity to cooperate within the investment opportunity, more than two/third of the respondents stated their willingness to participate in the collective action, with an average amount to invest that varies significantly between the two farms typologies. While on average wine and vine farmers declared to be ready to invest 33,000 Euros, farmers involved in the livestock sector showed a willingness to invest much higher, equal to 276,000 Euros (Table 1).

Table 1. *Statistical figures of the sample of farms.*

	Wine & Vine				Livestock			
Variable	**Mean**	**std.dev**	**Min**	**Max**	**Mean**	**std.dev**	**Min**	**Max**
Utilized land area (ha)	23.21	23.64	2	80	97.63	91.75	14	450
Age of the entrepreneur	49	12.62	24	69	44.41	11.22	24	80
Gender of the entrepreneur	0.72	0.46	0	1	0.84	0.37	0	1
1 if located in Campania Region	1		0	1	0.34		0	1
Livestock count					319.3	446.7	6	2,500
Previous Participation in cooperation	0.375		0	1	0.09		0	1
Knowledge of cooperation initiatives	0.375		0	1	0.15		0	1
Stated participation in the investment opportunity	0.722		0	1	0.77		0	1
Stated amount to invest (euro)	32,778	71,850	0	250,000	275,892	484,746	0	2,000,000

Table 2. *Attributes and levels of contracts.*

Attributes	Levels definition	mean	St.dev	min	max
Investment degree of	values are randomly generated from an uniform in the 9-20	14.77	3.84	9	20
capital invested	Presence (1) or absence (0)	0.50	N.A	0	1
Length	Discrete value are randomly generated from an uniform	17.54	1.69	15	20
Management decision	Presence (1) or absence (0)	0.50	N.A	0	1

N.A: not applicable.

From an empirical point of view, the framework used in this study has roots in the random utility theory and it has been applied for contract attributes analysis by Roe *et al.* (2004) and Cembalo *et al.* (2014) among others. The model assumes that when a number J of contract alternatives has showed to a *i-th* farmer, the utility assigned by the farmer to each c contract alternative is a linear, additive, and separable function of all *a-th* attributes that constitutes the contract:

(1) $$U^i_j = f^i(\mathbf{x}_j) + \varepsilon^i_j$$

where $\mathbf{x}_j$ is a vector of observed attributes characterizing the c-contract.

The random nature of combining levels values populate the matrix $\mathbf{x}_j$ characterizing the *j-th* contract, including 121 different profiles of contracts over the total 828 submitted in 3 tasks to 92 farmers (Table 2).

The alternative chosen j represents the outcome of an expected utility maximization exercise of the farmer. The random utility model considers utility U^i_j equal to the sum of an observable component $\boldsymbol{B}^i\mathbf{x}_j$, with $\boldsymbol{B}^i$ as vector of unknown parameters varying across farmers, and ε_j the stochastic component:

(2) $$U^i_j = \boldsymbol{B}^i\mathbf{x}_j, + \varepsilon^i_j$$

Distribution of each $\boldsymbol{B}^i$ follows a normal distribution N~(t,σ^2), relaxing the i.i.d. assumption on the error terms. Estimates of t indicate the average value of the parameter: the greater (in case of statistical significance) the t, the greater will be the preference for that attribute of the contract. Estimates of σ^2 show the variability of the preferences toward each contract attribute across the farmers. $\boldsymbol{B}$ parameters can be estimated through the maximum likelihood estimator (Train, 2003).

3. Results

Below estimates obtained by conditional (random effects) logit model are reported (Table 3). From the estimation of the model it appears clear that the only contract attribute not considered by the farmers in their choices is "Management", that is the possibility, for the investors, to take part in the entrepreneurial decisions taken in monthly meetings. The coefficient is indeed not statistically significant (coefficient estimate 0.451, z-value 0.286). The model provides statistical evidence that farmers clearly prefer lower degree of risk and shorter length of the investment. Such attributes seem driving the farmers preferences towards the choice of a contract more than other attributes. Farmers prefer also the presence of the option that safeguards the capital invested. The relevance of the presence of this attribute is also showed by figure 1 that reports the influence of return from investment (degree of the risk) and the presence of capital invested warranted condition on the probability of choice the j-th contract.

Clearly, farmers willingness to join is negatively related with the degree of the risk but the presence or the absence of the option that safeguards the capital invested is indeed able to largely shift the pattern of this relation.

