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The strawberry marketing network in Michoacán, Mexico: A structural view (A)

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Contents

Introduction

Strawberries are a highly important crop, economically and socially speaking, in the State of Michoacán in Mexico[2]. The strawberry business there is currently in the midst of a process of transition from commodity-type production towards a dynamic industry capable of creating value added. A significant policy challenge in this sector is thus to integrate the strawberry producers into the market's new trends.

A vast body of literature has grown up around the issue of how agricultural producers access different markets, particularly the factors that determine their choice of marketing channels[3]. This research has provided valuable information on the importance of producers' own traits, their capacity to access different assets and transition costs as determinants of their involvement in markets. These analyses, however, are based on individual agents' economic rationality and have neglected social structures and relations as conditioning factors in decisions on production, consumption and distribution[4]. In this regard, trading relations are often found to be determined by a preference for certain suppliers or buyers, social and/or cultural considerations, a track-record of trust or even mere convenience[5].

The hypothesis at the core of this work is that first-line buyers are key actors in the strawberry marketing network in the State of Michoacán. Since they act as intermediaries between producers and end destinations, they play a crucial role in determining which markets the goods will ultimately reach. This paper also argues that deep asymmetries of commercial power exist between and within different groups of buyers, as well as in linkage patterns among the different levels of the marketing chain. Lastly, geographical disparities are expected to emerge in the trading positions of actors, as some agents may be locally important but their influence is diluted when the network is examined from a global perspective.

In order to pursue these hypotheses, this paper proceeds with a structural analysis of the strawberry marketing chain using a Social Network Analysis (SNA) approach. SNA may be defined as the formal study of linkages between actors and the social structures that arise as a result of their recurrence[6]. Rather than taking the individual as the unit of analysis, this approach focuses on relational data or the tie between a pair of social actors[7]. SNA is thus based on the premise that social phenomena are explained not by the sum of a set of individuals acting according to their own individual rationality, but largely by structured patterns of linkages among them.

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[2] Medina and Aguirre, 2007.

[3] Goetz, 1992; Hobbs, 1997; Ferto and Szabo, 2002; Key et al., 2000; Bellemare and Barret, 2006.

[4] Granovetter ,1985.

[5] Newman, 2002.

[6] Porras, 2005.

[7] Wasserman and Faust, 1994.

The network concept has been used in a variety of studies as a framework to understand social structure and its effects on different trading systems. Some authors have explored the importance of cohesion in networks of sellers in North Africa during the Middle Ages[8]. Others have conducted a qualitative analysis of networks of street sellers in the city of Lima, Peru[9]. At a more macro level, SNA concepts have been employed to study industrial relations from a regional perspective in Spain's Basque Country[10]. Research has also been conducted into governance networks as determinants of regional industrial development in Denmark[11]. SNA's potential contribution to the study of the strawberry chain in Michoacán lies in its ability to provide a distinct and original conceptual and methodological framework for the systematic analysis of the social component of behaviour.[12] This is based on a vision no longer of production chains, but of social networks that exhibit certain structural properties arising from the position of the actors and their interrelationships, which both condition and result from their behaviour.

This study proposes to establish the traits of the main marketing channels for strawberries in Michoacán by identifying the final markets for the produce, determining the role of intermediaries as key actors within the network and analysing potential structural differences in the local networks of the State's various strawberry-growing valleys. Based on these results, the study hopes to formulate a number of recommendations for the development of federal and state policies to improve access to dynamic markets for strawberry producers.

[8] Greif,1989.
[9] Aliaga, 2005.
[10] Semitiel and García, 2004.
[11] Jensen, 2006.
[12] Freeman, 1981.

1.0 Structural indicators of the network

1.1 Cohesion

The primary structural attribute of social networks is the density of relations, which may be interpreted as a measurement of social cohesion[13], or of the intensity of ties between actors[14]. In the particular case of a network of commercial relations, measures of linkage density may represent an indicator of associativeness. Density indicators measure the number of ties, which are usually expressed in a relative form. The density of connections at the level of the total network is examined using the *global density index*, which measures the ratio between the sum of all the linkages existing in the network and the maximum number of possible connections. In order to analyse density patterns between and within different groups, the total network may be partitioned into sub-networks defined on the basis of particular attributes exhibited by the actors.

For this research, the marketing chain is categorised by levels in order to represent the vertical and horizontal structure of the network. Comparison of relationship density among levels thus helps to determine potential differences in the dynamics of forward or backward linkages. Within levels, density can also reveal distinctive patterns of horizontal linkages between actors.

1.2 Embeddedness

From the perspective of SNA, it is essential to examine the way actors are embedded within the social structure in order to understand how it affects their behaviour. Granovetter argues that economic relations are embedded within a broader framework of social relations, which in one way or another condition the actions of economic agents beyond mere individual rationality[15].

Global density analysis can, however, mask certain patterns of localised relationship densification that form centres of greater associativeness and commercial cohesion among actors. Such groups are identified within the network by using a clustering index, which indicates the density of a particular actor's linkages relative to the size of his or her area of relationship, i.e. the number of pairs of actors directly related to that person. The clustering index thus measures the degree to which actors are integrated into associative environments. Such structures promote the internal

[13] Coleman, 1988.
[14] Porras, op.cit.
[15] Granovetter,1985.

diffusion of information and enhance their members' capacity to adapt their behaviour through shared normative, symbolic and social structures[16].

1.3 Accessibility

Another common method of analysing cohesion is to calculate the *accessibility matrix*, which captures the capacity of the different actors to connect with each other, either directly or indirectly, by means of the structure of linkages existing within the network. In this particular research, the accessibility analysis aims to determine the type of second-line buyers to which producers have access, as a function of the intermediaries with whom they relate. Accessibility analysis can thus help to identify different types of marketing channels and to understand how the network structure favours, limits or even excludes certain groups of producers from particular types of markets.

1.4 Structural equivalence

It is useful to determine the degree of similitude of the actors' social positions in order to establish patterns of competition and concentration of trading/commercial power, as well as to identify areas of cooperation and complementarity. This may be approached by means of a *structural equivalence analysis*, which is used to establish the degree of similarity among linkage structures pertaining to different actors.
The many indicators of structural equivalence include those based on the paired comparison of agents. Such indicators seek to determine the frequency with which actors share linkages with third parties. In large, spread-out —or low-density— networks, simple indicators tend to show low values with little variation[17]. In order to mitigate this problem, a binary indicator based on Jaccard[18] was used to express the number of common linkages as a proportion of the total linkages reported by each actor. This indicator can serve as a basis for constructing clusters of structurally equivalent actors, i.e. those who have similar positions within the social network structure.

1.5 Centrality

Centrality refers to a particular actor's relative importance within a social network. In this case, centrality analysis can identify the types of buyers and individual actors where relational power within the strawberry network is focused. Possessing a large number of linkages is usually interpreted as a source of social capital. In fact, the connections that an actor establishes are viewed as a valuable asset, providing that

[16] Grannovetter, 1992.
[17] Hanneman and Riddle, 2005.
[18] Jaccard, 1900.

they enable him or her to adopt a position within the structure of interchanges among agents[19]. The simplest indicator is Freeman's *degree centrality*, which measures the number of partnership ties possessed by each actor[20].

