Technology diffusion in agro-cluster: The role of multinational companies in the case of Almeria (Spain).

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Executive Summary.

Several studies have analyzed the spread of technology by multinational. The conclusions obtained are unsettling. Multinationals benefit more from local branches in terms of knowledge than what they contribute. In an agro-industrial business cluster multinationals are present as supply companies (e.g. seeds and machinery). However, they also play an important role because, in most cases, they constitute company demand (retail distribution chain). In this context, this study intends to verify whether multinationals, by means of these two forms of interaction, encourage the use of generic technology, acting as a vector (carrier) that transfers (diffuses) technology throughout their branch networks. In this sense, we analyze the role of multinational companies within the cluster comprised of production and marketing companies as well as the auxiliary industry for agriculture in the Almeria province (Spain). This study makes it clear that in agroindustrial clusters there are two important channels for the transfer of knowledge to the competition: multinational companies established in auxiliary industry and demand (retail distribution chain). Both actors share the same common denominator and that is to standardize the technology utilized. However, it is a generic kind of innovation and, therefore, is easily transferred to the competition.

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Abstract:

Several studies have analyzed the spread of technology by multinational. The conclusions obtained are unsettling. Multinationals benefit more from local branches in terms of knowledge than what they contribute. In an agro-industrial business cluster multinationals are present as supply companies (e.g. seeds and machinery). However, they also play an important role because, in most cases, they constitute company demand (retail distribution chain). In this context, this study intends to verify whether multinationals, by means of these two forms of interaction, encourage the use of generic technology, acting as a vector (carrier) that transfers (diffuses) technology throughout their branch networks. In this sense, we analyze the role of multinational companies within the cluster comprised of production and marketing companies as well as the auxiliary industry for agriculture in the Almeria province (Spain).

Keywords: transfer of technology, agribusiness, multinational.
JEL: M21, Q13

Introduction: justification of the study.

Various studies have analyzed technology diffusion in multinational companies and how they utilize knowledge generated within business clusters (Almeida, 1996; Frost, 2001; Nobel and Birkinshaw, 1998; Singh, 2004; and Zhao, 2003). The conclusions obtained are unsettling. Multinationals benefit more from local branches in terms of knowledge than what they contribute. In an agro-industrial business cluster multinationals are present as supply companies (e.g. seeds and machinery). However, they also play an important role because, in most cases, they constitute company demand (retail distribution chain). In this context, this study intends to verify whether multinationals, by means of these two forms of interaction, encourage the use of generic technology, acting as a vector (carrier) that transfers (diffuses) technology throughout their branch networks.

In order to conduct this analysis, it is necessary to discern whether the main function of clusters is the generation or diffusion of technology and if it possesses its own technology (adapted), i.e. different from those in other competitive areas (for example, Morocco, Turkey or Egypt). Another hypothesis that we will verify is whether the incorporation of technology takes place as result of cluster initiative or if it is motivated by demand (retail distribution chain) and, therefore, if retailers provoke general innovation in all the zones where they supply, creating a more intense competition. From a theoretical point of view, this study features the novelty of describing new communication channels between business clusters and their immediate environment, via companies located outside this local sphere (demand), which in the end determine their function.

The aspects addressed in this study will be of use insofar as: i) they help companies recognize that the creation, transfer and application of knowledge are sources of competitive advantage (Almeida et al., 2002; Zollo and Winter, 2002), and that ii) the positive effects of knowledge diffusion derived from the geographical aglomeration of activities (Baptista, 2001) can be neutralized by the transfer, to competition, of technology that they produce, that is, the demand (retail distribution chain) and all other multinationals from the auxiliary industry located in the business cluster.

Great attention is paid to the role of multinational companies within the cluster comprised of production and marketing companies as well as the auxiliary industry for agriculture in the Almeria province (Spain). This cluster has a turnover of 3.469 million

