

1. Description du Modèle

The origin of the agency: The historical/cultural context of the Concrete System of Action (CSA)

To understand a Concrete System of Action (CSA) we must briefly refer to the context in which it appears, that where the language or culture, social constructs and particular interests of the actors occurs. A culture is in a good state if people looks for and *cultivates/cares* common good, and if it is auto-generative. On the other hand, a culture is ill if it is not autonomous, for instance, when it is highly imitative and oriented by external influence, actors and interests, creating some processes of change that disturbs its auto-generative capacities. Until the first decades of 1900, the Latin-American culture was in a good state. It was mainly of a rural character and auto-generative. Common good (including the culture) was cultivated. After these decades in the XX century, a high percentage of people from the country side moved to the cities (the rate: “people in the cities / people in country side” changed from 20/80 to 80/20 in many countries). Along this, imitation of other cultures promoted by, for instance, communication media like radio, TV, CINEMA, etc., increased the demand for material instruments, things, and technology that were poorly pertinent for the Latin-American society. Over time, also the quality of education and caring of common good in general decreased. Finally, the culture became ill (at different degrees, in almost all countries) in the sense described above as it lost its auto-generative capacity. As a result, socially negative attitudes appear in organizations, e.g., workers distract their effort towards activities different from their duties, creating an institutional problem in the public sector. This allows us to understand better why many actors in the CSA we are studying follow interests different, and even contradictory, to their duties, and then have more clear the differences between the normative game (the one that ideally must occur in accordance to the national and local laws, and in case the culture of the country were in a good state), and the actual played game (after particular interests of the actors appear in the game) (for more about this see Fuenmayor (2006)).

Like many regions of the world, in Latinamerica, and in particular in Venezuela, consumption and production of potatoes (and potato seeds) is highly important. The region around Mucuchíes town in Venezuela concentrates the highest national production of potato seeds. This work aims at representing the (social) game of power around the potato seeds in this region. We can see a graphical description of both, the formal ideal game and the actual game (or CSA), in Figure 1 and 2, respectively (in both graphs the green arrow indicates the flux of potatoes or of potato seeds). Afterwards, in Figure 3, we present the simulated simplified actual game/CSA. We are going to briefly describe here the three games, and will explain much better the simplified CSA in the following section.

In the ideal, nominal, game the state is involved and represented by a diversity of entities such as the Ministry for Agriculture and Lands (MAL), and the Ministry for Science and Technology (MST). The MST must give scientific and technological assistance. The MAL design the agricultural policies and gives monetary, technical and other kinds of support (instrumental and non instrumental (e.g., organizational aimed at qualitatively improving the system)) either directly or via dependant organizations.

MAL enjoys of the highest capacity in the country of monetary agricultural support, but has a bad management culture and is itself inefficient. *As said above, it designs the agricultural policies, but these are not really implemented in practice (this will be better explained in the actual model below).* Among the organizations subordinate to MAL we have: a) AGROPATRIA (“AGRO motherland”), a distributor of inputs including seeds; b) FONDAS (Fund for Agricultural Development), a provider of monetary assistance for promoting agricultural development; c) INIA, the national institute for agricultural research and technological assistance; d) INSAI, the National Institute of Integral Agricultural Health. This entity licenses imported potatoes seeds, by certifying the good quality of the potato seeds. Such a license is supposed to be a requirement to be fulfilled by the imported potato seeds (in the actual system this is not the case); e) SENASEM, or National Service of Seeds, an entity providing assistance to detect, and combat seed deceases. It provides the certification to the national potato seeds. All this entities, except FONDAS and AGROPATRIA, are represented in figure 1. FONDAS is not represented because its role is simple and

instrumental: to offer loans. AGROPATRIA from 2012 on takes the role of the importers of potato seeds and distribution of agro-chemicals. In Figure 1 we represent importers of potato seeds rather than AGROPATRIA, because in this work we are interested in the model of the system to 2011.

Apart from the state and its dependencies, in Figure 1 we have: a) PROINPA, a Civil Association of integral producers of potato seeds of the Venezuelan Andean high lands, or Páramo¹. It aims at generating models of productive diversification in general, and in particular at quantitative- and qualitative-ly improving the national production of potatoes seeds (including the whole production process, and local know-how). PROINPA in practice is the main actor producing pre-basic seeds², as INIA realises this role poorly; b) the university research centres, which give technological support to the producers of different kinds of potato seeds; c) the independent producers of potatoes seeds, who produce certified basic potato seeds (some PROINPA's producers also produce basic potato seeds); d) producers of potato seeds to the market and consumers (people and agro-industry after being distributed); e) the producers of potato seeds in another countries (this is a foreign actor out of the national system of production of potatoes, and will not be taken into account); f) the importers of potato seeds.

¹ We use the classification of the páramo "... according to its regional placement in the northern [Andes](#) of South America and adjacent southern Central America. The páramo is the ecosystem of the regions above the continuous forest line, yet below the permanent snowline. It is a "[Neotropical](#) high mountain biome with a vegetation composed mainly of giant rosette plants, shrubs and grasses" (see <http://en.wikipedia.org/wiki/Páramo>)

² Pre-basic seeds might have either sexual or asexual origin. "Original" potato seeds coming from the flower of the potatoes plant have sexual derivation, while seeds coming from manipulation of parts of the plant in a laboratory are the asexual seeds or vitro-plants. PROINPA only produces vitro-plants. .

Plants coming from pre-basic seeds produce abundant potato seeds in his first generation, and, though decreasing from generation to generation, also in the following two generations (they have too high productivity). Potato produced from vitro-plants in the first, second and third generation is called basic potato seed.