In the case of directed data such as the sale/purchase relationships analysed here, values are obtained for outdegree centrality (partnerships in which the actor is selling) and for indegree centrality (where the actor is buying). The number of outward linkages provides a measure of the influence a particular actor has over others. In the case of a marketing network, this influence is based on diversification of the channels and markets in which an actor can place his output. The number of inward relationships is interpreted as an indicator of prestige, since it identifies those actors to whom others wish to send information[21]. For the purposes of a network of the type studied here, the number of purchase relationships is basically an indicator of an actor's commercial importance as a destination for produce.

Another way of analysing the power of the actors is to study their *betweenness centrality*[22]. This is a complementary measure of degree centrality, which shows the frequency of an actor's presence along the shortest (most efficient) paths between another pair of actors. By enabling connections between actors who would otherwise be unconnected or linked only at a high cost, the intermediary has the capacity to exert control and generate dependence[23]. This position enables the actor to extract benefits from transactions and possibly add value to them[24]. Hence, the more actors who depend on a particular intermediary to establish their connections, the more power that agent has.

1.6 Structural holes

The pattern of linkages established in a particular actor's direct commercial environment helps to determine important structural properties of his personal network (egocentric network). Analysis of bilateral and tripartite relations within these networks provides a deeper insight into the nature of the power conferred by the capacity of intermediation.

Disconnections among actors within a personal network can give rise to what are known as *structural holes*[25]. These are generated by the existence of groups of unconnected actors and hence lead to the separation of sources of non-redundant

[19] Burt, 2005.
[20] Freeman,1979.
[21] Hanemman and Riddle, 2005.
[22] Freeman, 1977.
[23] Burt, 2005, op.cit.
[24] Burt, 1992.
[25] Burt, 1992, op.cit.

information[26]. Thus, those actors whose relationships pass through structural holes have a comparative advantage because they can access more information, exert some degree of control over disconnected groups and take on diverse roles and identities vis-à-vis those other groups[27]. A number of indicators have been developed for the quantitative study of structural holes, including *dyadic constraint* and *network efficiency*.

The structure of a particular actor's ties can place limitations on the behaviour of agents linked to said actor. An indicator of the *dyadic constraint* index is used to conduct a formal analysis of this type of power. This indicator is complex to calculate and the details lie outside the scope of this work. However, the basic idea is that an agent who has few alternatives to trading with a particular intermediary with whom, moreover, the actor's other linkages are also related, will probably find his or her behaviour constrained by that intermediary[28]. The dyadic constraint variable thus represents a measure of an actor's ability to exert control within their immediate commercial environment.

Related to dyadic constraint is the indicator of *efficiency* of linkages, which represents the ratio of the effective size of an actor's network to the total number of linkages in it. Effective size indicates the number of the actor's connections minus the average number of linkages of the agents related to that actor. The efficiency calculation thus penalises personal network size by the level of diversification of related actors' linkages. Efficiency may be interpreted as a measure of the impact the agent is achieving as a result of the investment that has been made in establishing linkages[29], since it shows the extent to which such linkages are non-redundant and thus vital to the trading ability of related actors.

1.7 Commercial roles

By looking at the roles that actors play within the social network, we can add to the analysis of their power and influence from a qualitative perspective. From a structural point of view, the diversification of roles is an advantage because it allows an actor to reap tangible and intangible rewards from his or her capacity to broaden their spheres of intermediation.

Brokerage analysis provides a framework for the formal examination of commercial roles, of which five types are defined as a function of actors' capacity to form linkages with different kinds of agents[30]. The brokerage roles proposed are: (i)

[26] Burt, 2005. op.cit.
[27] Padgett and Ansell, 1993.
[28] Hanneman and Riddle, 2005.
[29] Ibid.
[30] Gould and Fernandez,1989.

coordinator, who mediates between actors within his or her own group; (ii) consultant, who mediates between actors from the same group, but does not belong to this group; (iii) gatekeeper, who connects different actors from the same group; (iv) representative, who connects an actor from his or her own group to an actor in a different group; and (v) liaison, who connects agents from different groups, neither of which are his or her own. In this scheme, the actors are classified by their level in the marketing chain. Therefore, liaison is the natural role of an intermediary and hence, is not the focus of attention in this analysis. The emphasis is placed instead on identifying other potential roles that agents may play within the strawberry network, especially those arising from the horizontal linkages that develop within a single level.

2.0 Survey and data treatment

With a view to establishing the characteristics of the marketing chain from an SNA standpoint, this work used the databases built up from surveys of producers and brokers conducted within the framework of the research on the strawberry production and marketing chain in the State of Michoacán.

The survey of producers was statistically based on a representative sample taken in the following regions of the State of Michoacán: the Zamora Valley (which comprises the municipalities of Jacona, Zamora, Tangancicuaro and Ixtlán), the Panindícuaro Valley (Panindícuaro) and the Maravatio Valley (Maravatio). The sample framework included all the producers who planted strawberries during the February 2005-July 2006 period.

A probabilistic, systematic sampling method was employed and the sample was stratified in two stages, giving a statistical confidence level of 95 per cent. Sample errors were less than 15 per cent in all the areas included in the research. The final sample size was 302 producers, with an expected non-response rate of 20 per cent. A high percentage of the larger and more mechanised producers did not respond to the survey, therefore it is not representative of that stratum.

A second survey was conducted with track buyers who purchased from intermediaries mentioned in the first instance by producers. The interviews were held in the Zamora, Maravatío and Panindícuaro valleys (fifty-two, nine and four interviews respectively), with a total of 65 surveys of agroindustries (packing and processing industries), wholesalers, brokers, intermediaries, transporters and so forth. The questions were asked mainly via personal interviews and, in some cases, by telephone or e-mail.

Based on the information compiled in the two surveys, a binary matrix of relational data was constructed for the Michoacán strawberry network. The data were purged of responses that did not allow the buyer in a particular transaction to be identified, in order to exclude these from the analysis.

Actors were categorised by their position in the marketing chain: (i) strawberry-producers (first level of the chain); (ii) first-line buyers (second level of the chain); and (iii) second-line buyers (third level of the chain). In the case of first-line buyers, the classification vector was based on the following six possibilities as defined by the producers: (i) exporter, (ii) agroindustry, (iii) wholesaler, (iv) retailer, (v) broker-trucker (*fletero comisionista*), and (vi) informal intermediary. Second-line buyers were classified, on the basis of expert opinion, in the following categories: (i) wholesaler, (ii) agroindustry, (iii) exporter, (iv) supermarket, and (v) other. As a complement to this and in order to classify the different actors' commercial significance in a more

meaningful way, the researchers developed a matrix of valuated relations in which each element represents the volume traded between a particular pair of actors, without considering possible discounts for rejection of the fruit.

The territorial dimension is especially important for analysing the relational structure of socio-economic systems, because of the existence of spatial clusters in which knowledge, information and innovation are disseminated and where local relations are based on trust[31]. In addition, due to potential spatial differences within the network structure, it may be necessary to add some territorial components into policies designed to improve access to dynamic markets. Sub-matrixes of both commercial ties and volumes were developed for the Maravatio, Panindícuaro and Zamora valleys in order to conduct a territorial analysis of their marketing networks. The actors falling within each of the sub-matrixes are geographically referenced producers, with the buyers related to them and clients of these first buyers either at the same level of the marketing chain or the next one up.