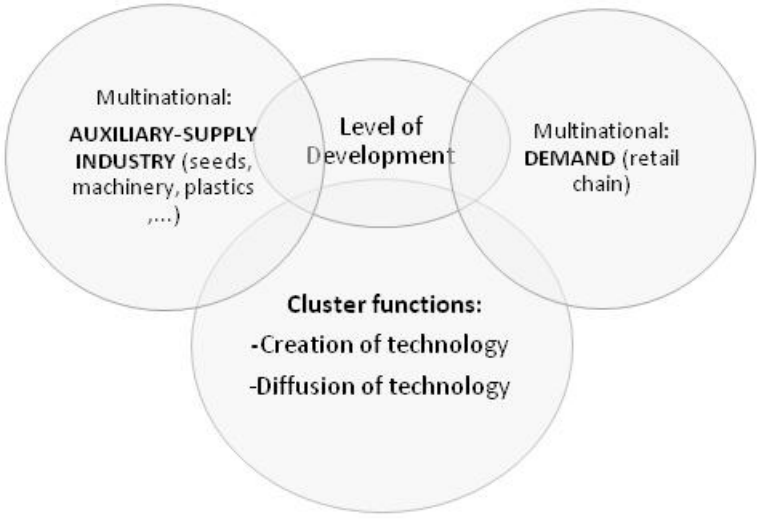
euros. The Spanish vegetable sector is found mainly on the Mediterranean coast and Canary Islands, areas where the world's largest concentration of greenhouses is located (27,500 Ha). The value of the Spain's vegetable production is 7,147 million euros and represents the most important portion of the final agricultural production in Spain (19% of the total).

Theoretical Framework.

Analysis Variables.

This paper tries to see how three variables that affect the agro-industrial cluster are related: i) effects attributable to it (creation and diffusion of technology), ii) the development degree and iii) the presence (or not) of multinationals. The proposed diagram (Figure 1) reveals a bidirectional relationship between all variables. However, subsequent analysis will focus on how multinationals may influence the functions of the cluster forcing the use of a standard technology. Also, we examine how the existence of a technology, created in the cluster, can be transferred to competitors through the multinational company. Both issues are in turn linked with the degree of development of the cluster. Therefore, there is a large analysis framework that we will try to condense by verifying a series of propositions that are defined below.

Figure 1: Relationship between key analysis variables



Various studies have focused on the process of disseminating new technology. The traditional approach emphasizes the transmission of information, that is, as time goes on, more companies will use a technology until a saturation point is reached. This process will evolve according to a logistical function and will manage to lower the risk of adoption (Mansfield, 1961). The empirical applications of this approach (Levin et al., 1987; or Mansfield, 1993) demonstrate that this process is gradual, not instantaneous (Geroski, 2000). Later studies have led to different adoption models, which mostly try to explain why slow advances arise during initial stages. Karshenas and Stoneman (1996) relate the factors that influence the diffusion of innovation: i) the characteristics of the company (range effect); ii) the existing number of users (stock effect) and iii) the order in which the innovation is adopted (order effect). There are very few references explicitly concerned with the role that the type of technology plays in the diffusion process, although this question is, however, implicitly addressed in the previously cited models, making it clear that a generic or standard technology is more easily transferred (Gatignon and Robertson, 1986).

Also, these studies suggest that geography is a very important factor in the development and diffusion of technology: their effects are positive on relatively nearby companies and seem to overcome the negative consequences of the agglomeration of the competition (Porter 1998a). Nevertheless, we must consider that these effects depend on the kind of knowhow and characteristics of the industries (Audretsch and Feldman, 1996). In this context, interpersonal connections and the establishment of networks play important roles in the transference and generation of knowledge and, therefore, in the competitive capacity (Baptist, 2001; Tallman et al. 2004; McEvily and Zaheer, 1999). Other sources of innovation in clusters are: regional associations (McEvily and Zaheer, 1999), or spillover effects (Saxenian 1990, Malmberg and Power, 2005; Maskell, 2001).

In general, there are numerous published sources about clusters, but it is difficult to classify them: it would be useful to know their main role. These questions can be related to their degree of evolution. In this sense, Porter (1998b), when he studies clusters based on the development of the country where they are located, observes that

the least developed of them have minor depth and influence, and use foreign technologies. Extending this classification, we can say that in a "basic" cluster the diffusion of generic technologies will be the main role and, in a "total" cluster, the development and diffusion of new technologies will be the fundamental effect. Following this argument, we would be able to know, in an indirect manner, the status of the cluster by observing the adopted technologies and the final output.

