Transportation Issues for Agroindustrial Project Preparation and Development

OSCAR DE BUEN AND MANUEL LAPIEDRA

Contributions of transportation to economic development and, more specifically, to the agroindustrial sector in Mexico are presented. The way in which transportation considerations should be linked to agroindustrial project design and implementation to increase the probability of success of firms dealing with them is examined. The definition of agroindustry is presented along with a description of its basic characteristics in Mexico. A description is offered of how transportation must be taken into account when preparing agroindustrial projects, as well as some initial ideas on how transportation can contribute to improving firm performance. Several case studies are presented that show different forms of linkage between transportation and agroindustry and that concentrate on exploring the ways in which transportation contributes to a project's success or failure. Some general conclusions are offered together with a broad description of Mexico's agroindustrial development plans along with comments on how transportation and product logistics can be managed to increase the plan's probability of success.

Agroindustry can be defined as a series of processes that are applied to agricultural or forestry raw materials to transform them, including facilities in which raw materials are only superficially treated, as well as complex industrial plants in which elaborate consumer goods are produced. Agroindustrial businesses process raw materials to transform them into products that are more valuable because the products (a) become edible or usable, (b) can be stored for longer time periods, (c) can be more easily transported, or (d) have greater nutritional value. Raw materials used by agroindustry are perishable, seasonal, of changing quality and quantity, and are of high cost in relation to the finished product.

Classification of agroindustry depends on the type of economic activity or process used. The first criterion includes food and nonfood agroindustries. Food-related agroindustries include the meat, milk, beer, sugar, and coffee industries, whereas the nonfood industries include tobacco, textiles, shoes, and paper. For the second criterion, process type, agroindustries are either primary, intermediate, or final. Primary industries change the presentation of the raw materials without altering their form or quality. Intermediate and final industries change presentation, form, and quality; however, final industries require additional materials for production, which are not necessarily agricultural, and the final products are destined for consumption.

Agroindustries are important to developing countries for a number of reasons, including (a) their capabilities of transforming agricultural and forestry raw materials into consumer products, (b) their dominant position within the manufacturing sector, (c) their significant export development potential, and (d) their ample potential for creating jobs at decentralized locations, thereby positively influencing local economic development. In Mexico, agroindustry is important both economically and politically because it not only links primary sector production with the satisfaction of consumer needs, but also helps to mitigate rural poverty by allowing rural zones to retain a higher proportion of industrial value-added production.

From an economic viewpoint, during the 1970s agroindustry contributed an average of 11 percent to gross domestic product and employed about 7 percent of Mexico's total work force. The industry's contribution to the manufacturing sector during that period was 45 percent of gross domestic product and 50 percent of that sector's employment. More recently, from 1982 to 1987, agroindustry accumulated a net positive trade balance of $5.27 billion, which represented about 10 percent of the country's total balance of trade surplus. According to figures of the 1980 economic census, Mexico's total agroindustrial production was produced by 79,581 firms of which 361 were responsible for 20.3 percent of the total. Of these, 170 were controlled by foreign investors, 80 by the Mexican private sector with some foreign participation, and 111 owned by the public sector. The remaining 79,220 firms are private and use mostly Mexican capital. Of them, 499 employed 250 or more workers and generated 20.7 percent of total agroindustrial production. Another 796 firms employed between 100 and 249 workers and contributed 8.5 percent of total production, whereas the remaining 77,925 are small firms, which employed less than 100 persons each and accounted for 50.5 percent of production. In addition, 1.6 percent of the total number of firms (multinational corporations, large public firms, and private firms) account for 29.2 percent of total production. At the same time, the 77,925 small, private Mexican firms, many of them nongovernment social organizations, make small individual contributions but together account for about half the country's total production. These structural characteristics of Mexico's domestic agroindustry are reflected in the technological, organizational, and financial means at the disposal of each firm. Although the major firms tend to be powerful and modern industrial groups, the small ones are traditional farmer associations and family businesses with little managerial sophistication.

Mexican agroindustry's current problems include poor organization, lack of financing, a depressed domestic market, and inefficient marketing. Factors posing the most relevant obstacles to marketing processes include excessive participation and influence of intermediaries, lack of storage facilities, insufficient financing for marketing operations, inade-

Mexican Institute of Transportation, Jurarez Sur 1 primer piso, Col. Gentro (76000), Queretaro Oro, Mexico.

quate criteria for providing government subsidies, and inadequate transportation infrastructure and services.