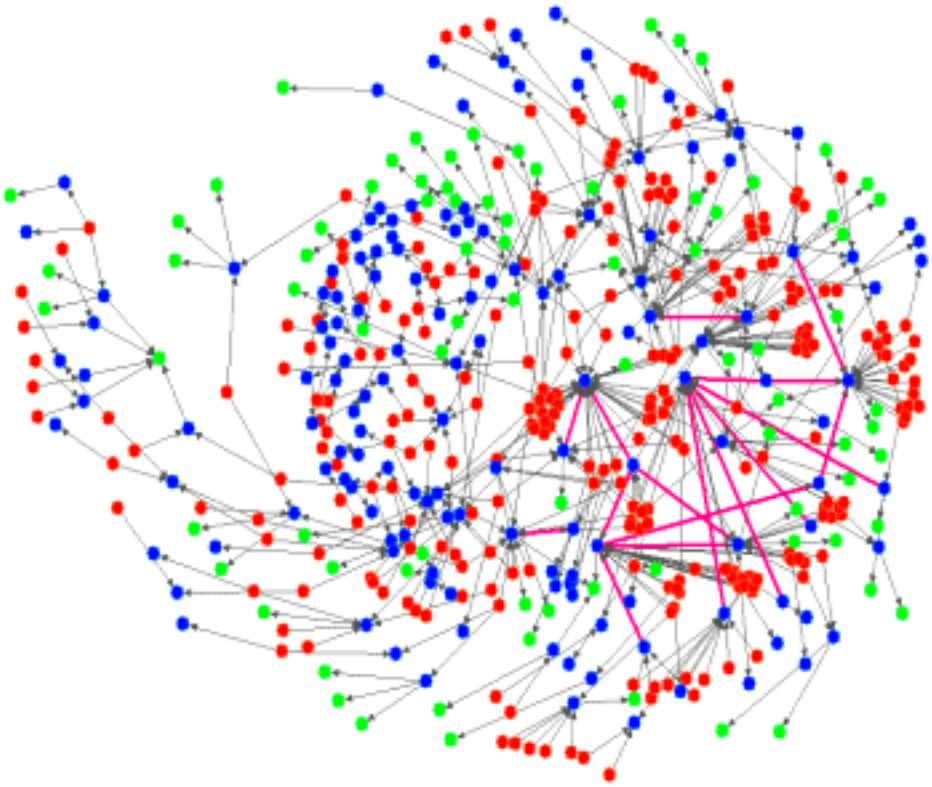
[31] Semitiel and Noguera, 2004.

3.0 Findings of the structural analysis

3.1 Commercial cohesion and patterns of embeddedness

Figure 3.1 shows a representation of the strawberry marketing network in Michoacán generated using the NetDraw network visualisation software. The nodes in the graph represent the different actors classified by their level in the chain. The colour red represents the producers, blue, the first-line buyers and green, the second-line buyers. The (directed) lines indicate the existence of a commercial tie, in which the node of origin is the seller and the destination node is the buyer. The pink lines represent horizontal relations between first-line buyers and the blue ones represent vertical relations along the chain (producer – first-line buyer – second-line buyer).

Figure 3.1: Graph of the strawberry marketing network in Michoacán



Source: prepared by the authors.

A number of the structural features of the strawberry network in Michoacán arise from simple observation of the figure. The network has a notably low density, i.e.

there are few ties in relation to the large number of actors and possible connections. It is also evident that there are a number of clusters of producers around a few first-line buyers.

The global density index[32] shows that at least 1 per cent of all possible linkages are in fact present. Calculation of density per level of the chain (Table 3.1) confirms that low cohesion of commercial ties occurs transversally. The total absence of commercial ties between producers is striking: the group's level of internal associativeness and organisation for marketing is virtually nil. Only about 0.9 per cent of all possible relationships between producers and first-line buyers exist, while between first- and second-line buyers only 0.8 per cent of possible linkages are formed. The low frequency of vertical relations suggests that the network has few crossed flows of trade and a minimum of superposition of marketing channels.

It is also apparent that there are some ties between first-line buyers (less than 0.1 per cent of the total possible). This small group of intermediaries is able to spread its commercial influence more efficiently by linking up with other intermediaries who mediate between actors at the levels above and below. In any case, although these agents have forward, backward and horizontal linkages within the chain, they were not found to be important points of localised cohesion within the network. In fact, the clustering index showed a maximum local density of only 3.3 per cent in the commercial environment of the FRUSAMEX agroindustry company. The linkages structure of these intermediaries also shows little similitude, with values of not more than 6 per cent. Those low levels of structural equivalence support the statement that these actors do not compete for their suppliers and clients but, on the contrary, stand as lone rulers of the spaces they have established within the strawberry marketing system.

Table 3.1: Density of commercial ties by level of marketing chain

Level of the chain	Producers	First-line buyers	Second-line buyers
Producers	0 (0)	0.0092 (0.0954)	0 (0)
First-line buyers	0 (0)	0.0008 (0.0283)	0.0084 (0.0914)
Second-line buyers	0 (0)	0 (0)	0 (0)

Note: Standard deviation within the group is shown in brackets.
Source: prepared by the authors.

[32] The calculation of the global density index was altered in order to exclude relations among second-line buyers; while these may be present, they are not captured in the surveys.

In summary, the analysis of cohesion and social embeddedness suggests that the channels are fairly vertical and narrow, with a typical funnel structure and minimal possibilities of diversification of marketing alternatives. It may also be concluded that the structure of the strawberry network in Michoacán is formed by actors who, in general, do not associate, cooperate or trade collectively. Nevertheless, the existence of commercial ties among first-line buyers shows that a predominant marketing circuit can be identified within the Michoacán strawberry network. This is represented in the sub-graph shown in Figure 3.2.

Figure 3.2: Network of first-line buyers with horizontal ties

3.2 Relationship dynamics

In order to classify the distribution of power in commercial relations throughout the network, degree centrality indicators were calculated at the different levels of the marketing chain. Striking in the case of producers is the small number of sales relationships, with 1.3 buyers on average. The survey found that no producer had more than four exit channels for their produce. In fact, over 90 per cent had no more than two exit channels and almost 60 per cent relied exclusively on a single buyer. This shows that the majority of producers are commercially vulnerable, which weakens their power to negotiate with intermediaries. There is a small group, by contrast, with a slight advantage, as it has more diversified channels (business relationships with three or four different buyers).

In turn, first-line buyers have, on average, 3.6 times more purchase than sales ties and their purchase linkages are highly dispersed, with a variation coefficient of 145.5 per cent. Their betweenness centrality was found to be even more concentrated than their degree centrality, with a variation coefficient of 353.8 per cent. These findings suggest that commercial power is highly concentrated in the hands of a few key actors at this level. Second-line buyers, on the other hand, tend to show a considerably more constant pattern of commercial linkages, since the coefficient of variation of the number of their purchase ties was 58.3 per cent.

In sum, the structure of commercial linkages is indicative of power asymmetries among and within the different levels all the way up the chain. There are a few highly structured channels in which a small number of first-line buyers determine the destination of much of the strawberry harvest. The findings show that the forward and backward linkages of those intermediaries exhibit qualitatively different relationship dynamics. Thus, whereas they have a fairly asymmetric relationship — in their favour— with producers, their trading leverage with second-line buyers is more balanced. In terms of power distribution within the groups, no great differences exist among producers or second-line buyers, but considerable imbalances do emerge among intermediaries.