Furthermore, parameters estimates reveal that the preferences towards the different contract attributes are quite heterogeneous across farmers (figure 2): for instance, with respect to the presence of the option that safeguards the capital invested, around the 25% of the farmers involved in both livestock and wine/vine sectors seems to be uninterested to that option. Preferences for contract attributes vary also between the types of farming activities: while the tota-

Table 3. *Conditional (random effects) logit estimates.*

Random Coefficients ($\boldsymbol{B}^i$)	Coeff (τ)	Std.dev	t-stat	*p*-value
Capital Warranted	2.04	0.586	3.48	0.001
Management	0.451	0.422	1.07	0.286
Investment riskiness	-3.651	1.093	-3.34	0.001
Length	-3.902	2.22	-1.76	0.079
Constant (opt-out)	-4.033	1.905	-2.12	0.034
	Coeff (σ^2)			
Capital Warranted	3.531	1.047	3.37	0.001
Management	2.068	0.644	3.21	0.001
Investment riskiness	2.64	0.762	3.47	0.001
Length	3.119	0.743	4.2	0

Figure 1. *Influence of return from investment on capital invested warranted.*

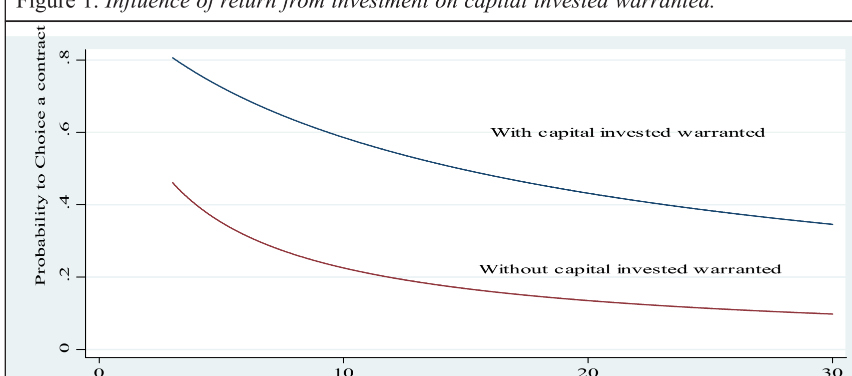
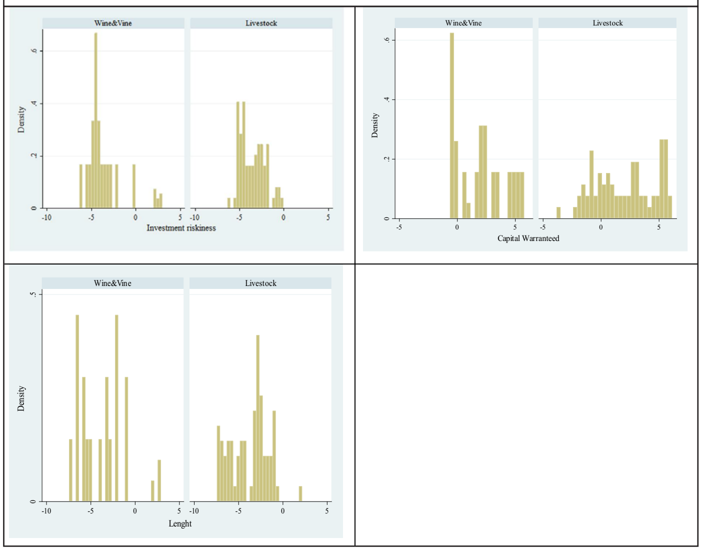


Figure 2. *Heterogeneity across farmers.*



lity of the farmers operating in the livestock sector prefers lower return and lower risk of the investment, a small share of the famers involved in the wine and vine sector (around 5 percent) prefers higher risks and returns (figure 2).

4. Conclusions

Energy-producing companies are paying attention to biofuel production attempting at a diversification of their activities. One of the main reasons is to gain room into the sustainable energy market. Companies, however, need to (re)invent new forms of cooperation with several investors and, often, they have to start from scratch. To this extent, a deep knowledge of the specific supply chain mechanisms and understanding how to manage integration and coordination become key elements to the success.

The focus of this paper was to study under what conditions it is possible to promote an agro-energy supply chain through a collective action. In our study areas, Sicily and Campania, a questionnaire was submitted to tackle the issue of a collective contract that promotes, though hypothetically, an agro-energy investment chain concerning biodiesel production by means of algal biomass. The analysis considered some attributes of a contract farming scheme and investigated the monetary tradeoffs farmers/investors are likely to make.