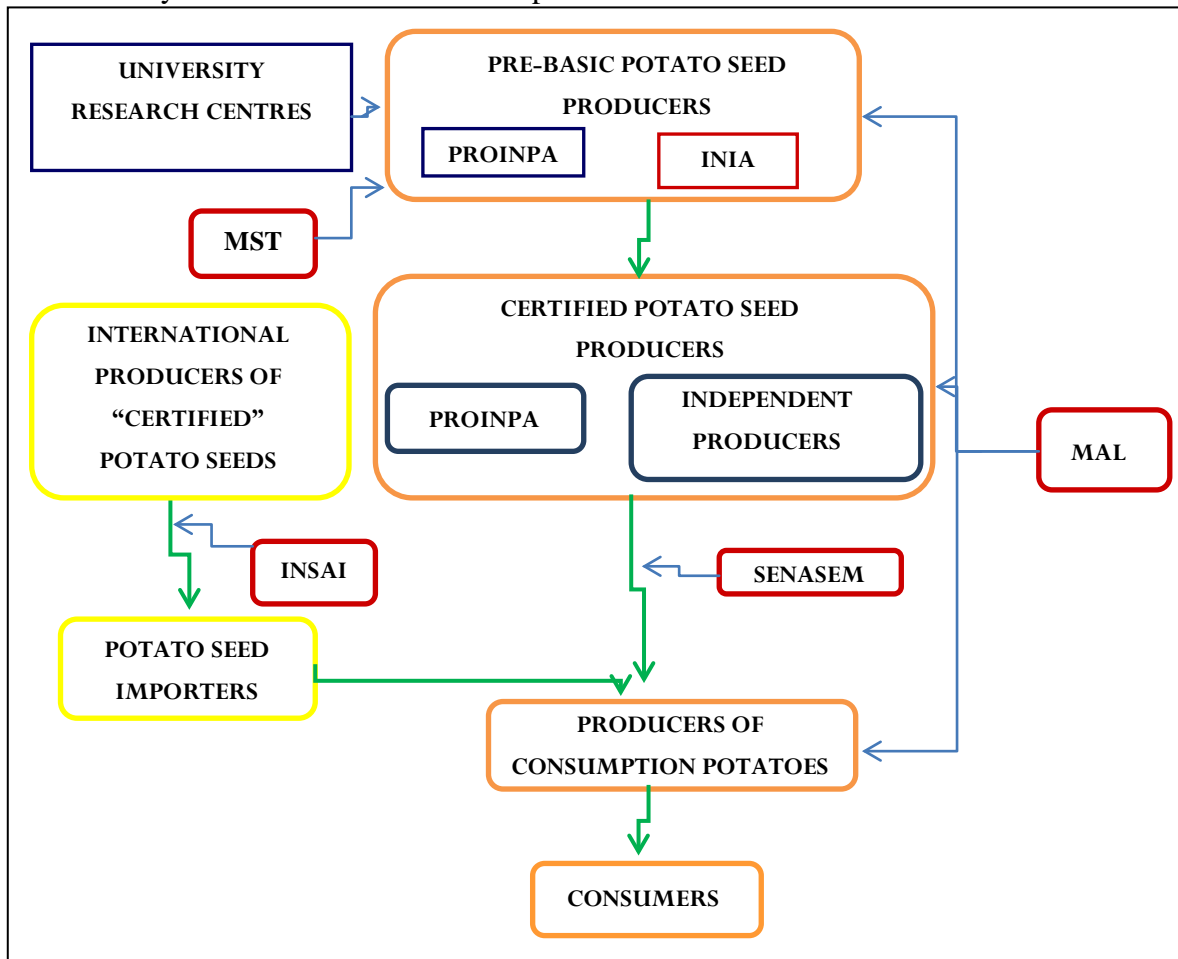


Figure 1. Formal/nominal ideal system, i.e., this is the system that is supposed to exist (in the laws and formalities of the Venezuelan STATE, and in many times in the diary language in Venezuela): all actors are supposed to be strongly engaged and looking for a sane potatoes seeds production process.

The actual game or CSA, alternatively, is presented in Figure 2. This game, in its reduced version (see Figure 3), will be described in the following sections. For now, let us mention some relevant issues making differences between the actual game and the normative game. First, in practice the Venezuelan state has contradictory strategies and actions; on one side, it favours research and production of national potato seeds; and, on the other side, it supports potato seeds importation, part of which frequently is contaminated (this is allowed by the MAL's subordinate entity, INSAI). The importation process is permeated by corruption, and has brought potato diseases from outside the country, which have infected local lands. Importation of foreign potato seeds discourages national production. Two new actors appear here (see Figure 2): the informal importers of potatoes seeds, who import potato seeds by using forms no approved by the state and the black market), and the mafia of distributors, who manipulate the market, to speculate with the price of the potatoes, and get particular profits.

In Figure 2, the strongly committed actors are placed at the right side, the lowly identified are in the left side and the other actors are close to the centre of Figure 2. The central actors in some way serve to the other two kinds of actors, allying with both of these in order to achieve their own goals. Because of this, they are in certain form more diffuse or malleable in terms of the interest of the other actors (this is indicated by the discontinuous lines in the figures representing these actors).