3.3 Different types of buyers

Analysis of the number of ties and volumes traded by type of first and second-line buyers (Table 3.2) shows that the largest groups are agroindustries, wholesalers and informal intermediaries. Agroindustry controls almost 47 per cent of purchase linkages and over 60 per cent of the total volume. The fact that agroindustry accounts for a higher concentration of production than it does of linkages suggests that this segment tends to establish commercial relations with larger-scale producers. The opposite is true of the informal brokers known as *fleteros comisionistas* (referred to hereafter as “broker-truckers”), whose niche seems to lie mainly within a dispersed

level of small growers (12.6 per cent of all supply linkages and only 2.7 per cent of the total volume). It is worth noting that informal intermediaries (referred to locally as "coyotes") are involved in a considerable proportion of transactions (17.3 per cent) and account for a large percentage of volumes (16.2 per cent). This confirms the perception in the field that such agents play an important role in the strawberry marketing network in Michoacán.

First-line buyers exhibit similar patterns of linkages and volumes for both sales and purchases. Agroindustry is again the channel through which the bulk (46 per cent) of commercial relations and the great majority of sales volumes (80 per cent) with the third level of the chain are conducted. Informal intermediaries still figure as significant channels, but only in terms of linkages (16.8 per cent of the total) since they account for only five per cent of total volume. This finding may be attributed to the effect of the large producers, who deal mainly with agroindustries. Since these were not included in the sample used in the research, their sales volumes were not registered in the survey of producers, although they were reflected in the sales of first-line buyers.

Interestingly enough, the inward linkages of second-line buyers show supermarkets as fairly insignificant actors at the third level of the chain, since they account for only 1 per cent of all commercial ties and volumes. This is probably because supermarkets bring in their strawberry supplies mainly from the United States and from the Federal District Central Market *(Central de Abasto del Distrito Federal*, or CEDA-DF)[33], and do not obtain them via the shorter channels indicated in the present survey. Together, agroindustry groups and exporters account for some 70 per cent of purchase linkages and approximately 90 per cent of the volumes bought at the third level of the chain. The wholesale market is important in terms of linkages (with a share of 18.6 per cent), though not in terms of volume (only 6 per cent). Thus the selection patterns according to agent size that were observed between producers and intermediaries are also repeated at the second level of the chain. While exporters and agroindustry obtain their supply from large buyers, wholesale markets tend to buy from smaller intermediaries.

In summary, the findings set out above show a clear pattern in which channels are structured around processes of value added. There is a dynamic channel made up of the linkages the larger producers form with agroindustries and, through these, with export markets. This contrasts with a separate channel through which smaller, more traditional producers link up with intermediaries such as broker-truckers, with the output ending up in fresh fruit markets in the country's central zone.

[33] Boucher and Salas, 2007.

Table 3.2: Commercial significance of first- and second-line buyers

Type of buyer	% of all purchase linkages	% of purchase volumes	% of all sales linkages	% of sales volumes	% of total betweenness
First-line buyers					
Exporter	3.1	4.4	7.6	4.5	0.6
Agroindustry	46.9	61.1	46.2	79.5	58.3
Wholesaler	19.0	15.5	10.1	6.5	5.7
Retailer	1.2	0.1	7.6	1.6	0.0
Broker-trucker	12.6	2.7	11.8	3.0	29.1
Coyote	17.3	16.2	16.8	5.0	6.3
Second-line buyers					
Exporter	18.6	49.6	-	-	-
Agroindustry	41.2	39.7	-	-	-
Wholesaler	29.4	5.9	-	-	-
Supermarket	1.0	1.3	-	-	-
Other	9.8	3.5	-	-	-

Source: prepared by the authors.

An analysis of betweenness capacity according to type of first-line buyer shows agroindustries and truckers accounting for almost 90 per cent. These groups exhibit a high betweenness centrality — ten times higher, on average, than that of the wholesalers and ´coyotes´. In turn, this variable is highly dispersed within all the groups (coefficients of variation of over 200 per cent), which reflects the predominant role of a few actors in each. Notably, no retailer is located on the most efficient route between any other pair of actors. This group is therefore a second-choice alternative, with no collective power within the strawberry network. Lastly, the power of the coyotes diminishes considerably when analysed from the perspective of betweenness. This finding is consistent with their niche as an alternative channel to which producers turn in circumstantial situations, such as liquidity restrictions or problems with fruit quality.

Having examined the linkages structure of the different types of actors in the network, data were obtained on the ability of producers to access different types of second-line buyers. Regardless of the route taken (through one or more intermediaries), the end markets for about half of all the producers' output are agroindustry (48.3 per cent) and exports (52 per cent). Conversely, only a small proportion (14 per cent) of producers has access to the wholesale market (mainly the supply centres in the country's central zone) and much fewer (less than 3 per cent) to the retail market (supermarkets).

These results confirm that dynamic markets, both domestic and international, are becoming increasingly important for the area's strawberry production[34].

[34] Boucher and Salas, 2007.

Nevertheless, it is clear that the structure of the marketing channels imposes barriers that prevent Michoacán producers from locking into the benefits of localisation and getting their produce into supermarkets. This exclusion from the supermarket channel has a detrimental effect on the competitiveness of producers as regards their peers in other parts of the country, particularly in Baja California[35].

3.4 The heart of the network

Given the evidence of power concentration among the different types of first-line buyers, individual data were examined in order to identify the actors with the most influence within the network. A multi-attribute analysis was conducted on an individual basis, and the findings are set out in Table 3.3 below. The main first-line buyer by inward centrality is the wholesaler Carlos A. Gutiérrez, who accounts for 8.1 per cent of all purchase ties registered for those buyers. This agent is followed by Agrana Fruit de México S.A. (agroindustry), Interfrut S.A. (agroindustry) and Mendiola S.A. (broker-trucker), with 4.7 per cent of all relations. These agents thus enjoy a strategic position of power and influence within the structure of the marketing network by providing supply security, enhanced access to production and commercial information and greater capacity to disseminate trade standards and practices.

By contrast, the producers linked to these first-line buyers are in a vulnerable position, since each is just one more alternative among a broad range of supply options. Among the second-line buyers, the export firm Interamerican Quality Foods shows the largest number of purchase relations, with 5 per cent of the total registered at the third level of the chain. However, within this group, linkages are considerably more evenly distributed than among the intermediaries, and none of the final buyers account for a large proportion of all commercial linkages.

An examination of the importance of actors from the perspective of purchase volumes shows that the main first-line buyers tend to be those who also account for the bulk of the linkages. Notable exceptions to this are the agroindustry Frexport, S.A. and the wholesaler José Luis Navarro. The producers from whom they source their strawberry produce account for a small percentage, but some of them are large concerns.

Among the second-line buyers, the agroindustry Danone and the export firms Interamerican Quality Food and Congeladora Latinoamericana stand out, because together they purchase almost a quarter of the output at this level of the chain. Interamerican Quality Food is the only significant actor in terms of both number of commercial linkages and purchase volumes. The rest of the main second-line buyers

[35] Ibid; Medina and Aguirre, 2007.

by volume have suppliers that are few in number but tend to buy in large volumes. This type of dynamic may reflect highly personalised relations with their intermediaries. From the point of view of the suppliers, this may be interpreted as an indicator of social capital that may actually offset the loss of betweenness stemming from their lower levels of connectedness[36].