Our results seem to highlight that cooperation among farmers can be enhanced by contract farming if effective contract attributes are proposed to them. Results indicate, moreover, that conditions for a contract farming approach, aiming at building a bio-energy supply chain in the study area, do exist. However, individual differences for contract attributes should be taken into consideration. While companies would prefer standardized contracts, our empirical evidence indicates the need of personalized contract schemes. Farmers' willingness to join collective action/contract scheme seems, in fact, positively related with presence of the option that safeguards the capital invested and, negatively with the investment length and lower degree of risk (jointly with lower long run return).

Unlike the several studies in the literature on contract farming, which have mainly highlighted economics perspectives or policy implication, this study specifically contributes to managerial aspects. Our findings, however, suggest two policy implications. First, a large part of farmers interviewed have shown a significant motivation to invest in the proposed project conditional to receiving assistance in the field of capital investments. Hence, to promote participation in the proposed contract farming, public agencies should support agribusiness firms by facilitating access to credit and providing other forms of investment incentives. This condition would be particularly useful for farms and firms operating in the Mediterranean regions where credit access is more difficult to obtain.

Second, our findings suggest that balancing the risk averseness of farmers for capital investments is a prerequisite for an optimal contract design. So, the risk averse attitude of farmers might be balanced by innovative institutional framework aiming at sharing either risks and benefits (Meinzen-Dick *et al.*, 2004; Cembalo *et al.*, 2014). A possible policy intervention could be the facilitation of collective action building by means of producer organizations. This intervention may also induce agribusiness firms to offer more competitive contracts to farmers that would gain bargain power through cooperation (Poulton and Macartney, 2012).

Further research is needed in this field: i. The present study does not explore contract attributes in detail; ii. A deeper farmers' preferences exploration is needed. For instance, same attributes but in alternative arrangements; iii. Finally, results of a model with random effects is needed to go into potential heterogeneity of responses; iv. Our study somehow lacks of external validity. A larger number of interviews distributed nationwide would improve our findings in this respect.

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APPENDIX A – The questionnaire submitted

Introduction

Dear Sir/Madam,

My name is *(name of the interviewer)* and I'm conducting a research for the University of Palermo and the University of Naples Federico II.

This research is aimed to know the opinion of farmers operating in this area about the real investment possibilities for a new supply chain.

For this purpose, we would like to ask you to devote about 20 minutes of your time for responding our questions. Your responses are strictly confidential and will be used only for the objectives of this scientific research.

Section I. ***General information on the farm***

First, I would like to ask you some questions concerning you and your farm. I would like to remind you that all responses are completely anonymous and confidential.

1.1 Gender ☐ M__ ☐ F__

1.2 Age________

1.3 Self-employed farmer ☐ Yes ☐ No

1.4 Municipality in which the farm is located

1.5 Legal form
Individual farm ☐
Cooperative ☐
Other________________________

1.6 Agricultural land utilized
SAT (Total Agricultural Land) ha______________
SAU (Utilized Agricultural Land) ha_________________

1.7 Land ownership (SAU)
Property ha_____________
Rent ha_____________

Other (please, specify)________________________________ ha_____________

1.8 Main production____________________________

1.9 If the main production is livestock:
species (please, specify if more than one species)_________________
type of production (*e.g.* milk, meat, mixed)_________________
number of animals__________________ number of buffalos/cows________________

Section II. ***Attitude to changing***

2.1 Did you do investments in your farm in the last 5 years? Yes__ No __
If yes, which investments did you do?
2.1.2 Machines No __ No __
2.1.3 New constructions Yes__ No __
2.1.4 Processing and packaging Yes__ No __
2.1.5 Marketing Yes__ No __
2.1.6 Land acquisition Yes__ No __
2.1.7 Other

2.2 In the last 5 years, you did:
2.2.1 Cropping system changes Yes__ No __
2.2.2 Cropping techniques changes Yes__ No __
2.2.3 Organization changes Yes__ No __

Previous experience with contracts

2.3 Are there any type cooperation in your area (contracts
or informal cooperation, such as sharing of machines)? Yes__ No __

If yes, which type?____

2.4 Did you participate or are you participating to one of them? Yes__ No __

Why? ____

2.5 Did you participate or are you participating in one of the following types of contracts or informal agreements:

Contracts	Formal (written)	Informal (verbal)
Single Annual		
Collective Annual (cooperatives)		
Single multi-year		
Collective multi-year (cooperatives)		

Section III. ***Choice scenario***

Your farm is located in an area showing high potential to creating an energy supply chain for the production of biodiesel through a new technology based on algae biomass. This technology is also able to produce high value nutrients for humans and livestock from the residues of the algae biomass.