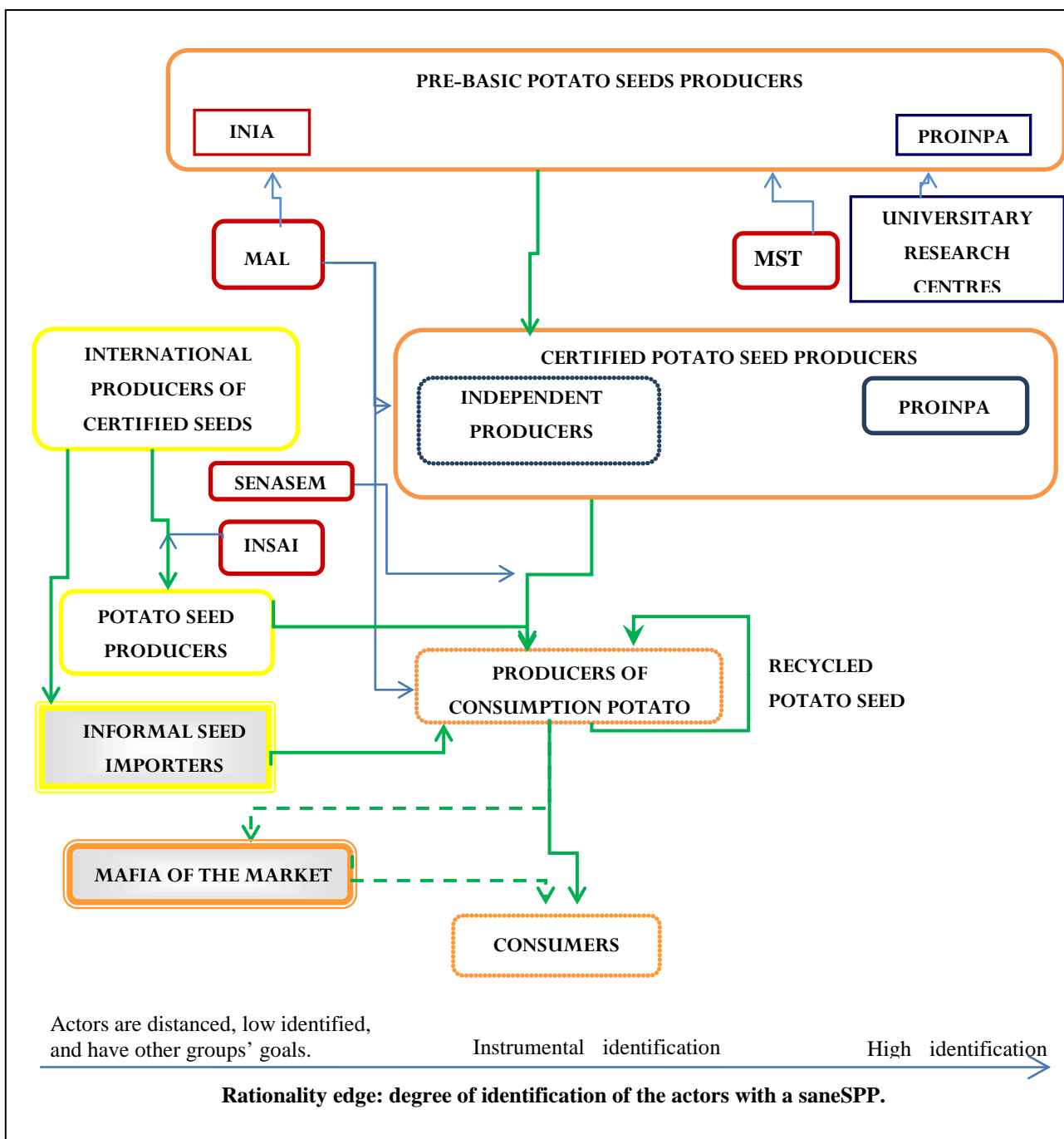


Figura 2. The actual system: actors and relations in the SAC. The actors more identified with a sane system of production of potatoes seeds (saneSPP) are at the right side, the less identified at the left side, and the moderately identified at the centre (their behavior seems more ambiguous if compared with that of the other actors, and because of this are drawn with a diffuse/discontinuous line). Two new actors appear, comparing with the normative system: the informal seed importers and the mafia of the market, as indicated by the double line of the border of the figure. The existence of these two actors has no sense (no explanation) in the normative game.

As said above, some actors described are irrelevant for the model, because they have similar interest and manage similar resources, and then several of them can be joined in a single actor, or can be subsumed in the more relevant actor, in Figure 3. For instance, the MAL represents INSAI, SENASEM, part of AGROPATRIA (other aspect of AGROPATRIA is represented by importers of potato seeds), INIA and FONDAS. These more relevant actors of the actual game are presented in Figure 3. The University Research Centres are subsumed within the actor called PROINPA. MST and PROINPA are represented as a single actor. The international producers of certified potato seed's actor is outside the national game. INIA is

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The consumers are eliminated from Figure 3, because they do not play a role different from those already represented in the model, and their interest might be in a good part reduced in the CSA to that of the producers of potatoes seeds. Both producers and consumers are interested in a good quantity (no too much on a high quality) of potatoes in the market. This is not necessarily is the case in the *ideal normative* game (here the actors look for a sane system of production of potato seeds, and are highly exigent), where consumer's action, thought as *political pressure*, could be understood as a function of the level of potatoes and the quality of the potatoes ($\text{political pressure} = \text{constant} - \text{constant1} * \text{amount of potatoes} - \text{constant2} * \text{quality of the potatoes}$). However, in the CSA the consumers are little exigent about quality, and their requirements are reduced to sufficient availability of potatoes in the market at a good price. We can say that in the CSA the satisfaction of consumers is a function of the satisfaction of producers ($\text{consumers' satisfaction} = \text{constant} * \text{producers' satisfaction}$), as long as the price of the potatoes is not too high, what is the case in the actual system of production of potato seeds. Though the price of the potatoes is not too high in the actual system, there is an important difference between the price of potatoes at the producer's field, and the price the potatoes have for the consumer: in the market there are low prices for the producer and high prices for the consumer. This is a fact that seems to be related with the presence of the mafia. Despite of this, when prices significantly increase, producers are also affected, because the demand is constrained.

That game shown in Figure 3 will be simulated in a computational model, by using the simulation platform SocLab. This model is aimed at understanding better the game of power, and to evaluate the potential (power) of the Venezuela State to significantly increase national potato seeds production. We will show that the low identification³ of the Venezuelan state with the national production of potato seeds is a critical factor that not only makes difficult the creation of a national system of production of potato seeds in a good state (a sane system of production of potatoes seeds, which we will call saneSPP), having important direct effects in the actual system (or CSA).

An important element of the simulation model is the set of solidarities between pairs of actors. Solidarities are due mainly to common interest of pair of actor, were an actor get satisfaction if the other has satisfaction – the satisfaction (equivalently influence) of an actor depends not only on his achievements, but also on the achievements of those actors he has solidarities to. Solidarities can be either positive or negative. In our simulation model, solidarities might be given to the fact that members of actors might overlap, i.e., some individuals or subgroups are members of actors A and B, simultaneously, For instance, this happens with the pair of actors: mafia of distributors and potato producers; producers of certified potato seeds and PROINPA; producers of certified potato seeds and potato producers.

³ Organizational (system, or in-group) identification characterizes the strength of the actor's membership to the system, organization, or group, and includes both a motivational component (his attachment to group goals) and a cognitive component (sharing of the group culture) (Simon, 1998).