With regard to the first-line buyers' sales relations, generally speaking, the intermediaries with the largest numbers of supply ties tend also to sell to the largest ranges of buyers. However, the most diversified first-line buyer in terms of sales, Frusamex S.A., is not among the agents with the largest numbers of purchase linkages. Frusamex is a party to around 4.2 per cent of possible sales relations among first and second-line buyers and is followed by agroindustries Congeladora del Rio, Agrana Fruit de México S.A., Mendiola S.A., Alimentos Profusa S.A. and Procesadora García, which account for 3.4 per cent of all sales relations at the second level of the chain. With the exception of Alimentos Profusa, these intermediaries are among those with the most linkages with both producers and second-line buyers. In the opposite position to Frusamex is Carlos A. Gutiérrez. This actor has more linkages with producers than any other, but is not among the most diversified in terms of sales channels.

The sales volumes of the first-line buyers show the agroindustries Agrana, Congeladora del Río and Alimentos Profusa as the chain's main second-level sellers (about 25 per cent of total volumes). These agents also dominate sales relations at this level. By contrast, a number of important intermediaries, such as Carlos Gutiérrez and Mendiola, do not figure as major sellers, even though they are large buyers. Again, this is attributable to the exclusion of large producers from the data compiled in the survey. To conclude, the contrast between the first-line buyers' volumes and linkages for purchases and sales suggest that, although the dynamics of the linkages are different, those agents with most power in the chain usually wield that influence both forwards and backwards.

It may be inferred from the individual analysis of betweenness centrality that the main first-line buyers tend to be those that also stand out in terms of purchase linkages and volumes. However, unlike those two variables, betweenness reveals a much sharper centralisation of power in the network. One clearly influential agent, Mendiola S.A., figures on 22.4 per cent of all the existing routes of minimum betweenness. Its power thus lies not only in the large number of its ties, but also in the fact that those links are with producers who lack other efficient marketing channels. Mendiola is followed in order of importance by Agrana Fruit de México and Congeladora del Rio, which represent between 10 per cent and 15 per cent of total betweenness. The high level of dependence associated with these first-line

[36] Aliaga, 2005.

buyers gives them a predominant commercial role and places them in a highly powerful position. Interestingly, Carlos A. Gutiérrez, the intermediary with the largest number of ties, is much less significant from the perspective of betweenness capacity (with only 3.2 per cent of the total possible), reflecting the fact that many of that agent's suppliers have access to more direct channels to markets at the higher levels of the chain.

The index of dyadic constraint confirms the strong capacity of the main intermediaries to exert control over the actors that trade with them. Agrana Fruit de México, Mendiola S.A. and José Luis Navarro are some of the more significant players, able to totally restrain the trading activities of 60 per cent or more of their trading partners. The actor with the greatest capacity to control its trading environment, however, is the Impulsora Agropecuaria S.A. agroindustry (dyadic restriction of 87.5 per cent), which is not, however, very significant in terms of relations or volume.

As the earlier analyses suggest, the intermediaries in the strawberry network are highly efficient in their trading relations, having established practically exclusive links with their suppliers and buyers (all the intermediaries identified in Table 3.3 have an efficiency rate of over 94 per cent). In sum, the indicators relating to structural holes show that the major actors in the Michoacán strawberry network are typically well positioned to control their trading circuits and consequently, can impose their own terms in commercial relations with a broad margin of discretionality.

Brokerage analysis served to identify first-line buyers in different commercial roles. Hence it was established that certain actors are able to assume gatekeeping and representative roles, as well as their natural function as intermediaries. The main gatekeepers are Mendiola S.A. de R.L de C.V., Familia Arredondo (an informal intermediary) and Bonifacio Ordóñez (a broker-trucker). Together, they are stakeholders in around 70 per cent of indirect linkages between a producer and another first-line buyer. These actors typically do not process the primary output in any way. Thus, they form a kind of sub-level within the second level of the marketing chain, probably acting as contingency suppliers to help cover large orders from other intermediaries.

In turn, Agrana and Congeladora del Rio are the main actors fulfilling representative roles, i.e. linking another intermediary with a final buyer. Together, these two are involved in around 66 per cent of such commercial ties. Unlike the gatekeepers mentioned above, these firms have production processes that add value to the commercial linkages, thereby opting to access more dynamic and profitable final markets.

Table 3.3: Main actors in the strawberry network

Actor (1)	% of total purchase ties	% of purchase volume	% of total sales relations (2)	% of sales volume (2)	% betweenness centrality (2)	% linkages with full dyadic constraint (2)	Efficiency of linkages (%) (2)	% total gatekeeper relationships (2)	% total representative relationships (2)
First-line buyers									
Agrana Fruit de México S.A. de C.V.	4.7	11.9	3.4	9.7	14.3	75.0	99.7	0.0	37.9
Carlos A. Gutiérrez	8.1	8.7	0.8	0.7	3.2	34.3	99.8	0.0	6.9
Frexport, S.A. de C.V.	3.8	8.2	0.0	0.0	0.0	18.8	100.0	0.0	0.0
Congeladora del Rio	2.8	4.6	3.4	8.1	10.6	43.8	99.2	0.0	27.6
Jose Luis Navarro	0.5	4.4	2.5	0.2	0.4	60.0	100.0	0.0	0.0
Alimentos Profusa S.A. de C.V.	1.7	4.3	3.4	7.1	2.1	45.5	100.0	0.0	0.0
Procesadora García	4.3	4.3	3.4	3.5	5.3	36.4	100.0	0.0	0.0
Interfrut S.A. de C.V.	4.7	4.0	2.5	3.3	4.4	47.8	100.0	0.0	0.0
José M. Callejas	1.4	3.5	2.5	1.2	2.2	44.4	97.5	6.1	0.0
Familia Arredondo	2.6	3.3	1.7	1.7	2.4	7.7	100.0	13.4	0.0
Jose Luis Gutierrez	0.2	3.1	0.8	0.1	0.1	50.0	100.0	0.0	0.0
Congeladora Bonfil S.P.R. de R.L.	2.1	2.6	0.0	2.1	0.0	22.2	100.0	0.0	0.0
Agrosuperior	0.5	2.1	0.8	3.7	1.0	33.3	100.0	0.0	3.4
Congeladora Santa Rosa	2.4	1.7	2.5	3.1	3.2	46.2	98.8	0.0	10.3
Mendiola S.A de R.L. de C.V.	4.7	1.3	3.4	1.5	22.4	62.5	99.7	43.9	13.8
Impulsora Agropecuaria S.A. de C.V.	1.7	0.9	0.8	0.8	0.5	87.5	100.0	8.5	0.0
INPROFRUT S.A. de C.V.	0.5	0.9	0.8	2.5	9.9	33.3	100.0	1.2	0.0
PROMEGA (I. Tafolla)	1.9	0.9	1.7	4.7	1.6	20.0	98.0	8.5	0.0
Proveedora de Productos del Campo, S.A. de C.V.	0.2	0.3	2.5	2.3	0.5	25.0	100.0	2.4	0.0
Bonifacio Ordoñez	0.7	0.1	2.5	0.1	3.5	33.3	94.4	11.0	0.0