During the 1980s, Mexico's economic climate underwent profound changes. To overcome an economic crisis with no precedents during the modern history of the country, the government instituted an economic policy that included innovative measures with the potential for radically transforming activities in all aspects of the country's economic and commercial life. These measures included Mexico's entry into the General Agreement on Tariffs and Trade (GATT), new regulations for foreign investments, a smaller public sector through the sale of public firms, incentives to the private sector, deregulation of federal road freight transportation, and other actions. These are examples of recent measures that have shaped a different economic environment for the country. Such measures imply significant challenges and opportunities for domestic agroindustrial activities. The most relevant of these challenges relate to the inflow of foreign capital and to the need to rapidly increase competitiveness and productivity to retain domestic market shares. Opportunities have surged as a consequence of the political willingness to revitalize Mexican agriculture. The new policies have transformed agroindustrial activities into a rapidly growing segment of the economy that is capable of bringing foreign exchange into the country, creating new jobs, and promoting economic development in rural areas.

PREPARATION OF AGROINDUSTRIAL PROJECTS

Agroindustrial projects are prepared by firms and nongovernment social organizations frequently aided by financial agencies. The preparation process includes identifying, designing, implementing, and evaluating projects. According to Austin (*1*), preparing a project requires the analysis of three activities that are decisive for any project's success: procuring raw materials, processing raw materials, and marketing finished products. Raw material procurement is relevant because of potentially significant implications for the quality and cost of the finished product and because of links with both agriculture and industry. Processing activities are the heart of agroindustrial transformations and involve technological choice, plant location, inventory management, acquisitions and supplies, and process control and management. Finally, marketing moves agroindustrial products to markets within restrictions imposed by consumers and by the competition.

In all of these phases the proper integration of transportation is key to increasing the chances for a project's success. In supplying raw materials to the plant, an effective performance by the transportation system is crucial for meeting the requirements of the plant in terms of quantity, quality, cost, reliability, and organization. Transportation services must be able to not only move the raw materials to the plant, but also minimize in-transit damages and partial or total losses despite the highly perishable and delicate nature of the raw materials. From an economic viewpoint, the origin and amount of transportation costs out of total production costs must be adequately identified in order to reduce the likelihood of making decisions based on distorted information.

For the agroindustry, time is one of the variables most directly affecting the supply system. Given crop seasonality and raw material perishability, the supply system must be precise. If the transportation system is incapable of rapidly moving raw materials between fields and plants, or if storage facilities are lacking and flows between production and transformation cannot be regulated, then the probability of projects failing will be high. Because established organizations, special interests, group attitudes, and power structures can potentially affect the performance of the project's activities, they have to be carefully analyzed to avoid implementing supply schemes that are likely to encounter opposition from any of the participating groups.

Transportation considerations also may play an important role in agroindustrial plant location decisions. Relationships between raw materials and markets, among other factors, are essential items for deciding where to locate a plant. Product type and characteristics may be decisive for locating the plant close to production and far from the market or vice-versa. Transportation infrastructure, transportation costs, and their likely evolution and incidence on product price will also be relevant for location decisions.

During the marketing and distribution phase, transportation operations play a role in defining the distribution system's structure, functions, integration, and sales strategies, and therefore must be studied within that specific perspective. In addition, flow structures, availability of properly equipped trucks, distribution of power and control among the different actors, adopted sales strategy, and other activities heavily involve transportation and logistics operations that must be properly conceived and executed if the project is to succeed.

In summary, transportation and more broadly the logistics supporting physical product flows are a necessary but not sufficient condition for ensuring an agroindustrial project's success. Even if all project stages are studied to perfection, if transportation is not systematically analyzed and properly integrated into project design then the probability of a project falling short of its stated objectives, or not reaching them at all, will be high (*2–5*).

CASE STUDIES

Case studies were taken from different regions and involve various products, including produce exports from Sinaloa, fruit exports from Michoacan, marketing forestry products in Chihuahua, lentil production and marketing in central Mexico, and milk distribution in central Mexico.