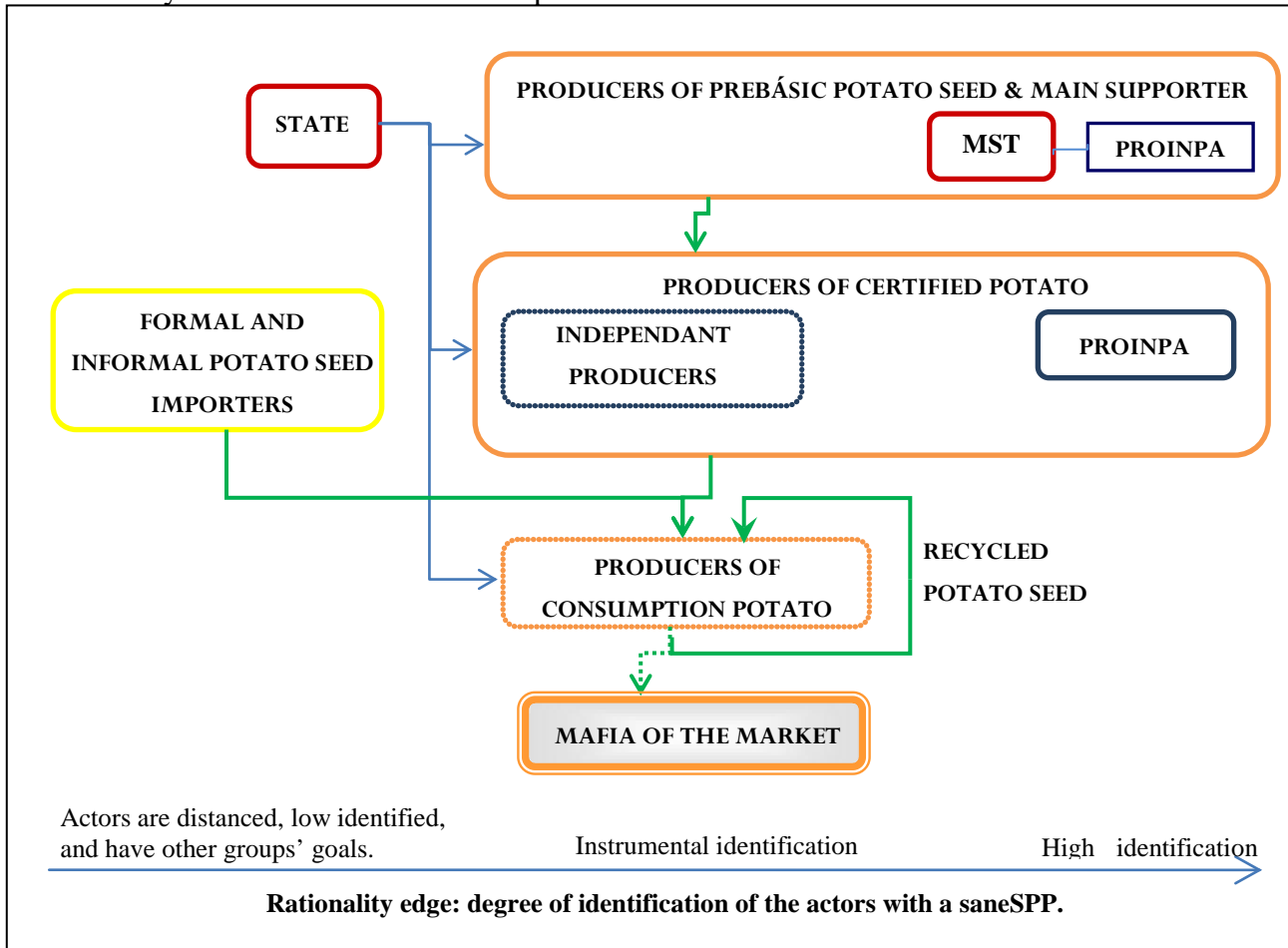


Figura 3. Simplified SAC. As in Figure 2, highly identified actors are in the right side, poorly identified actors are in the left side, and actors with an instrumental identification are in the centre of the figure. Redundant actors in Figure 2 whose action is not too important, etc., have been eliminated or joined to other more important actors.

In the present stage of the research, some specific hypothesis are of interest. These hypothesis could lead to other new hypothesis, and to a new version of the model, in a second stage of the research. Among the initial hypothesis that could be explored we have:

Hypothesis 1: A higher identification of the STATE with the actual system of production and distribution of potato seeds (that one modeled) here, would notably favor the increase of national production of potato seeds, and qualitative change the actual system towards a saneSPP.

Hypothesis 2: A STATE reeducated and highly identified with the production of national potato seeds (PROINPA_MCT's goal) would significantly favor the increase of national production of potato seeds, and the quality of the system towards a saneSPP.

We would like to explore the difference between a STATE identified with the actual system, and the state identified with a SPP, by using the model of the actual systems and the model of the normative ideal system. At present we have model of the actual system up to 2011, and we are working on two other models: the model of the actual system to 2015, and the model of the normative ideal game. Also we are exploring how the actual model could be directed towards the ideal normative game (i.e., about the necessary actions/policies).

Note:

From the present discussion we can see that the actual game is structurally different from the ideal normative model where the actors are compromised with a local system of production of potato seeds in a sane state. For instance, in the ideal model the mafia would not exist, the state will have a different attitude

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from that in the actual game (in the actual game the state has no control over the importers of potato seeds, who play a perverse game, where the STATE is in practice an ally of seeds importers in a certain sense. IN the ideal normative game the importers of potato seeds would be controlled by the state, so that they would bring in to the country only good quality and healthy potato seeds. Thus, it seems that we can not obtain the equivalent to the actual game represented in SOCLAB by changing only the identification of the actors in the ideal game, but rather a deeper structural change is needed.

We turn now to the description of the simplified CSA, in the next section.

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2. Acteurs et solidarités

2.1. Identification des acteurs

2.1.1. PROINPA_MST

Description : PROINPA is a Civil Association of integral producers of potato seeds of the Venezuelan Andean high lands, or Páramo. As said above, it aims at generating models of productive diversification in general, and in particular at quantitative- and qualitative-ly improving the national production of potatoes seeds. It produces vitro-plants (potato plants grown in vitro). PROINPA enjoys also of very good cognitive capabilities, management practices, good quality lands, and good market connections. It is strongly engaged in a sane system of production of potatoes seeds, aiming at satisfying the national demand with sane potatoes, compromised also with the good state of the lands. Contrary to this, actually it is usual to have actors importing seeds in bad state, which bring diseases to local lands, and/or manipulating the chain of distribution of potatoes seeds to get individual economic benefits, despite of the negative consequences to the system of production of potatoes seeds. On his side, the Ministry of Science and Technology (MST) formally is responsible for the national research policy, and executing the governmental budget aimed at supporting scientific research in the country. This Ministry gives technological support to the system of production of potato seeds, especially via PROINPA (e.g., by constructing for PROINPA labs to grow vitro-plants). Contrary to PROINPA, MST enjoy basically of monetary capabilities (it does not has good cognitive capabilities about potato seeds production, for instance). Both, PROINPA and MST show a high level of identification with a good system of production of national potato seeds, nevertheless PROINPA is (additionally) autonomous, and highly motivated, as it is continuously involved in action, not sporadically (as the STATE)..

2.1.2. SEEDS_PROD

Description : It represents the national producers of potato seeds. Its goal is to produce seeds for potato producers (POTAT_PROD), who in turn provides potatoes for the market/distributors. It gets pre-basic seeds from both, PROINPA, and importers of potato seeds (SEEDS_IMP). It constitutes an important link between PROINPA and the POTAT_PROD; because of this, PROINPA and a sane system of production of potato seeds has a strong dependence on it. If this actor does not perform its role properly, then a bottleneck would appear in the system, affecting the production of vitro-plant, what actually sometimes has occurred, preventing an effective flow of the potato seeds from PROINPA to the POTAT_PROD. A good information system, and a good system of distribution of vitro-plants, certified seeds, would help in diminishing this problem. The STATE's performance is fundamental for strengthening

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the link among the actors of the CSA. SEEDS_PROD are a weak actor, who prefers sometimes to produce potatoes for the market than potatoes seeds, if production of potatoes seeds is not well remunerated and appreciated.