Actor (1)	% of total purchase ties	% of purchase volume	% of total sales relations (2)	% of sales volume (2)	% betweenness centrality (2)	% linkages with full dyadic constraint (2)	Efficiency of linkages (%) (2)	% total gatekeeper relationships (2)	% total representative relationships (2)
FRUSAMEX, S.A. de C.V. (Frutas Sandoval de México)	0.2	0.1	4.2	4.4	0.6	33.3	94.4	1.2	0.0
Rogelio Uribe	0.5	0.1	1.7	0.1	2.2	50.0	100.0	2.4	0.0
Procesadora del Valle de Camucuato, S.P.R. de R.L. (3)	-	-	0.8	0.0	-	-	-	-	-
Procesadora de Zamora S. de R.L. Proceza (3)	-	-	0.8	0.0	-	-	-	-	-
Empacadora Latinoamericana S.A. de C.V.	1.7	1.2	1.7	6.7	1.0	66.7	100.0	0.0	0.0
Productores Agricolas de Jacona S de R.L	0.9	1.2	1.7	4.6	0.6	0.0	100.0	0.0	0.0
Sociedad de Produccion rural de R.L. El Duero de Zamora	1.2	0.6	2.5	4.6	1.1	37.5	100.0	0.0	0.0
Second-line buyers									
Danone	2.0	10.1	-	-	-	-	-	-	-
Interamerican Quality foods	4.9	7.9	-	-	-	-	-	-	-
Congeladora Latinoamericana	1.0	5.5	-	-	-	-	-	-	-
La Huerta	2.0	3.9	-	-	-	-	-	-	-
Broker	1.0	3.7	-	-	-	-	-	-	-
Alpura	2.0	3.4	-	-	-	-	-	-	-
Lala	1.0	3.4	-	-	-	-	-	-	-
Valmex Producer fruits	1.0	3.3	-	-	-	-	-	-	-

(1) Listed in descending order by purchase volumes at each level.

(2) Indicators not calculable or not significant for second-line buyers, owing to the structure of the data.

(3) Actors not indicated by producer, but mentioned in the survey of first-line buyers.

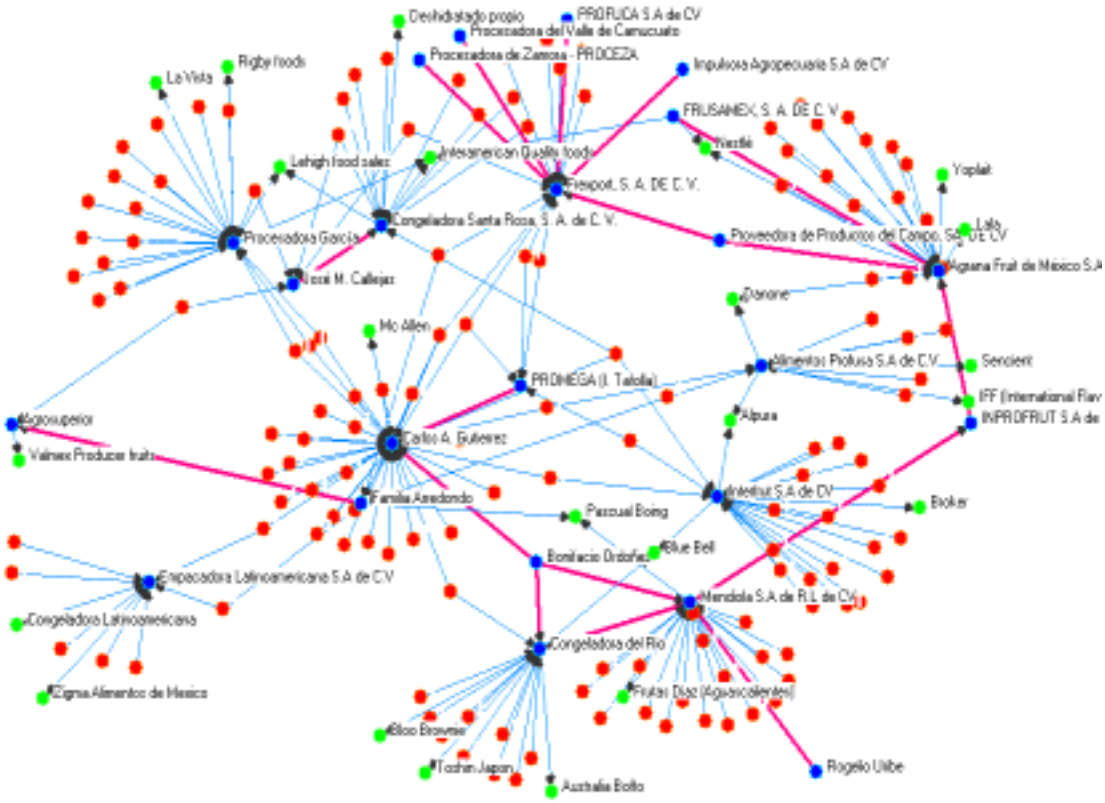
Source: prepared by the authors.

In summary, the analysis of commercial roles shows that the network's key actors also carry out important functions of coordination at their own level of the chain, which are important for undertaking larger-scale commercial ventures that involve adding value.

Lastly, the findings of the structural analysis serve to identify the heart of the strawberry marketing network in the State of Michoacán (Figure 3.4). The network has a centralised structure with a few main intermediaries linking many producers with a relatively small number of second-line buyers. The nucleus consists largely of the circuit (highlighted in pink) of horizontally linked intermediaries (Figure 3.2), together with other important actors such as Procesadora García and Empacadora Latinoamericana, among others.

Within this sub-network, the principal actors have a broad base of commercial leverage, which is built on the high number of their linkages, the large volumes traded, a high level of betweenness, control over the trading behaviour of the agents with whom they are linked, the diversification of roles within the chain and the absence of competing linkages within their market niches.

Figure 3.4: The heart of the strawberry marketing network in Michoacán



Source: prepared by the authors.

3.5 Territorial differences

An analysis was conducted of the patterns of accessibility, centrality and volumes traded by valley, in order to identify geographical variations in the strawberry marketing channels. It should be noted that the local component was clearly discernable only at the first level of trading relations, i.e., in the link between producers and first-line buyers. For this reason, relations between intermediaries were excluded from the calculation of the centrality degree indicator, in order to limit the indicator to the number of producers supplying each intermediary in the respective valleys.

Analysis of the number of buying relationships by valley and type of intermediary revealed a number of geographical differences that warrant further comment. As shown in Table 3.4, the Panindícuaro and Zamora valleys exhibit similar patterns, which are substantially different from those observed in Maravatío. Whereas coyotes and agroindustries are important only in the first two (together accounting for 85 per cent of linkages in Panindícuaro and 77 per cent in Zamora), in Maravatío, broker-truckers and wholesalers are much more relevant (a combined 83 per cent).

The relative importance of the different groups is in general quite similar, whether measured by purchase volumes or frequency of trading relationships with producers. However, in Maravatío and Panindícuaro agroindustries account for a larger proportion of first-line buyers, to the detriment of broker-truckers in the case of Maravatío and coyotes in the case of Panindícuaro. The agroindustry share increases from 13.3 per cent measured by linkages to 28.1 per cent measured by volume in Maravatío, and from 45 per cent of linkages to 74 per cent of volume in Panindícuaro. Conversely, the coyotes' share drops from 40 per cent measured by linkages to 16.3 per cent measured by volume in Panindícuaro, and that of broker-truckers drops from 53.3 per cent of purchase ties to 41.6 per cent of volume traded in Maravatío. In Zamora, meanwhile, there is no great difference between the two measures of commercial influence for first-line buyers.