Produce Exports from Sinaloa

An agricultural association in the state of Sinaloa located in northwest Mexico annually exports around 650,000 to 700,000 metric tons of produce to the United States. These exports generate foreign exchange earnings of about $400 million and include tomatoes, cucumbers, zucchinis, watermelons, and melons. The export season extends from November through May with peaks occurring during February, March, and April. The products are sold in Nogales, Arizona, to local brokers that market them in the United States. Sales are made through the association's agents in Nogales, who monitor local market conditions and provide information to the farmers back in

Sinaloa about local prices and about convenient times for scheduling export shipments. Obviously, all products are subject to strict sanitary measures enforced by U.S. authorities and to the buyer's specifications concerning product size and quality.

Sinaloa's export-oriented farmers have developed highly capital-intensive and efficient operations with, in many cases, packaging plants located near the fields where the crops are concentrated, selected, cleaned, and packaged and then shipped to Nogales, on the border. The distance from Culiacan, the state capital and main agricultural center, to Nogales is about 1,000 km (600 mi), and both highway and railway transportation are available. Under these conditions, the challenge for transportation in the marketing operations of the local agroindustry is great. From small packaging plants dispersed throughout the coastal plains of the state, perishable products that are seasonally grown must be moved 1,000 km to be sold at a price fixed by the buyer according to market conditions and to the quality and presentation of the product. In order to accomplish a successful commercial operation, transportation services must be fast, reliable, refrigerated, safe, and economical.

Transportation services offered today to the local farmers that meet their quality requirements and allow them to integrate marketing chains, permitting sales in the strict but attractive U.S. market, include trucks and piggy-back. Of the total exported tonnage, 70 percent goes by truck at a cost of approximately 2.2 million pesos per trip (about $1,000), whereas the remaining 30 percent uses piggy-back service at a cost of 1.3 million pesos ($560) if the trailer belongs to the railway or 0.9 million pesos ($380) if the trailer belongs to the farmer. Travel times are similar.

Despite the relative backwardness of railway services in Mexico, their performance in this operation clearly illustrates significant potential for participating in nontraditional markets. Railways, supported by a strong performance from their marketing agents and good coordination from their traffic departments, are able to offer integrated services to the farmer that include pickup by truck, using either the farmer's own trailer or one supplied by the railway; ramp services to place the trailer on the rail platform; transportation from Sinaloa to Nogales; and border crossing services, for an additional $100. The railway uses refrigerated trailers and its announced delivery time is between 13 and 16 hr, which is reasonable for the farmer.

Sinaloa's agroindustrial export project has been working successfully for more than 25 years. From the start a key element in ensuring feasibility was the ability to solve difficult transportation problems. For Mexico, the solutions introduced were pioneering in at least two fields: the implementation of a highly successful, custom-designed piggy-back service, which even today is unparalleled in other regions of the country, and the use of refrigerated trailers. Refrigerated trailers were started by the railways and later adopted by truckers.

Melon Exports from Michoacan

A regional farmers' association in the western part of Michoacan in central Mexico affiliates about 5,000 producers of vegetables and fruits, of which melons, watermelons, and cucumbers are the most important. The association participates in exporting these products mostly to the United States but at below-potential levels because of difficulties in adequately handling and shipping the products with the regularity, timeliness, and quality levels expected by its clients.

The region's melon is famous for its high quality, which is high enough to meet any market's requirements. However, the product deteriorates rapidly because of inadequate handling after harvesting. Melons are cut piece by piece and collected in a basket that is manually placed on a 3-ton truck that takes them to the packaging plant. Usually, the truck lacks refrigeration and any other protection for the product, despite travel distances of up to 30 km (18 mi) under temperatures that can reach 40°C (104°F).

At the plant, the melons are manually unloaded onto a continuous band system where damaged pieces are separated and the others classified, according to size, into lots for export or domestic consumption. After each piece is selected it is cleaned, waxed, and packaged for final shipment. Exports are specially packaged and piled to await the arrival of trucks that will move them to their destinations. Loading operations are also manual and once the melons are loaded, one-half ton of ice per ton of product is added to the truck in order to avoid or reduce in-transit losses. Trucks have a typical capacity of 15 to 18 tons. The shipments are then covered with a piece of cloth, and other than the ice, there is no temperature control during the trip. Even on those rare occasions when refrigerated trucks are available farmers have observed that the drivers do not use their refrigerating equipment, mostly because of ignorance. However, farmers do not consider the railway a good option, even though services are available, because of its excessive trip times and its lack of specialized, good-quality refrigerated cars.