As discussed above, we may ask what the main role of the Almeria horticultural cluster is. For that reason, we make the following proposition:

- *The main role of the cluster is the diffusion of technology (not its development), and the most important difference of Almeria (Spain) in relation to other clusters is the "speed" of this process.*

In addition, and as a complement to the previous statement, the presence of multinationals in the zone will be analyzed. The question about the existence of this kind of firm in clusters does not have only one answer. In many cases its presence simply looks for a place that serves as an export platform (Ketels, 2004). In our case, the answer to this question will be important because it can explain the potential of differentiation of the area: a technology imposed by this type of company will be easily imitated by the competition. However, a technology of one's own will be a source of competitive advantage. As a conclusion, we will try to verify if:

- *The supply of technology is controlled by multinationals, i.e., the available technology is generic and it is not adapted to the characteristics of the area.*

Demand as a driving force behind change.

We are unable to find a categorical answer to the question as to what motivates the creation and diffusion of technology. On one hand, we can argue that the growth of scientific knowledge is the fundamental driving force that leads companies to innovate (technology push). From this perspective, Roder et al. (2000) see a clear link between R+D, patents, industrial concentration, and the size of the companies as sources of innovation. From a different point of view, it is demand that stimulates the new applications (demand pull). At the present, it seems logical that if we consider innovation to be an economic activity, demand will play a predominant role. Other

Eclectic ideas have also been published (e.g. Burgelman and Sayles, 1986). In line with the previous concept, Bruce and Meulenberg (2002) comment that traditional demand orientation or technology push, applied to the agro-food sector, are overly simplistic since the stategy that companies follow will depend on the culture and market in which they operate.

It has been empirically demonstrated that innovation depends on the geographic proximity to markets, in other words, it depends on the final demand (Bottazi and Peri, 2000). William (2003) argues that the provision of innovation is controlled by demand and, therefore, the progressive character of innovations cannot be assumed because there is an accelerated process of new product propagation. On the other hand, it is known that small and medium companies show a resistance to change (more intensive in the primary sector) that limits their competitiveness (Minguzzi and Passaro, 2000).

Demand is very important in the agro-industry where ideas are generated throughout the value chain (Rama, 2005). Agro-industry uses the suppliers of machinery or packing as a source of innovation, but also their clients and especially the distribution chains (Christensen et al., 1996). This fact makes it possible for the supermarket to be the *spark* of the innovation process because it has continuous contact with consumer needs and demands. In this sense, we will try to verify the following hypothesis:

- *The innovation pusher of the Almeria (Spain) horticultural cluster is the demand (retailers); therefore, it pushes local and external suppliers: increasing competition.*

Description and analysis of Almerian agro-industrial cluster.

Procedures and methods.

The information used in this paper was obtained through interviews conducted in 2007 of representatives of the horticultural production sector and the agricultural auxiliary industry of Almeria, whose greatest supporters are: The Association of Harvesters and Exporters of Fruit and Vegetables of Almería (COEXPHAL), the Growers Association of Almeria (ECOHAL), and the Foundation for Auxiliary Technologies for Agriculture (TECNOVA). Additionally, these partnerships have

provided information from their own databases. Contact was also made with individual firms belonging to these entities.

COEXPHAL, founded in 1977, represents 70% of Almeria horticultural production and 75% of exports. This association is also the Almeria delegation of the Andalusian Federation of Agricultural Cooperative Enterprises (FAECA). COEXPHAL (and FAECA) currently has 110 companies as members. ECOHAL was created in 1986 and includes 6 limited companies (all auctions) with large marketing volume: they represent about 20% of the production and 15% of total Almeria exports. TECNOVA (created in 2001) includes 116 companies with services related to agriculture.

The Network of Vegetable Exporter Companies and its Relation to Auxiliary Industry.

The Almerian horticultural production-marketing system and its auxiliary industry constitute a production-marketing cluster (Figure 2) in which intense territorial concentration favors a continuous relationship and constant communication among its members. This is possible by means of many different channels: symposiums, conferences, courses, exhibitions, personal and professional contact, worker exchange and specialized local publications. This relationship is so close that the transfer of knowledge takes place virtually in real time, which makes immediate response to any unexpected event possible. In regards to individual relationships we must also mention the existence of certain business associations which promote these kinds of relationships as well, such as COEXPHAL, ECOHAL and TECNOVA.