Based on these findings, certain patterns of spatial differentiation emerge in the purchase linkages of intermediaries. In Maravatío and Panindícuaro, agroindustries are the agents who tend to link up with the large producers. In Panindícuaro, the coyotes deal mainly with small producers and in Maravatío this segment is channelled mainly through broker-truckers.

Table 3.4: Distribution of linkages and purchase volumes in each valley by type of first-line buyer

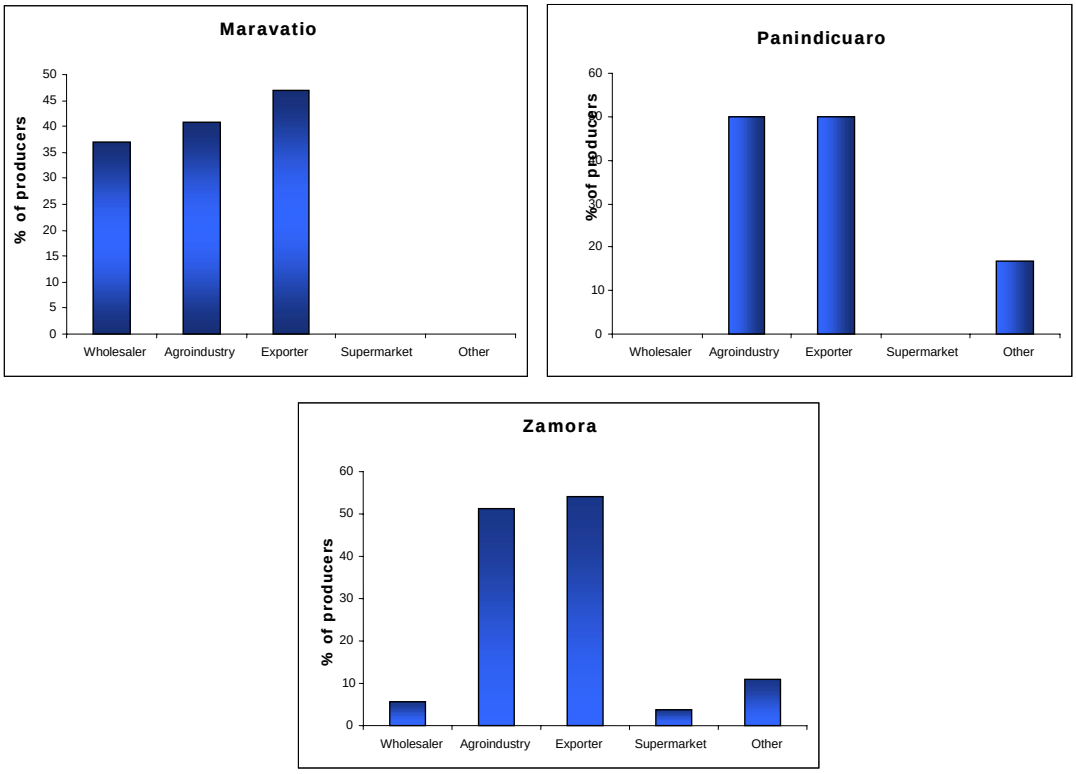
Type of buyer	% of total purchase linkages	% of the total volume purchased
Maravatío		
Exporter	0	0
Agroindustry	13.3	28.1
Wholesaler	30.0	29.2
Retailer	2.2	0.9
Broker-trucker	53.3	41.6
Coyote	1.1	0.2
Panindicuaro		
Exporter	0	0
Agroindustry	45.0	74.0
Wholesaler	10.0	8.9
Retailer	0	0
Broker-trucker	5.0	0.9
Coyote	40.0	16.3
Zamora		
Exporter	4.4	6.2
Agroindustry	55.6	58.3
Wholesaler	16.6	13.6
Retailer	1.0	0.1
Broker-trucker	0.7	0.1
Coyote	21.7	21.7

Source: prepared by the authors.

Analysis of local patterns of accessibility to second-level markets (Figure 3.5) reveals a number of differences among the different valleys. Although the export market and agroindustry tend to be the leading final destinations, the wholesale market is significant only in Maravatío. This finding is attributable to the importance of transporters and wholesalers as first-line buyers, as noted earlier. Nevertheless, this channel functions as a complement to the dynamic ones, since Maravatío's pattern of accessibility to agroindustrial and export markets remains similar to that observed in Panindícuaro and Zamora.

Lastly, it should be noted that Zamora is the only valley with channels to supermarkets, to which only four per cent of the valley's producers have access. Thus, there is also a spatial pattern of exclusion from this important market.

Figure 3.5: Percentage of producers with access to the different types of second-level markets in each valley



Source: prepared by the authors.

The geographical sphere of influence of the main first-line buyers was identified by individually analysing the linkages and purchase volumes in each valley (Table 3.5). In terms of number of trading ties, the cross-cutting power of the wholesaler Carlos Gutiérrez stands out, since it extends across the Maravatío and Zamora valleys. Unlike this agent, the rest of the principal intermediaries according to this criterion, confine their influence to a local level. This is true of the agroindustries Interfrut, Agrana and Procesadora García in Zamora, and Mendiola in Maravatío. Interestingly, there are also new actors whose centrality does not stand out in an analysis of the network as a whole, but who are strongly connected within their respective geographical areas of influence. This is the case of Gregorio and Gabino Moreno Gonzáles (broker-trucker) in Maravatío and the wholesaler Antonio Socorro Cortez and informal intermediaries Sergio Martínez Razo and Juvenal in Panindícuaro.

When individual importance is measured by purchase volumes, the locally influential actors tend to be those who also account for the largest numbers of ties with producers. It is interesting to see that Congeladora del Rio has almost absolute dominance in Panindícuaro (65 per cent of the total volume), as well as being one of the main first-line buyers in Maravatío, even though the firm has few trading ties in the latter valley and therefore does not figure among the principal intermediaries

there by level of connectedness. Hence, its importance in Maravatío lies in its linkages with a few large producers. Carlos Gutiérrez, a firm that was notable in the analysis of relational power for its extra-territorial influence, also stands out as regards purchase volumes in both valleys.

Analysis of purchase quantities also shows Congeladora del Rio positioned similarly to Carlos Gutiérrez as a significant transversal agent, with a sphere of influence expanding into Maravatío and Panindicuaro. As was the case for the number of linkages, new actors are found to be important on the local trading scene. Although not abundantly connected, they stand out in their respective valleys as buyers of large volumes. This is the case of the Empacadora Latinoamericana S.A de C.V. agroindustry in Maravatío.

Examination of local strawberry sub-networks in the State of Michoacán reveals important structural variations, territorially speaking, with different relationship dynamics by type of intermediary in each valley and the existence of actors with a strong local influence. This directly impacts on the patterns of geographical differentiation observed in the strawberry trading circuits. These results undoubtedly speak in favour of a territorial approach to complement sectoral policies aimed at enhancing access for Michoacán strawberry producers to more dynamic markets.