The region's annual melon crop is about 80,000 metric tons, which exits the region in about 3 months. During the season an average of 80 trucks are required per day, a demand that generates significant economic benefits for local truckers. In all, the region produces about 500,000 tons of various products throughout the year and therefore generates transportation demand that would make it attractive, at least in principle, to invest in transportation equipment to overcome current service shortages.

In this case, difficulties in handling and transporting the product reduced otherwise feasible export opportunities. The main drawbacks related to the type of packaging, to product protection while in transit, to the recurrent lack of transport service supplies, and to the absence of quality control processes that would ensure high confidence levels in dispatching shipments and complying with the delivery schedules set by clients. Despite these problems, it is likely that the main obstacle to increasing exports is that they have not been conceived as integrated agroindustrial projects, but rather as a marginal activity that is subject to each crop's annual results.

Marketing Forestry Products in Chihuahua

A state-owned firm specializing in forestry products in the northern state of Chihuahua will soon be transferred to local organizations involved in forestry. The firm produces two main product lines: raw materials for the cellulose, paper,

and pulp industries and rigid finished products for furniture and carpentry. More specifically, the items produced at the firm's five plants, which are located closer to the forests than to markets, are logs, three types of cellulosic products (logs, sawable, and piles), air-seasoned sawed timber, stoved sawed timber, structural timber, and furniture. The five plants are directly supplied from the forests that cover a significant portion of western Chihuahua.

One of the key elements for the financially viable operation of the firm as a private concern is transportation, because transportation costs account for a substantial percentage of finished product costs. This is because of the volume and weight and cost relationships of forest products, not only during the log extraction phase, but also during the processing and marketing stages. Transportation costs represent, on average, about 60 percent of forest product prices. Half the costs are incurred while moving logs from the forest to the processing plant, whereas the other half is expended during processing and marketing. The industry traditionally cited the lack of and deficiencies in the region's road infrastructure as the major obstacle to increasing forest exploitation, but not because of its incidence on costs but because of the physical restrictions it imposed on production. Today, however, the recent changes in the economy's environment have increased the firm's sensitivity to transportation costs and to greater international competition. Given the location of the firm's plants, the average distance traveled by the 1.6 million tons moved annually is 244.5 km. In 1985, available services were provided by a fleet of 2,250 two- to five-axle trucks capable of moving 8- and 16-ft logs. With these trucks, it was estimated that there was a shortage of about 500 trucks per year.

In this industry, the specific conditions under which transportation operations take place vary according to type of product, economic value, and market. Table 1 presents a summary of each product's typical operating conditions. The significance of transportation costs is high for nearly all products, with the possible exception of furniture. For that reason, transportation is becoming a key element for designing the most adequate strategy for transferring the firm to the producer organization. As a consequence and in contrast to the previous stages of the firm's development, transportation is being explicitly studied as a decisive element for increasing the return on investments.

Lentil Production and Marketing in Central Mexico

A farmer organization in central Mexico engaged in the production of lentil has been traditionally subjected to the abuses of intermediaries that control their product's marketing channels. These intermediaries penalized the prices paid to the producers and thus reduced the farmer's income to their advantage. To avoid such problems, the farmers decided to construct a packaging plant and storage facilities, and to incorporate their organization into the CONASUPO distribution system, which the government operates to regulate national food markets. Once accomplished, this arrangement helped to increase farmer income by avoiding the intermediaries.

Despite their apparent success, the farmer organization's marketing project would not have been feasible if Diconsa, another public sector enterprise belonging to the CONASUPO system, had not loaned the organization a fleet of four 12-ton trucks for distribution and two smaller trucks for moving the product from the field to the storage facility. Although the operation of the truck fleet allows the farmer organization to accomplish its goals by having greater control of their product's distribution activities, it is an extremely expensive solution made possible only because of the special circumstances in which the trucks were made available to them—the fleet is unused most of the time because of the seasonality of production. However, this project would undoubtedly have failed if the farmer organization had been unable to ensure the operation of its own transport fleet and their dependence upon the intermediaries would have persisted.