From a technological point of view, it can be said that the horiticultural production system is characterized by:

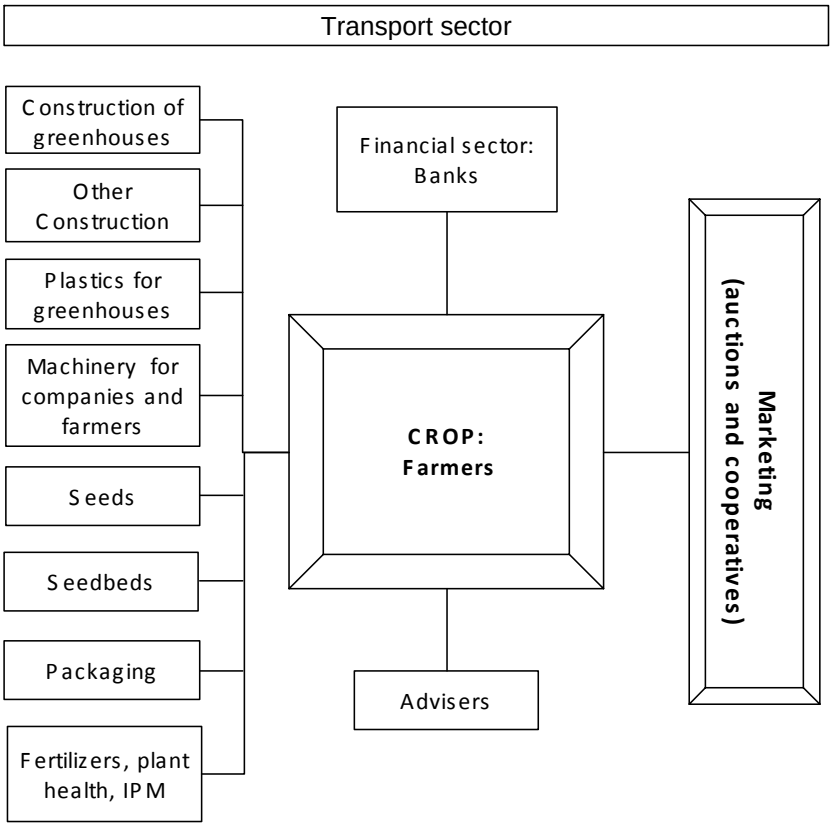
- A model which has not seen abrupt technological advances, that is, there has been not radical, but progressive innovation.
- A pragmatic model based on a method of trial and error.

In the introduction process for an innovation a distinction should be made between the production system and that of marketing[1]. The majority of innovations have

[1] In Almeria (Spain) it is difficult to differentiate between the concept of production and concept of marketing: the implementation of technology by farmers is derived from a process that, in some situations, originates from the marketing company itself (be it a cooperative or not). Therefore, when mention is made of technology applicable to marketing, we refer to the utilization of technology that takes place during the phase of sale.

been developed in production: "enarenado[2]" (1967), hybrid seeds (1975), drip irrigation (1977), thermal plastics (1982), inline drippers (1983), structural improvements to greenhouses (1985), natural pollination (1990), "long shelf-life" varieties" (1991), prefabricated greenhouse structures (1995), soiless growing and automated irrigation systems (1997), climate control (2000), widespread use of Integrated Pest Management (2007).

Figure 2: Almerian Horticultural Cluster System.



However, in the marketing phase, there has not been an incorporation of technology; rather, there has been a renewal as a result of depreciation and not strategic planning. Focusing on this phase alone, it is possible to enumerate the most relevant innovations in recent years:

1. Product innovation[3]. Standing out in this point are quality certifications (UNE 150,000, GLOBAL-GAP, ISO 9000, ISO 14,000, British Retail Consortium), advanced application of Hazard Analysis and Critical Control Points and