Table 3.5: Main first-line buyers in each valley

Name	% of all purchase linkages in the valley	% of total volume in the valley
Maravatío		
Mendiola S.A de R.L. de C.V.	20.0	19.0
Carlos A. Gutierrez	12.2	11.0
Gregorio Moreno y Gabino Moreno Gonzales	6.7	4.2
Congeladora del Rio	3.3	13.4
Empacadora Latinoamericana S.A. de C.V.	1.1	5.2
Panindicuaro		
Congeladora del Rio	30.0	64.5
Antonio Socorro Cortez Norte	20.0	6.3
Congeladora TEVAC S.A. de C.V.	15.0	9.5
Sergio Martínez Razo	10.0	8.9
Juvenal	10.0	7.8
Zamora		
Carlos A. Gutierrez	6.6	6.0
Interfrut S.A. de C.V.	7.3	5.6
Procesadora García	6.2	6.1
Agrana Fruit de México S.A. de C.V.	5.8	6.3
Frexport, S.A. de C.V.	3.6	6.9
Jose Luis Navarro	0.7	6.3

Source: prepared by the authors.

4.0 Conclusions and policy recommendations

The design of policies to improve the access of producers to dynamic, more lucrative markets has tended to focus on building up their production, organisation, management and commercialisation capacities. It is assumed that if producers increase their capacities, they will be able to successfully position themselves in the markets.

This research contributes a number of elements to complement this approach with other public and public-private policies and programmes. The main conclusions and proposals are set out below:

- **Make key actors in the marketing network the subjects of public policies**

  This study has identified the heart of the strawberry marketing network in the State of Michoacán. This network is made up of a small group of firms, most of which are interlinked horizontally, generating commercial circuits that govern the flow of strawberry produce. Although the strawberry system in Michoacán involves some 1,500 producers and firms, the nucleus occupies a core position in the definition and enforcement of the rules of the game.
  Multiple aspects underpin the power of the actors at the heart of the strawberry network. These include the centralisation of trading relations and the volumes traded; the concentration of betweenness; the establishment of highly efficient linkages; the ability to create dependence; and the diversification of roles. It has also been seen that the formation of linkages reflects different dynamics depending on the level of the chain at which it occurs. Thus, whereas these actors tend to be able to exert control in the backward linkage with producers, the forward linkage with second-level buyers is based on trust and reciprocity.
  Development policies that do not consider the actors at the heart of the strawberry marketing network run the risk of finding their influence limited to the network periphery, and of ultimately failing in the objective to help small producers position themselves in dynamic markets.

- **Promote the development of supplier networks that include small and medium-sized producers**

  Through the existing federal and state programmes, it would be possible to generate schemes of direct incentives to integrate small producers as suppliers in the most dynamic and profitable market channels. A number of successful supplier development programmes have already been carried out and could be applied in Michoacán. Obviously, the key to the success of such programmes is to engage the network's core firms in their design and implementation.

- **Engage the firms at the heart of the strawberry marketing network more effectively in organisations that use the product-system approach at national and state levels**

  The product-system approach employed in Michoacán to strengthen productive chains is a good fit with the situation on the ground in the strawberry marketing network. This approach supposes the convergence of all the agents in the agrifood chain for the achievement of common objectives, based on the premise that market competitors are not individual, isolated firms, but in fact consist of a complex system of which every actor is a part. The findings of the structural analysis of the Michoacán strawberry network validate this approach for the design of policies to develop the strawberry industry. However, for the initiative to result in a real opportunity to generate consensus and make a substantial impact on the industry, efforts must be made to engage the marketing network's key actors more fully in instances such as national and state strawberry councils.

- **Recognise the importance of informal merchants and intermediaries**

  The research highlighted the importance of informal merchants and intermediaries (known as "coyotes"), particularly for the smaller, less mechanised producers with less capital. These intermediaries typically run large trading surpluses, without adding value to the produce. One response to this problem is to implement policies aimed at shortening the marketing chain, thereby cutting out this type of intermediary. Evidence compiled in different countries and contexts suggests that such strategies often fail to produce the desired results, and may actually help push the market deeper into informality and concealment (the black market).
  It is therefore necessary to recognise that informal intermediaries play an important social function, by offering sales routes for producers who lack the means and the capacity to meet the standards and requirements of more dynamic markets. Hence, there arises the challenge of designing public polices directed towards bringing these actors into a more formal setting and improving access to assets and capacities for the small producers who are linked to them. Yet informal buyers probably lack any incentive to shift from a position in which they have strong trading leverage and have no need to incur the costs associated with operating in the regulated markets.

- **Adapt strawberry production to the requirements of markets and the marketing network**

  Small producers have no chance of securing a stake in the most dynamic and profitable segments of the marketing network as long as their products fail to

meet market requirements of cost, quality and safety, imposed via the key actors in the marketing network.

One possible public policy, which could also be deployed within a scheme of public-private partnerships, would be to set up systems of technical and commercial assistance for producers. What is most important here is that the central actors in the network be directly involved in defining the specific features of technical assistance, so that it can be targeted efficiently in order to support and prepare producers to move into clearly established segments in the marketing network. In short, it is a matter of putting in place a system of productive and commercial technical assistance that can act as a bridge between producers and those who make up the strawberry marketing network.

- **Strengthen organisation among producers for participation in the strawberry marketing network**

The study confirmed that small and medium-sized strawberry producers tend to participate in an individual and isolated manner in the marketing network. The producers' lack of commercial organisation further complicates a situation that is, in itself, already highly unfavourable to them.

Small and medium-sized producers are practically excluded from the most direct channels to the most profitable markets, such as the main agroindustries or supermarkets. To help these actors to achieve commercial empowerment, the logical approach in terms of policy is to encourage schemes of cooperation and association. Although this seems a reasonable course of action, the generalised absence of commercial cohesion in the particular case of Michoacán's strawberry industry represents a structural barrier that will be a major challenge to overcome. This is especially visible in the case of the producers who are deeply involved in a variety of social organisations[37], yet trade individually, isolated from their peers.

Unless they organise, producers must settle for being mere suppliers of raw material, completely dependent on the decisions of the network's central actors. The public sector can provide support, but the responsibility on this front lies with producers themselves.

- **Recognise the territorial dynamics of the marketing network**

Evidence of local differences in the commercial circuits and in power dynamics within the strawberry network offers an opportunity to develop policies designed with a territorial rationale. Specific objectives and the contents of public programmes need to be differentiated to achieve a good fit with the specific production and commercial situations in the Zamora, Panindícuaro and

[37] Berdegué et al. 2007.

Maravatío valleys. This type of strategy could help to tighten the focus and heighten the impact of public and private efforts to increase the overall competitiveness of the strawberry industry in the State of Michoacán.

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Regoverning Markets

Regoverning Markets is a multi-partner collaborative research programme analysing the growing concentration in the processing and retail sectors of national and regional agrifood systems and its impacts on rural livelihoods and communities in middle- and low-income countries. The aim of the programme is to provide strategic advice and guidance to the public sector, agrifood chain actors, civil society organizations and development agencies on approaches that can anticipate and manage the impacts of the dynamic changes in local and regional markets. The programme is funded by the UK Department for International Development (DFID), the International Development Research Centre (IDRC), ICCO, Cordaid, the Canadian International Development Agency (CIDA), and the US Agency for International Development (USAID).

Agrifood Sector Studies

These studies look at specific agrifood sectors within a country or region. Research studies have been carried out in China, India, Indonesia, Mexico, South Africa, Turkey, Poland and Zambia covering the horticulture, dairy and meat sectors.
Part A describes the observed market restructuring along the chains.
Part B explores the determinants of small-scale farmer inclusion in emerging modern markets. Using quantitative survey techniques, they explore the impacts on marketing choices of farmers, and implications for rural development.

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