2.1.3. SEEDS_IMP

Description : Importers of potato seeds. Usually they have imported potato seeds with diseases. This actor is lowly compromised with a sane system of production of potato seeds. The resource managed by this actor is important for the STATE, CONSUMERS AND PRODUCERS of potatoes, especially when the amount of potato seeds in the national market is too low. In order to get authorization to import potato seeds, this actor is interested in generating the opinion that the level of potatoes seeds and potatoes in the market is low, and thus it can benefit by the action of the MAFIA, who manipulate the market. If the level of potatoes seeds in the market is perceived as too low, or is going to be too low in a near future, then the government would be prompted to give foreign currency to the SEEDS_IMP to buy potato seeds from outside the country.

2.1.4. POTAT_PROD

Description : This actor grows potatoes for the market. These potatoes are used both, for consumption and for agro-industry. Also, potatoes are used as recycled potato seeds (low quality seeds), by the POTAT_PROD itself. POTAT_PROD is interested in a good price of the potatoes, and then it is not interested in producing excessively - its goal is to produce an appropriate quantity of potatoes in order to keep a appropriate level and a good price of the potatoes in the market. POTAT_PROD control two relations: production of potatoes, and use of recycled seed. POTAT_PROD benefits from the MAFIA, as long as the action of this actor does increase too much the price of the potatoes, and affects the price and the demand. Even more, as long as POTAT_PROD works in favour of a low and accessible potatoes price, his satisfaction is a good indicator of consumers' satisfaction (satisfaction of consumers is proportional to satisfaction of POTAT_PROD)..

2.1.5. STATE

Description : It is constituted mainly by the Ministry for Agriculture and Lands (MAL), and a set of institutions administratively dependant on this ministry, whose formal goal is to promote agricultural production in the country (MAL, INIA, INSAI, FONASEM, etc, see above). It is formally responsible for designing and implementing the agricultural national policies. It includes several organizations having, in practice, a closely similar identification (middle negative level) respect to an ideal sane system of production of potato seeds. It must give two kinds of support: instrumental, specially monetary funds; and, non instrumental, such as for instance, technological and organizational assistance to improve the system of production of potatoes seeds in order to achieve better its goal, and become more efficient (increasing, for instance, the synergy among the actors, as well as the quantity and quality of the product). However, the STATE's actual role in the CSA is badly performed, and too instrumental.

Cognitive and organizational resources would help in improving qualitatively the system of production of potatoes seeds beyond what only monetary support can offer. Such resources help, for instance, PROINPA to produce good quality potato seeds, which in turn are used by other actors. As said above, this second kind of support is almost inexistent. It seems that the rationality of the practice differs from the rationality of the formal statements and policies of the STATE. In addition, the interest of the STATE for politicism is sometimes in conflict with the STATE's support of the system of production of potatoes seeds, because of the scarcity of resources. .

2.1.6. MAFIA_MARKET

Description : This actor is comprised of part of the distributors of potato seeds, who manipulate the market in order to get power and economical benefits. For instance, they speculate by hiding a good quantity of potatoes from the market in order to "artificially"/deliberately increase the price of the potatoes (and recycled potato seeds). These practices give the mafia a strong influence on the market, since their action can artificially generate high/low prices. This, in turn, will create an important effect in diverse actors, and

then on the whole system of production of potatoes seeds. For instance, an artificially high price would incentive production of potatoes (and potential of recycled seeds), but constraint the demand, simultaneously, giving false and contradictory signals to the other actors, including the producers of potato seeds. This distortion of the market sometimes facilitates arguing in favour of importation of potato seeds, because of the perception of low existence of potatoes in the market. In turn, imported potato seeds along the hidden potatoes would create the opposite effect: too much potato in the market. This, in turn, falsely incentives low prices. Likewise, artificial low prices have associated negative effects. Thus, the MAFIA creates instability in the market, which, for instance, will affect PROINPA's production of vitro plants, as the market moves from high to low demand, and then to high demand again, in an "unnatural" form. Wrong signals from the market do not allow PROINPA and the other actors properly adapt to the market, as they follow untrue signals. Furthermore, wrong behaviour of the actors generates incorrect new signals, an incorrect feedback (e.g., the potential/likelihood for leaving unsatisfied demand in the market increases). In an ideal sane system of production of potato seeds, the action of the MAFIA_MARKET would be neutralised by the negative reactions and effects that this intervention on the market has. For instance, the actor would have difficulties to get support from the banks, and the government. However, such negative effects do not exist in the actual market of potato seeds we are studying, since the government, banks, etc, do not take into account such kind of actor's harmful action, when evaluating the actors' behaviour (perhaps because they are also little identified with a sane system of potato seeds (saneSPP) (that were good quality of the processes of production of potatoes, and of the potatoes, is well valued)).

2.2. Solidarités

solidarity	PROINPA_MST	SEEDS_PROD	SEEDS_IMP	POTAT_PROD	STATE	MAFIA_MARKET
PROINPA_MST	0.95	0.05	0.0	0.0	0.0	0.0
SEEDS_PROD	0.05	0.9	0.0	0.05	0.0	0.0
SEEDS_IMP	0.0	0.0	0.8	0.05	0.1	0.05
POTAT_PROD	0.0	0.05	0.05	0.85	0.0	0.05
STATE	0.0	0.0	0.1	0.0	0.9	0.0
MAFIA_MARKET	0.0	0.0	0.05	0.05	0.0	0.9

Matrices des solidarités entre acteurs. Chaque cellule représente la solidarité qu'un acteur (en ligne) accorde à un autre (en colonne). La valeur absolue indique l'intensité de la solidarité, elle peut être positive ou négative.

Here we explain all solidarities: Solidarities appear because certain individuals are members of several groups constituting the actors simultaneously, i.e., the set of individuals or groups that constitute the actors intercept among them. For instance, some individuals grouped in SEEDS_PROD are also members of PROINPA. Thus, what generates satisfaction for SEEDS_PROD generates certain satisfaction also for PROINPA, and vice versa. In particular, the set of individuals comprising the actor POTAT_PROD intercepts with several other sets of individuals constituting other actors, such as SEEDS_PROD, MAFIA_MARKET, and SEEDS_IMP. We find the following interceptions, and thus the corresponding pairs of actors linked with solidarities:

Solidarities because of "groups intersections":

SEEDS_PROD with PROINPA, and with POTAT_PROD (2)































POTAT_PROD with MAFIA_MARKET, and with SEEDS_IMP (2)













Other solidarities are due to common interest between the SEEDS_IMP and the STATE in using part of the support, given from the STATE (public funds) to import potato seeds, for their own particular benefit. For instance, a considerable monetary difference might occur in particular negotiations between the international price of the potato seeds, and the price at which the imported potato seeds are sold in Venezuela, generating a significant monetary difference which could be owned by the named actors; or, part of the dollars (external currency), given by the STATE to import potato seeds, might not be used to buy potato seeds, but rather deviated towards particular bank accounts of the named actors. There is, then, a sort of coalition between the STATE and SEEDS_IMP, originating certain solidarity between them.