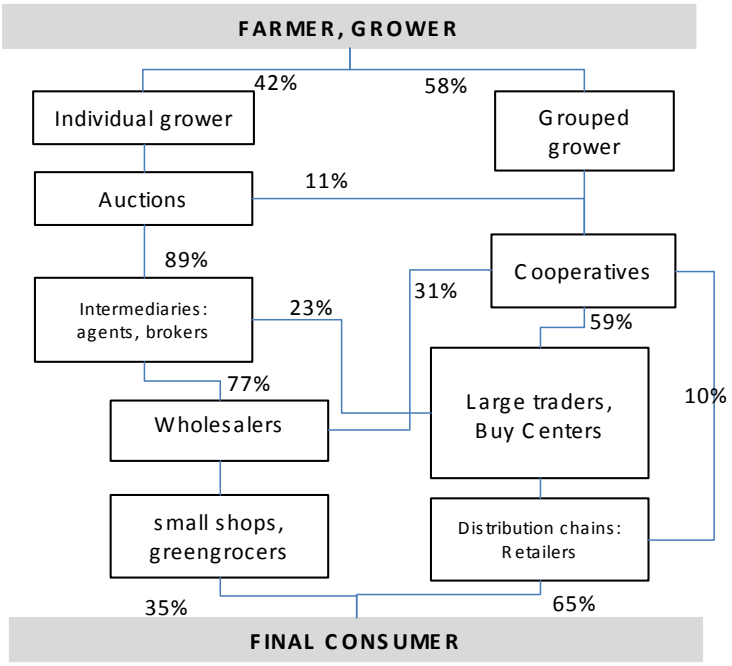
[2] "Enarenado" is an agricultural technique which implements the creation of a low permeable soil.
[3] This refers to actions designed introduce new formats/designs in the market, create websites, certifications, new payment methods, material changes in production,...

tracking, varietal improvement[4] considering it has an effect on marketing, and the recent initiatives to introduce processed products.

2. Process innovation[5]. Novel standouts include the implementation of RFID technology[6] to tracking processes and the development of performance monitoring systems in packing plants.

There is a negative aspect that should be mentioned and that is that many of these achievements had to be motivated by the publication of specific regulations, although its implementation had gone far beyond mere compliance with the law.

Figure 3: Almerian Horticultural Marketing System.



%= Shows the percentages sold by each channel.
Source: Own elaboration, designed for this study using survey of salespeople in the sector.

As can be seen, Almeria's marketing companies are significantly lacking in innovation, that is, despite everything already achieved, changes have been small: the range of products is identical to 10 years ago (De Pablo and Pérez-Mesa, 2004) and the

[4] Although this merit belongs to the seed companies.
[5] This refers to electronic catalogs, electronic sale, new communication systems, customer service centers, network system improvement, software for supply chain management, etc.
[6] Radio Frequency Identidication.

formulas of presentation have not notably varied either[7]. In other words, a generic product is being sold. There is also no attempt made to approach consumers directly, i.e. an "interpretation" of their needs is provided by an intermediary client. The sale chain is so extremely long before it actually reaches the final customer that it is impossible to know firsthand what their habits and demands are. As can be seen in Figure 3, it is the ... of distribution that are ultimately in charge of gathering all information and providing it to companies as this is a required obligation stipulated in their supply contracts.

In short, at first look, and because of the existing type of innovation, it seems possible to deduce that this is developed thanks to the existence of a strong auxiliary industry and the "imposition" of intermediate demand (retail distribution chain). The rest of this study will seek to confirm whether this previous statement corresponds with reality.

Multinational Presence: Is Auxiliary Industry the Key to Innovation in the Cluster?

We will be begin by answering the following question. Who is hiding behind the auxiliary sector of agriculture? In order to respond we will study the three most important industries by turnover: seed companies (turn over 23% of the entire auxiliary sector); plastics industry (21% of turnover) and the packaging and packing industry (15% of the total).

In regards to production and sale of seeds, there are six very important companies: Enza Zaden, Hazera, Nunhems, Rijk Zwaan, Eurosemillas and Western Seed. Most of these companies conduct research on other crops, apart from horticultural ones, including genetic modification and biotechnology.

As regards the plastics industry, the principal companies in the sector have undergone nation-wide mergers (Spain). Those groups that remain have become multinational companies with headquarters in Spain and Turkey, as well as delegations in Central and South America, Kenya, Tanzania, China, Morocco, Germany and Tunisia.

[7] In fact, of the 669 foods and beverage product launches in Spain in 2003, 90% were additions to existing product ranges (Nueno, 2004). This verifies the difficulty of developing new products (and subsequently maintaining them on the market).

As for the packaging and packing industry, companies in the sector are of a less regular nature than those dedicated to the seed or plastics industry. Furthermore, these companies combine their activities, logically, with the sale of machinery dedicated to horticultural handling, as is the case of Smurfit Kappa, which is present in Europe, Latin America, and even China.