Milk Distribution in Central Mexico

Members of a farmer organization in central Mexico received financial aid to carry out a project to provide milk for families in their own community. Liconsa, a state-owned firm dealing with milk marketing and distribution at the national level, provided the aid through one of its broader programs that included technical assistance. In this case, money was used to purchase cows and to construct stables.

This project turned out to be successful and started producing quantities of milk that surpassed the community's demands. Producers tried to sell their milk surplus at the closest urban center, a very small city, where they rapidly exhausted this market because residents preferred pasteurized milk instead of the nonpasteurized product offered by the producers. Faced with an oversupply of milk, the producers studied the convenience of installing a pasteurizing plant, but they soon found that it was not economically feasible because of low production quantities. Another alternative proposed transforming the milk into cheese, but it also was not feasible because of low production volumes. A final option consisted of building a refrigerated tank where milk could be stored before sending it to the market, but this option was canceled because transportation services suitable for the project's needs were unavailable.

In all options, transportation was analyzed as an afterthought and in the end was identified as an obstacle to realizing the project's full benefits. The failure to take a comprehensive view of the available options, including the role and contribution of transportation in daily operations, prevented this theoretically successful project from being highly successful in practice.

RELEVANCE OF TRANSPORTATION IN AGROINDUSTRIAL PROJECTS AND CASE STUDY ANALYSES

Because transportation is a highly relevant element for the different phases of agroindustrial project development, it is absolutely necessary to analyze and design the role transportation plays in providing raw materials for the plant, in defining plant location, and in marketing and distributing finished products. Despite such relevance, it is hypothesized that transportation issues have historically attracted little attention within the realm of agroindustries. This hypothesis undoubtedly var-

TABLE 1 TRANSPORTATION OPERATING CONDITIONS FOR FORESTRY PRODUCTS IN CHIHUAHUA (*6*)

PRODUCT AND USE	MARKET	TRANSPORT SERVICE CHARACTERISTICS	TRANSPORT COSTS
Logs for basic sawed products and plywood	Local or regional sawmills; plywood plants	The trip from forest to sawmill is made on a two-axle truck owned by the producer.	For an average distance of 25 km, $4-8 dollars per ton; for 60 km, $16-28 per ton.
Cellulosic log for cellulose, pulp and paper production	Three plants located in the state; others at out-of-state locations	The trip from forest to plant is made on two-axle trucks owned by the producer and acquired via financial leasing arrangements.	Transport costs are 70% of FOB costs at the sawmill, and 45% of costs at the processing plants. For a 45 km distance, costs are about $12/ton.
Piles and sawable products	Local sawmills; mining industry	The trip from forest to sawmill is made on two-axle trucks owned by the producer.	Transport is the major component of finished product costs. For a 40 km distance, costs vary between $10 and $16 per ton.
Air-seasoned sawed timber for various uses	Regional and national.	The trip from the sawmill to the buyer's facilities is made by for-hire, 15 to 35 ton trucks, by 25-45 ton railway cars and by private trucks.	The buyer arranges transport for his/her products and covers costs.
Stoved sawed timber for various uses	Furniture and door factories. Carpenters and artisans.	The trip from the sawmill to the buyer's facilities is made by for hire, 15 to 35 ton trucks.	The buyer arranges transport for his/her products and covers costs.
Structural timber	National railways. Construction industry	The trip from sawmill to plant is made on two-axle trucks owned by the producer. Rail is used occasionally.	About $8 per cubic meter.
Furniture	Domestic and export	Specialized services by moving companies.	About 5% of selling price, depending on each case.

ies from case to case and according to each industry's specific circumstances, as will be seen. Within the research community, efforts dedicated to the simultaneous, joint study of agroindustrial and transportation issues in Mexico and probably in other developing countries have been sparse, and as a consequence there is much to learn and to study in future projects dedicated to this topic.