3. Relations et dépendances

Relation	Controller	Bmin	Bmax	Frequence
PREBASIC_S	PROINPA_MST	-10.0	10.0	1.0
CERTIFIED_S	SEEDS_PROD	-10.0	10.0	1.0
¬IMPORTED_S	SEEDS_IMP	-10.0	10.0	1.0
POTATOES	POTAT_PROD	-10.0	10.0	1.0
RECYCLED_S	POTAT_PROD	-10.0	10.0	1.0
SUPPORT	STATE	-10.0	10.0	1.0
¬MANIPUL_M	MAFIA_MARKET	-10.0	10.0	1.0

Liste des relations de l'organisation.







effect	PROINPA_MST	SEEDS_PROD	SEEDS_IMPORT	POTAT_PROD	STATE	MAFIA_MARKET
PREBASIC_S	 3.5	 2.0	 0.5	 1.0	 0.5	 0.2
CERTIFIED_S	 1.5	 3.0	 1.5	 1.5	 1.5	 1.0
¬IMPORTED_S	 1.0	 1.0	 3.5	 1.0	 1.5	 1.5
POTATOES	 0.5	 1.5	 1.0	 3.0	 2.5	 2.5
RECYCLED_S	 1.0	 1.0	 0.5	 1.5	 1.0	 1.5

SUPPORT	 1.5	 1.0	 2.0	 1.0	 2.5	 0.3
MANIPUL_M	 1.0	 0.5	 1.0	 1.0	 0.5	 3.0

Matrice récapitulative des fonctions d'effet et enjeux des acteurs sur les relations. La somme de la distribution des enjeux pour chaque acteur est normalisée à 10.

3.1. PREBASIC_S

Description : Pre-basic seeds (generally vitro plants), including the varieties : “Única”, “Granola”, R12, and “varied certified seed”. These are used to produce the basic certified seed, which in turns is used to produce potatoes for the market. They have better quality than certified seeds and recycled potato seeds, because of their high productivity, and because they are diseases free (phytopathologically sane). They, then, are appreciated by diverse actors in different forms. The demand of these kinds of seeds is a source of power to the actor controlling them.

	PROINPA_MST	SEEDS_PROD	SEEDS_IMP	POTAT_PROD	STATE	MAFIA_MARKET
PREBASIC_S						

Fonctions d'effet de la relation "PREBASIC_S".

Intervalle	Interpretation
[-10.0 ; -6.0[There is too low or null production of pre-basic seed.
[-6.0 ; 6.0]	There is little production of pre-basic seed.
]6.0 ; 10.0]	There is good production of pre-basic seed.

Interprétation de l'échelle de valeur de la relation "PREBASIC_S



Effet sur PROINPA_MST : The lower the production of pre-basic seeds the worst for PROINPA_MST (PROINPA' goal is to produce pre-basic seeds). The larger the production of pre-basic seeds, the more PROINPA_MST gives, and the higher the potential for PROINPA_MST for receiving from other actors who appreciate the pre-basic seeds.



Effet sur SEEDS_PROD : The higher the production of pre-basic potato seeds, the best for the SEEDS_PROD, who use them as their main input. However, alike what happens with the state, after some point the additional benefit of a certain increase in the production of vito-plants is lower, while very low levels of the resource do not generate an important effect. This is related to the low identification of the SEEDS_PROD with a sane system of production of potato seeds (seed producers with a higher identification would appreciate better pre-basic seeds, and then the stake and the effect function would be different: higher both of them). However, this actor has a higher identification than that of the state.



Effet sur SEEDS_IMP : The lower the production of pre-basic seeds the best for the SEEDS_IMP, as this resource is natural competence for imported potatoes.



Effet sur POTAT_PROD : The higher the level of pre-basic seeds, the higher the availability of potatoes seeds, the main input of this actor.



Effet sur STATE : The higher the production of potato seeds, the higher the potential for certified seed, and then for potatoes. In addition, the higher the production of potatoes, the higher the potential of the state to get votes in the next elections. However after some point, the additional effect generated by an augment of this resources for the state increases more slowly, because the additional potential for producing more potatoes and increasing the potential for votes is lower (already there is enough potatoes in the market, and the difference cause little effect on the actor's perception of the STATE's performance). Also very low levels of this resource do not generate an important effect.



Effet sur MAFIA_MARKET : A high amount of pre-basis seeds increases the potential for a high production of potatoes. For MAFIA_MARKET a certain but not too high level of production of potatoes is good (after some point the production of potatoes makes difficult to manipulate the market). Thus, after some point the production of pre-basic plants would not be good, as it facilitates a too high production of potatoes.

3.2. CERTIFIED_S

Description : Production of certified seeds, or seeds grown from the PROINPA's vitro-plants. These seeds require a good quality certification, which in Venezuela is given by the INSAI, one of the entities being part of the STATE actor. These seeds are the main input (along imported potato seeds, and recycled potatoes) to produce potatoes for the market.

	PROINPA_MST	SEEDS_PROD	SEEDS_IMP	POTAT_PROD	STATE	MAFIA_MARKET
CERTIFIED_S						

Fonctions d'effet de la relation "CERTIFIED_S".

Intervalle	Interpretation
[-10.0 ; -5.0[Production of certified seed is too limited or null.
[-5.0 ; 5.0[There is little production of certified seed.
[5.0 ; 10.0]	There is good production of certified seed.

Interprétation de l'échelle de valeur de la relation "CERTIFIED_S"



Effet sur PROINPA_MST : The higher the level of certified seeds, the higher the demand for pre-basic

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seeds (produced by PROINPA, and the good state of the whole system of production of potatoes seeds (for PROINPA it is better to produced national certified seed than to import seeds)).



Effet sur SEEDS_PROD : The higher the CERTIFIED_S, the best for this actor up to some point, after which it might means a high stress, because of the high work required (such a point would be higher if the actor had a higher identification with a sane system or prod. of potato seeds). On the other hand, a high level of CERTIFIED_S requires some scarce resources, such as appropriate warehousing for the accumulated produced seeds (warehouses with low, close to 0° C, temperatures are demanded and the exiting capacity is limited).