In more general terms, among both the industries analyzed and the auxiliary sector as a whole, there is a tendency to search beyond the local market to find new ones, i.e. sales efforts are being focused in Central and South America, mainly in Mexico and Brasil as well as in northern Africa, mainly in Morocco.

We come to the conclusion that auxiliary industry is a sector with a multinational presence which provides a generic technology. Any variations made to products in order to adapt them to the local market are minor (with some exceptions). This statement is confirmed by observing that 67% of the suppliers for this industry are from outside the province (Cajamar, 2001). Manufactured products are produced quickly transferred to competing areas by means of an extensive network of branches, and consequently marketing companies obtain no competitive advantage from using them.

The difference, in respect to other competing fields, is not based on the function of the auxiliary industry (and the marketing industry) as a creator of innovation, but rather on the fact that it participates in the process of technology diffusion and its subsequent acceptance by farmers, cooperatives, agrarian transformation associations and produce exchanges. This process is based on strong local concentration of activities, active work on the part of associations and research bodies – be they private or public – and the presence of dynamic adminstration. In light of the above, production investment is the key to this development, something which would not have even possible without an agile financial system, whose top exponent is Caja Rural Intermediterránea (the most important bank in the area).

A Real-Life Example of Innovation.

This example contains many of the statements that have been set out in this article, which can be summarized in the following manner: “demand commands, the means of diffusion function and auxiliary industry takes advantage”

The example that is herein described is the evolution of the implementation of integrated pest management (IPM) on horticultural farms belonging to members of social economy companies in Almeria. Integrated pest management, as a technology, involves:

- The introduction of arthropods that are natural enemies of pests. At first it was thought that this technology was not adaptable to the Almeria growing system due to: the massive presence of pests, the mild climate, the type of structures (non-hermetic greenhouses), as well as the lack of adaptation of the necessary auxiliary fauna since it was developed to be utilized in Central European countries (e.g. Holland).
- The adaptation of chemical product lines that are less detrimental to the environment in combination with predators, used to complement the former.

In the 1990's, the Andalusian Regional Government, private companies and the majority of cooperatives all began to express interest in this growing system. With respect to private companies, it was businesses with prior experience using the system, principally in Holland (the most prominent example is Koppert[8]), that first tried to expand its usage to the southeast of Spain: Almeria, Alicante and Murcia, albeit without much success.

So then why was this type of technology not widely utilized? In addition to the causes previously mentioned, a lack of environmental and food safety awareness among consumers, which was made evident by the purchases of large retail distribution chains (the main customers of horticultural production-marketing companies of Almeria). Strategy change on the part of these large chains was then quickly brought about by serious food safety problems that began to appear in Europe towards the end of the 1990's, which consequently affected requirements, with regard to quality, which suppliers were forced to comply with. Contrary to the way it may seem, these circumstances did not significantly alter the activities of horticultural production-marketing companies, as the sector considered itself free of any food hazards by complying with the most widespread quality regulation in the field: Spanish Regulation UNE 155,000:2005, established by the Spanish Standardization and Certification Association (AENOR) which is a controlled production process for fresh fruits and

[8] Koppert's main business center was created in 1967 and was located in the Netherlands. Koppert also currently has sales and/or production subsidiaries in England, France, Italy, Spain, the United States, Canada, Mexico, Turkey, Kenya, Poland, Morocco, South Korea and New Zealand.

vegetabes[9]. Compliance with this regulation implies limiting the use of phytosanitary products to 50% below the legal maximum residue levels (MRLs).