Firm Size and Transportation Solutions

The broad relationship between agroindustry and transportation hides an enormous heterogeneity of cases that prevents general conclusions from being made. This heterogeneity rises from existing differences among product types, processes in which they are used, regions where they are grown or transformed, types of markets where they are commercialized, and relevance of transportation in costs and operations. Such differences are large and lead to the need for preparing specific studies for particular products and regions that can be expected to reach pertinent conclusions. Despite these comments, it seems reasonable to distinguish firms according to size because size is relevant for approaching, analyzing, and solving agroindustrial problems. Large firms with vast technological, organizational, and financial means at their disposal have a radically different view of their problems than do small firms lacking technological sophistication, opportunities for negotiation, and financial resources.

From the analysis of the case studies, it can be safely concluded that large firms invariably solve their transportation problems, whereas the same cannot necessarily be said of smaller firms. When users generate large traffic volumes with established flows and periodicities, their position vis-à-vis the transportation operator is favorable not only in terms of having services available, but also in negotiating rates and service attributes. The case of agroindustrial export products from Sinaloa reveals that it is even possible to generate technological innovations in transport, such as using refrigerated trailers or introducing piggy-back services, which the operator may be willing to introduce if such actions allow him to capture a stable and lucrative market.

Transportation in a More Competitive Environment

A second point that can be extracted from the case studies is that transportation was not a priority concern in the heavily regulated market which had prevailed in Mexican truck transport until recently. In part, that was a result of not only the lack of alternatives available to the user, but also to the fact that the market was held captive by a few producers and transportation service providers that were insensitive to consumer needs. In the end, consumers did not have any other choice but to pay for the excess costs resulting from inefficiencies. Under Mexico's abandoned regulatory system trucking service availability was ensured by establishing compulsory rates, by giving route authorizations to farmers, or by negotiating agreements at national or regional levels to ensure that adequate capacity was provided at points where crops required transportation in large quantities for short time periods, especially if those crops were for satisfying basic needs.

Today, both agroindustrial and trucking firms have started to feel pressures from a more competitive environment. Agroindustries must endure higher levels of competition because of the country's liberal trade policies, whereas truckers no longer enjoy the protection of regulation. As a consequence, it is likely that both groups will start to seek higher efficiency levels, to adopt innovations that allow them to expand their market shares, and to comply with their clients' quantity and quality requirements.

Transportation Cost Contribution to Price

The significance of transportation costs as a portion of a product's final price is as varied as are the products. In some cases, such as produce exports, furniture, or melons, the incidence of transportation costs is low or of minor significance with respect to other problems, such as ensuring the availability of services. However, in other cases, such as forestry products, transportation costs are the decisive component of the product's final price. In general, the more basic the treatment that the raw material receives before being sold, the greater the significance of transportation costs in its price. When the incidence of transportation costs is low, the availability of a transportation system that can provide high-quality service becomes of paramount importance to the shipper.

Logistics Support for Exports

Availability of a good product is a necessary but not sufficient condition to launch successful export operations. As the case of melon exports shows, successful exporters must comply with their clients' quality and price requirements. To accomplish this the exporter must develop a comprehensive project that includes all the details of the operation; otherwise, exports would be impossible. By incorporating transportation in a more ample logic dealing with the handling of products, both transportation operators and shippers may discover new, interesting commercial opportunities that may help them increase their firms' economic returns.

Establishing an agroindustry that is both serious and efficient cannot be accomplished without properly planning and designing all activities involving the handling of products, particularly where export projects are concerned. For this reason, in order to maximize the contribution of agroindustrial projects to national and regional economic development, it is necessary to design all the activities belonging to product logistics before actually implementing the project. Improvising as the project progresses is equivalent to condemning it to failure.

Traditional Approach to Transport Problems in Agroindustry

The analysis of the case studies shows that failure to consider transportation issues when preparing agroindustrial projects is an important limitation that affects and sometimes even cancels the feasibility of projects. In the past, a frequent attitude during agroindustrial project development appears to

have been that the solution of transportation problems was not an integral part of the project, but rather an additional activity that someone had to confront at some time. Such an approach prevented transportation from being actively incorporated into product logistics as an activity that is capable of adding value to the agroindustrial product and of multiplying the potential benefits of the project.