Effet sur SEEDS_IMP : the lower the amount of this resource the best for this actor, since this resource competes with the resource the actor controls in the market. A low level of CERTIFIED_S facilitates to argue in favour of getting foreign currency to import potatoes and potatoes seeds, which then will generate strong economical benefits (these wins could be used to pay functionaries who give the approval to the foreign currency (these are lateral/marginal payments between actors in a coalition)).



Effet sur POTAT_PROD : the higher the level of this resource the best for this actor, as CERTIFIED_S is a key input for this actor.









Effet sur STATE : Certified seeds are used for producing potatoes for the market, what in turn helps the state to justify its role, as well as the political party managing the state to promote itself in politics and diverse kinds of elections. The state receives a better impact as the amount of CERTIFIED_S increases, however after some point, a certain increase in CERTIFIED_S has lower effects than a similar increases at revious values of CERTIFIED_S.



Effet sur MAFIA_MARKET : On one hand, low (equivalently too high) level of any kind of seeds helps in decreasing (equivalently increasing) production of potatoes and other potato seeds; on the other hand, too low (scarcity) or too high production of potatoes and potatoes seeds makes difficult to manipulate the market. Consequently, an intermediate, somewhat low level (certain scarcity), of potatoes and of any kind of potatoes seeds is good for this actor.

3.3. -IMPORTED_S

Description : This relation shows the negative value of the quantity of imported seeds, which sometimes has a bad quality, comes into the country in a too high level, and is subsidized. Importation of potato seeds in a high amount and with bad quality, as well as manipulation of the market of potatoes by the MAFIA_MARKET, disfavour the endogenous or internal production of potato seeds, thus their negative value favours a sane system of production of potato seeds. The negative value of importation of potato seeds (low importation or cero importation represented to the right side of the horizontal edge), is in favour of national production of all kinds of potato seeds and of potatoes.

	PROINPA_MST	SEEDS_PROD	SEEDS_IMPORT	POTAT_PROD	STATE	MAFIA_MARKET
¬IMPORTED_S						

Fonctions d'effet de la relation "¬IMPORTED_S".

Intervalle	Interpretation
[-10.0 ; -5.0]	There is a good level of imported seed.
[-5.0 ; 5.0]	There is little imported seed.
]5.0 ; 10.0]	There is too little imported seed.

Interprétation de l'échelle de valeur de la relation "¬IMPORTED_S"



Effet sur PROINPA_MST : The less the levels of IMPORTED_S the better for PROINPA_MST, as IMPORTED_S (usually strongly subsidized) competes with local seeds produced by PROINPA.



Effet sur SEEDS_PROD : Imported seeds compete with the certified seeds the SEEDS_PROD grows, thus the higher the level of imported seeds (to the left side of the horizontal edge) the worse for SEEDS_PROD.



Effet sur SEEDS_IMPORT : The higher the level of IMPORTED_S (left side of the figure) the better for the SEEDS_IMPORT, as its goal is to get benefits from importing potato seeds.



Effet sur POTAT_PROD : POTAT_PROD are interested in potatoes seeds, whatever be their origin, because this is the basic input for producing potato seeds.









Effet sur STATE : the higher the IMPORTED_S the best for the state in order to bring into the market a great quantity of potato seeds and thus potatoes. For levels of this resource far from a central value, changes of the value of the resource generate little change of the effect.



Effet sur MAFIA_MARKET : scarcity of imported potato seeds (up to some point) has a good effect on the activity of this actor, as it facilitates manipulation of the market. However, a too high level of scarcity of potato seeds in general is negative, since then there would not be any market to be manipulated.

3.4. POTATOES

Description : Potatoes are the central resource in the system of production of potato seeds, that one appreciated positively by all actors, and justifying the existence of the system.

	PROINPA_MST	SEEDS_PROD	SEEDS_IMPORT	POTAT_PROD	STATE	MAFIA_MARKET
POTATOES						

Fonctions d'effet de la relation "POTATOES".

Intervalle	Interpretation
[-10.0 ; -5.0]	Production of potatoes is too limited or null
[-5.0 ; 5.0]	There is little production of potatoes.
[5.0 ; 10.0]	There is good production of potatoes for consumption

Interprétation de l'échelle de valeur de la relation "POTATOES"



Effet sur PROINPA_MST : The higher the production of potatoes, the higher the demand for certified seeds, and for vitro-plants. Thus, the higher the production of potatoes, the better for PROINPA.



Effet sur SEEDS_PROD : the higher the level of potatoes, the higher the demand for certified seeds, thus the best for this actor.



Effet sur SEEDS_IMPORT : if the production of potatoes for consumption is high, so is the demand of seeds, what is good for this actor



Effet sur POTAT_PROD : up to some point, the higher the level of POTATOES produced, the best for this actor; however, too high levels (beyond that point) would mean certain stress for the actor, and low prices of the potatoes they produce (too high offer in the market).



Effet sur STATE : The higher the level of POTATOES, the better for the state, otherwise there will appear high political pressure over the state from diverse actors including producers (and consumers), which the state wants to prevent.









Effet sur MAFIA_MARKET : Up to some point, the higher the level of potatoes the easier to manipulate the market.

3.5. RECYCLED_S

Description : Represents the usage of Potatoes as (low quality) seed. This favours several actors, because from it also potatoes for the market are gotten, however, productivity and quality of the potatoes is

low. The actors getting benefits from this practice are: the state, the mafia and producers of potato seeds. Actors who consider this practice negative are the other providers of seeds, including PROINPA, importers of potato seeds, and producers of certified seeds.

	PROINPA_MST	SEEDS_PROD	SEEDS_IMPORT	POTAT_PROD	STATE	MAFIA_MARKET
RECYCLED_S						

Fonctions d'effet de la relation "RECYCLED_S".

Intervalle	Interpretation
[-10.0 ; -5.0[Usage of potatoes for consumption as recycled seed is very limited or null.
[-5.0 ; 5.0]	There is little usage of potatoes for consumption as recycled seed
]5.0 ; 10.0]	There is a good level of usage of potatoes for consumption as recycled seed.

Interprétation de l'échelle de valeur de la relation "RECYCLED_S



Effet sur PROINPA_MST : The use of recycled seed, on one hand, is competence for the other kinds of seeds, such as certified seed which uses as input PROINPA's vitro-plants; and, on the other hand, is bad for the system of production of potatoes because it is of low quality. Thus, the higher its value, the worst for PROINPA (an actor well identified with a saneSPP).



Effet sur SEEDS_PROD : recycled seed is competence for certified basic potato seeds, thus, the lower its level, the best for this actor.



Effet sur SEEDS_IMPORT : The lower the level of recycled potatoes in the market, the best, since this facilitates getting foreign currency and authorization to import potato seeds.