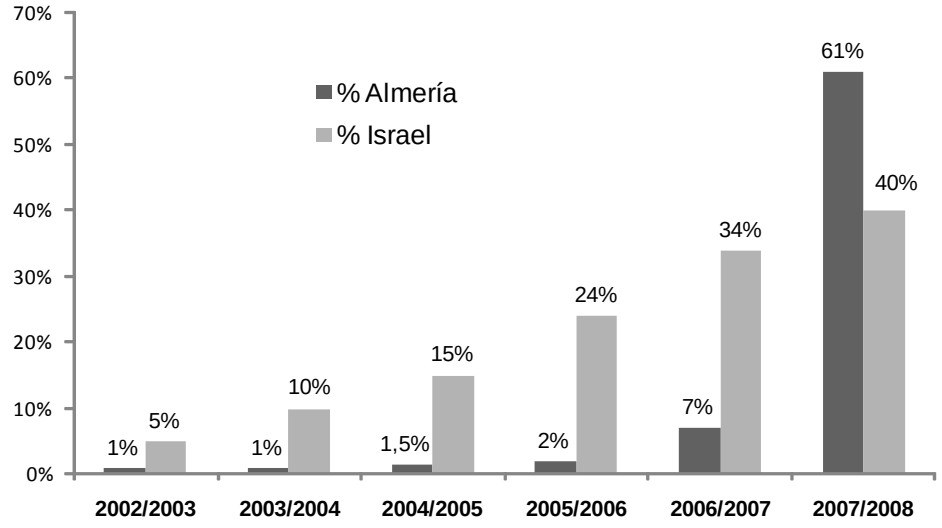
Until 2006, the implementation of biological pest management on Almerian farms was marginal. However, the sector took a complete turn in only one year due to: i) the emergence of resistences, among the most common pests, to the active chemical ingredients being used until that point (mainly on peppers), completely "disarming" all phytosanitary control methods[10]; and, ii) above all, enquiries made for "information requests" on the part of Germany, United Kingdom and Holland from the Andalusian Department of Agriculture for the discovery (December 2006) of traces of an unauthorized active ingredient (isofenphos-methyl) in peppers exported to these countries (which did not result in a public health alert). The main distribution chains in Germany urged their suppliers to radically change their attitudes, both directly (obligating them to conduct chemical analyses[11] on all commercialized produce) and indirectly, through the substitution of produce from Almeria for that from other origins (e.g. Israel). Companies had no choice but to implement a drastic change in growing systems in the field. This fact is confirmed by the evolution of the number of hectares utilizing biological control in the province of Almeria (Figure 4): the percentage of use of this technique increased from 7% in the 2006/2007 season (on a total growing area of 8,200 hectares dedicated to peppers) to 61% in 2007/2008 – in other terms, a variation of almost 800%. A formidable competitor as is Israel only managed to increase utilization by 17% during the same period of time, and, moreover, this was done on a total growing area of 2,000 hectares dedicated to peppers. The overall effort was therefore smaller in terms of percentage and total hectares converted. Nevertheless, an almost epidemic development of technology (logistics) can be observed in both zones.

When presented with this particular evolution, it is logical to wonder what mechanisms made such a rapid change possible. The key proved to be perfect coordination between the private and public sector. The public sector (Department of Agriculture-Andalusian Government) invested huge sums of money in a promotion campaign run throughout local media. This campaign, dubbed "green commitment,"

[9] Recognized by GLOBALGAP and used by 70% of the horticultural marketing companies in Almeria.
[10] This had been a fact for several seasons.
[11] This was demanded by the Andalusia Government in order to be able to market any horticultural produce. Every batch brought to an exchange or cooperative by a farmer had to be accompanied by a chemical analysis of the produce that guaranteed no unauthorized active ingredients were utilized.

expressed the need to introduce biological control; and it also subsidized a portion of the cost of buying "natural enemies" to be used on farms. The Association of Harvesters and Exporters of Fruit and Vegetables of Almería (COEXPHAL) created a team of specialists, led by the ex-technical director of Koopert Spain[12], that was in charge of training the field technicians from companies belonging to COEXPHAL, as well as providing advice and guidance directly on farms. In addition, this association anticipated the need to provide predator insects and therefore created a technology-based company called Biocolor S.L., (shared by the company itself and others belonging to the association). Its focus was on production itself and research into the adaptation of species to the particular characteristics of Almeria. The main beneficiaries of all these events were those companies which had been traditionally involved in the production and sale of integrated pest management (e.g. Koopert, Biobest and Agrobio) which saw their sales grow exponentially in only one season. Indeed, in only one year, Almeria became the world's largest IPM-using area (6,500 hectares for both peppers and other products), larger than areas in other countries with a more established tradition of using this method, such as Holland and Israel.

Figure 4: Evolution of Areas with IPM in Almeria and Israel. Peppers.



Source: Designed for this study using data from the Department of Agriculture (Andalusian Regional Government) and Steinberg (2007)

[12] This is a clear example of diffusion of technology due to the movement of personnel within the industry.

Conclusions and Discussion.