The interest in biodiesel in our country is growing. According to predictions about the use of renewable energies in the future, the use of biodiesel will significantly increase in the next decades. Similarly, products generated from the residues of algae biomass are gaining consideration in the domain of healthy food products for human nutrition.

As regards as the socio-economic conditions of the area under analysis, a system for the production of biodiesel and nutritional supplements would be an opportunity for both farmers and the community. Farmers would access to new and promising markets and new jobs would be available for the community.

The system for the production of biodiesel and algae needs a heated greenhouse (1500 m^2) provided with photo-bio-reactors, which are transparent plastic containers for cultivating algae in water. Furthermore, the system needs a lab equipped with the machines for the extraction of oil from the algae.

This new technology requires an investment of € 2 million, that would be partially guaranteed from public/private capital (state/banks) and partially provided from local farmers in order to assure that positive effects of the investments remain on the site. There are already in Italy examples of supply chains that subscribe partnership contracts with groups/cooperatives of farmers.

The aim of our research is then twofold: i. verify whether in this area there are the conditions for creating an energy supply chain based on biodiesel; and ii. identify which types of contracts local farmers would prefer for getting involved in an investment for a potential system for the production of biodiesel.

An energy supply chain is grounded on a contract between farmers and the public/private company that produces algae and derivative products. This contract regulates the starting investment and the allocation of profits.

Factors on which a contract is based – and on which please focus your attention – are the following:

DURATION OF THE INVESTMENT. Number of years for which the investor is committed.

RISK LEVEL OF THE INVESTMENT. Risk profiles are five: low, low-intermediate, intermediate, intermediate-high, high. High return of investment and potential profit fluctuations are associated to the high risk profile. The fluctuations are due to the price volatility of both biodiesel and algae for humans and livestock. Lower risk profiles are less risky thanks to an insurance depending on returns. The insurance cost represents the difference of the potential profit.

GUARANTEE OF THE CAPITAL INVESTED. Option aimed to safeguard the capital invested. The public/private company (state/banks) ensures to private participants a minimum return that allows to avoid the loss of the capital invested.

MANAGEMENT. Possibility for investors to be actively involved in business decisions by attending, on a bi-monthly basis, management and administration meetings of the company.

Now, I will show you a set of possible types of contracts that could regulate the relationship between the farmers of this area who decide to join the energy supply chain for the production of biodiesel and algae, and the energy company that builds and manages the production system.

Contracts will be showed in pairs and will be indicated as **contract A** and **contract B**. For each pair, please focus your attention on the abovementioned conditions implied for each factor, and choose the contract that you prefer.

EXAMPLE OF CHOICE

PLEASE, CONSIDER THE FOLLOWING PAIR OF CONTRACTS

		Contract A	Contract B
Characteristics of the contract	**DURATION OF THE INVESTMENT.** Number of years for which the investor is obliged to invest his share.	From 15 to 20 years	
	RISK LEVEL OF THE INVESTMENT. Risk profiles are five: low, low-intermediate, intermediate, intermediate-high, high. High return and potential profit fluctuations are associated to the high risk profile. The fluctuations are due to the price volatility of both biodiesel and algae for humans and livestock. Lower risk profiles are less risky thanks to an insurance depending on return. The insurance cost represents the difference of the potential profit.	Low 9% Low-intermediate 12% Intermediate 15 % Intermediate-high 17% High 20%	
	GUARANTEE OF THE CAPITAL INVESTED. Option aimed to safeguard the capital invested. The public/private company (state/banks) ensures to private participants a minimum profit that allows to avoid the loss of the capital invested.	YES/NO	
	MANAGEMENT. Possibility for investors to be actively involved in business decisions by attending, on a bi-monthly basis, management and administration meetings of the company.	YES/NO	

3.1 Which type of contract do you prefer?

Contract A [ ] Contract B [ ]None [ ]

If the interviewee has chosen at least one contract:

4.1 How much would you invest (in Euro – MAX 2 millions)? ___________

4.2 What is your average turnover per year (in Euro)? ____________