Effet sur POTAT_PROD : up to some point, the higher the level of use of RECYCLED_S, the best for this actor (it represents cheap and easy to find seed); however, too high levels of RECYCLED_S (beyond that point) would mean that the system of production of potato seeds will have very bad quality seeds, low performance, and bad quality potato. In an ideal model, the actor would appreciate better good quality seed, and much less recycled seed.



Effet sur STATE : A high level of RECYCLED_S is of interest for the state, because it increases the potential for potatoes, his main goal, in order to make easier his promotion and the promotion of the party in



Effet sur MAFIA_MARKET : Up to some point, the higher the level of recycled potato seeds facilitates the manipulation of the market, because it increases the potential for producing potatoes.

3.6. SUPPORT

Description : Production support includes diverse inputs, such as: agro-chemicals, loans, technical guidance, and foreign currency for importing potatoes or equipment for PROINPA. Support is directed to producers of pre-basic potato seeds, producers of certified potatoes, producers of potatoes for the market, and importers of seeds. Support indirectly benefits also the MAFIA, because it allows having in the market potatoes in a good amount and price, helping in leaving a margin for manipulation of the market (it helps in increasing potential difference between the price of potatoes at the production place/field, and the price of potatoes in the market).

	PROINPA_MST	SEEDS_PROD	SEEDS_IMPORT	POTAT_PRICE	STATE	MAFIA_MARKET
SUPPORT						

Fonctions d'effet de la relation "SUPPORT".

Intervalle	Interpretation
[-10.0 ; -6.0[There is little support for the production of potato seeds. There is very low monetary, and technical assistance
[-6.0 ; 6.0]	There is low support
]6.0 ; 10.0]	There is good support.

Interprétation de l'échelle de valeur de la relation "SUPPORT"



Effet sur PROINPA_MST : The highest the production support, the best for PROINPA_MST, as it facilitates currency and other assistance for importing equipment, for improving the production process and distribution mechanisms, and for acquiring inputs.



Effet sur SEEDS_PROD : The higher the support the best for this actor, as he himself and PROINPA, his main provider, receive support.



Effet sur SEEDS_IMPORT : The higher the support, the best for this actor, as this increases the probability of getting foreign currency to import potato seeds.



Effet sur POTAT_PROD : The higher the support the best for this actor, who will find more help to grow potatoes, including seeds, financial help, and other forms of assistance.



Effet sur STATE : Formally and ideally, the state shall be interested in giving a high level of support; however, in practice (actual model), it is happy with giving a low level of support, as it is lowly interested in a sane system of production of potato seeds. After a relative low level of support an increase in support has a negative effect on the state. Actually, this resource is too instrumental (consisting mainly in monetary support, and a low level of bad quality advise).



Effet sur MAFIA_MARKET : An intermediate, somewhat low level (certain scarcity), of potatoes and of any kind of potatoes seeds is good for this actor, since this facilitates manipulation of the market and of the potato prices. On one hand, support helps in increasing production of potatoes and potato seeds; on the other hand, too low (scarcity) or too high production of potatoes and potatoes seeds makes difficult to manipulate the market (too low levels or too high levels are far from an equilibrium point at which prices could intentionally be increased or decreased). Thus, support is good up to some point.

3.7. \neg MANIPUL_M

Description : This relation expresses the negative value of manipulation of the market of potatoes for consumption. Usually, manipulation can be understood as speculation in the market of potatoes, including hiding potatoes in order to increase scarcity and consequently increase the potatoes price. Manipulation destabilizes the market of potatoes, and then also the market of potato seeds. A stable market implies a steady demand of potatoes, as well as of pre-basic potato seeds, and basic seeds, without important sudden changes that would require changes in the offer of potato and of potato seeds. In turn, sudden changes in the demand of pre-basic seed, basic seeds, as well of potatoes, generate destabilising effects on the producers of potatoes and potato seeds. It would abruptly create too high demand so that the producer can not satisfy it because it was not pre-seen, or, alternatively, sudden too low demand making difficult for the producers to sell their production, losing part of it, and money. In addition, manipulation of the market can favour importation of potato seeds, because of the scarcity it generates some times, which generates political pressure over the state, who in turn then will afford foreign currency to import potato seeds. Usually in Venezuela, there is an important difference between the price of a product for the producer and the prices it has in the market for the consumer: low price for producer and high price for consumers. This is a fact that seems to be related with both: the presence of the mafias, and with the inefficiency of the distribution chains.

	PROINPA_MST	SEEDS_PROD	SEEDS_IMPORT	POTAT_PROD	STATE	MAFIA_MARKET
\neg MANIPUL_M						

Fonctions d'effet de la relation " \neg MANIPUL_M".

Intervalle	Interpretation
$[-10.0 ; -4.0[$	There is a high level of manipulation of the market.
$[-4.0 ; 4.0]$	There is a low level of manipulation of the market.
$]4.0 ; 10.0]$	There is a very low level of manipulation of the market.



Effet sur PROINPA_MST : PROINPA_MST is interested in a stable market, what means a not manipulated market.



Effet sur SEEDS_PROD : a high level of manipulation of the market would increase too much the price of the potato seeds and of potatoes for the consumers, what is not good as the demand of potatoes, and then of potato seeds in the market would decrease. However, certain level of manipulation of the market would increase the prices with a low impact on the demand.



Effet sur SEEDS_IMP : the higher the manipulation of the market, the better, as high manipulation of the market would create in general a high price of the potatoes and an instable market, a situation where it will be easier to convince the state for supporting importation of potato seeds (the state facilitates foreign currency). In addition, manipulation of the market has a negative effect on national producers of seeds, what would favour importation of seeds in the future.



Effet sur POTAT_PROD : Up to some point, manipulation of the market would have no negative effect for this actor, as it has little effect in increasing the price of the potatoes for the consumers, however, after some point manipulation of the market will generate a constrained demand of potatoes seeds, because of the high prices of the potatoes in the market, what affects consumers.



Effet sur STATE : After some point, manipulation is bad for the state, as it can create conflict and political pressure.



Effet sur MAFIA_MARKET : The higher the manipulation of the market the best for this actor - his goal is to manipulate the market get economical benefits.

4. Constraints

Contraintes	PREBASIC_S	CERTIFIED_S	¬IMPORTED_S	POTATOES	RECYCLED_S	SUPPORT	¬MANIPULATED_M
PREBASIC_S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CERTIFIED_S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
¬IMPORTED_S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POTATOES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RECYCLED_S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SUPPORT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
¬MANIPULATED_M	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Matrice récapitulative de l'ensemble des fonctions de contraintes.