This study makes it clear that in agroindustrial clusters there are two important channels for the transfer of knowledge to the competition: multinational companies established in auxiliary industry and demand (retail distribution chain). Both actors share the same common denominator and that is to standardize the technology utilized. These results are in line with those obtained in other sectors: semiconductors (Almeida, 1996), and the textile industry (Thompson, 2002). Multinational companies, just like demand and auxiliary industry, play an important role as a driving force behind innovation, exactly as in the case of the agri-food sector according to Rama (2005). However, it is a generic kind of innovation and, therefore, is easily transferred to the competition. These facts condition the cluster in such a way that its priority function is the diffusion of technology and not its creation. Despite what has already been stated, it must be noted that there are limitations to studying a specific real-life case, as was done in this article, which is important when the time comes to generalize results. However, this could be used as the preliminary stage in studies that seek to generalize results through other means.

In regards to the conclusions particular to the case of Almeria, it is worth pointing out, as of today, this horticultural business cluster, as top supporter of the Spanish exporting sector, is not very developed. Its function is not the creation of new technology, which, in most cases, is not adapted to this sector. Nevertheless, a small innovative group does exist (a subsector of organic chemicals and fertilizers, packaging and packing, and greenhouse construction) which is trying to open the export market for differentiated products, but whose main customer is currently the provincial production-marketing industry.

Farmers and local marketing companies, as principal buyers, limit themselves to adopting an innovation if it implies changing methods with respect of a habitual practice but not if it involves the utilization of a new technology. This fact is corroborated by observing the external composition of the auxiliary market, which should be the technological supplier for production and marketing. This industry is comprised of companies that serve zones competing with Almeria, which means that an innovation introduced locally will be introduced there in exactly the same way, providing no competitive advantage for its use.

The main function of the horticultural cluster is diffusion of technology, whether it be a newly implemented method or not, and primarily the speed with which the change takes place. The existence of a cluster oriented towards diffusion, which acclerates changes, entails positive complementary aspects as a result of being the first to adopt innovations (order effect). The problem which stands out is that the decision to innovate does not originate from the sector itself but is rather imposed from the outside by the demand, that is, by the retail distribution chain (main customer of marketing companies). Therefore, the competitive advantage that would be achieved by this rapid adaptation process is, for the most part, nullified by the fact that it is the customer who is adapting to its own obligation to do so.

For example, suppose that Socomo (Carrefour's purchasing center) wants all of its suppliers (Almeria and Morocco) to utilize integrated pest control management on their farms. Almeria, thanks to its organization as a diffusion cluster, would differentiate itself from Morocco in that its adaptation to the new technology would be very rapid (e.g., obtaining a one-year advantage). Following this time, Morocco and Almeria would have complied with the customer's standards, and their produce would be identical. However, if it were taken into consideration that Almeria's companies are faster than the competition, they are capable of taking control of scrace production inputs (highly-trained field technicians, development of storage systems, insect control and transport) and would be able to achieve an even greater return on this technology with respect of Morocco.

This example clearly demonstrates the need to establish systems that detect future market trends, i.e. Almeria would have been able to obtain a much greater competitive advantage if ten years ago, with the advent of integrated pest management in Spain, it had known how to identify and implement a future necessity.

Another conclusion is that the auxiliary industry, albeit with exceptions, only serves a purely commercial function, that is, selling its product, taking advantage of the strong local production concentration as a method of cutting costs (marketing, transport,...). Therefore, this industry's continuance, in Almeria, is indissolubly linked to the production and marketing phase. In this respect, insofar as what regards innovation financing on the part of public entities, all courses of action should prioritize projects through the collaboration between production-marketing companies and auxiliary industry. In this way a geographically adapted product would be developed.

Finally, this article also hopes to open discussion about a trend detected in technological incorporation during the agricultural production phase: if demand is the driving force behind innovation, new consumer trends towards biological farming (natural growing methods and elimination of pesticides) could result in a process of "technological disinvestment" as a means of obtaining competitive advantages or, at least, a slowing down of innovation (Beckeman and Skjöldebrand, 2006). This is because consumers are reluctant to accept new foods based on technological improvements, something which is evident, for example, when it comes to genetics (Miles et al., 2005) and functional foods (Frewer, Scholderer, and Lambert, 2003). This reluctance may be related to the fact that consumers maintain a high level of risk aversion when dealing with food.

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