Private Truck Fleets

One of the most frequent approaches in solving transportation problems in agroindustrial firms consists of forming and operating private truck fleets that allow a timely solution of problems without having to deal with public transportation providers (*7*). Given crop seasonality and perishability, agroindustrial firms require timely and reliable transportation services to ensure deliveries that prevent the loss of product value. However, their tonnages are generally low and therefore not particularly attractive to public service providers, who usually do not like the demand fluctuations derived from the seasonality of production. In such circumstances, public service providers typically react by either not offering services (also because roads are frequently bad) or by significantly increasing their rates.

Confronted with such realities, agroindustrial managers find that private fleets are convenient for managing product flows according to their own needs, for reducing or eliminating uncertainties, and for attaining the availability, reliability, and service quality levels that they wish. However, such a solution has the drawback of perhaps requiring prohibitively high investments as well as needing to establish an internal organization that is exclusively dedicated to the provision of transportation services and the maintenance of the fleet. Such an endeavor also has potentially far-reaching implications for the company's finances.

Perspective for Transport Solutions

The detailed analysis of the relationship between transportation and agroindustry reveals complexities that are otherwise difficult to discover and thus can be ignored or attributed to other causes. Given the involvement of many different groups, each with its own interests and positions of power derived from their specific participation in different activities of the agroindustry, frequently many of these conflicts surface as transportation problems. As a consequence, focusing exclusively on the transportation part of the problem may prove to be inadequate for solving it because the problem may have other origins and require other approaches for finding a solution.

Opportunities for Transportation Firms

Another interesting conclusion derived from the case studies is that transporting agroindustrial products is full of opportunities for transportation firms, and more broadly for logistics service providers, because there are multiple market niches defined by product type, region, or market characteristics that can be exploited through strategies that provide efficient, high-quality services and personalized attention to clients.

CONCLUSIONS

In general, the analyses of the case studies reveal that agroindustrial project preparation must devote more attention to transportation-related factors if project success is to be attained in a more open and competitive economy.

Today, such an approach is particularly helpful because the Ministry of Agriculture and Water Resources is establishing the foundations for a strategic project for developing rural industries that will provide the framework for the future development of agroindustry in Mexico. The project includes six agroindustrial corridors located in different regions of the country that will be developed to promote agroindustrial production and to help increase exports. The basis for developing such agroindustrial corridors consists of exploiting regional advantages for domestic and export production, depending both on product types and external demands. Because exports will be an important objective of the project, transportation will be extremely important to reach the productivity and reliability levels that will be required in all project phases. In particular, options to improve physical product handling and to reduce transit losses, including the use of refrigerated vehicles and storage facilities, will have to receive priority if efficient transport chains are to be constructed.

In the end, two things can be safely concluded from this study: first, transportation has to be properly regarded during agroindustrial project development because otherwise it has enough potential to disrupt project design and to reduce or eliminate its contribution to economic development. Second, detailed, industry- and product-specific studies are needed to better understand the agroindustrialist shipper's needs and to better shape the response that transportation services can provide.

REFERENCES

1. J. Austin. *Agroindustrial Project Preparation*. Johns Hopkins University Press, Baltimore, Md., 1984.
2. G. Rodriguez and G. Marco. De Investigaciones del Programa Nacional de Capacitacion Agroindustrial. Proyecto UTF/MEX/022, SARH–FAO. Mexico, 1986.
3. Secretaria de Agricultura y Recursos Hidraulicos. La Agroindustria en la Economia Nacional. Tendencias Recientes 1977–1987. Mexico, 1988.
4. Secretaria de Agricultura y Recursos Hidraulicos. La Agroindustria en Mexico. Un Analisis de la Estructura y Desempeno Economico a Nivel de Clase de Actividad y de Sistema Producto. Mexico, 1988.
5. Secretaria de Agricultura y Recursos Hidraulicos. Analisis, Evaluacion del Desempeno y Perspectivas para la Agroindustria de la Iniciativa Privada. Mexico, 1988.
6. Secretaria de Agricultura y Recursos Hidraulicos y Asociacion Rural de Interes Colectivo Felipe Angeles. Studio de Factibilidad Tecnico Economica de la Empresa PROFORTARAH. Mexico, 1989.
7. R. Izquierdo et al. Transporte de Carga en Mexico. Opciones de Desarrollo. Mexico, 1988.