Knowledge Transfer in Agriculture and Rural Development: Four Western European and North American Case Studies

A Joint ECSSD – Policy Development Publication

A Study by

Aron P. Goldman
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Knowledge Transfer in Agriculture and Rural Development:  
Case Studies in Western Europe and North America

Aron P. Goldman, Policy Development  
December, 2001

Abstract

EU accession countries, as they start to look more like their Western European neighbors, are considering new priorities for agriculture and rural development. New inputs for this priority-setting process derive from four case studies which consider the implications of the knowledge economy for agriculture and rural development in Western Europe and North America. The studies are from Ballyhoura (Ireland), Extremadura (Spain), Umbria (Italy), and Mississippi (United States). There have been successes and failures, and no unambiguous process of knowledge transfer is found everywhere. However, the study of these four cases yields lessons that may be widely useful:

- Technology and knowledge-driven industries considered for adoption should be commensurate with the local level of development.

- Technology and services should be used to (a) add value to existing agricultural products; (b) establish higher-value agricultural alternatives, or (c) establish non-agricultural alternatives.

- Planning for expansion of technology- or knowledge-based activities should be sensitive to effects on the environment, the quality of work, and other aspects of the quality of life.
I. Introduction

Background

This working paper is the result of a partnership between The World Bank and Policy Development (PD). The World Bank’s Environmentally and Socially Sustainable Development Sector (ECSSD) in the Europe and Central Asia Region is considering the implications of the knowledge economy for agriculture and rural development among applicants for accession to the European Union (EU). As the economies of the accession countries begin to converge with those of their Western European neighbors, knowledge about what works and what doesn’t in those economies is ever more relevant. To support its clients among the accession countries, ECSSD asked PD to gather and analyze some of the experiences of knowledge transfer in agriculture and rural development in Western Europe and North America. ECSSD and PD hope that this research will provide useful input as the EU accession countries set their agriculture and rural development agendas.

Findings

Our investigation of knowledge transfer in rural development in four regions revealed a multitude of activities that seemed to follow no single principle, or set of principles. Indeed, the paths followed were so diverse that it is not even clear how to judge the success or failure of these initiatives. The summary table below (Table 1) demonstrates the diversity of our cases. Each of the four cases – Ballyhoura (Ireland), Extremadura (Spain), Umbria (Italy) and Mississippi (United States) has distinct initial conditions and undertook a unique developmental approach.

Rewards and Risks of Globalization

Characterized by economist Samuel Bowles as “a reduction of impediments to international flows of goods and factors of production,” globalization is the essential context in which knowledge transfer in rural Western Europe and North America has taken place. “Virtual call centers” in Ireland, globalization of truffle exports from Italy, and international tourism in rural Spain would not be feasible without the recent advances in global communication, transportation, and technology. In these cases, minimal investments in knowledge transfer have led to unprecedented opportunities for growth. At the same time, globalization is linked to the withdrawal of agricultural subsidies. For many communities, the event precipitating experimentation with alternative activities has been the reining-in of agricultural subsidies; the United States Farm Bill, the Common Agriculture Policy (CAP), and Mexico’s Alianza Para el Campo (Alliance for the Countryside) are all being modified to conform to WTO and NAFTA rules. The urgency of technology and knowledge-based structural changes to agriculture and rural development in Western Europe and North America cannot be fully explained without proper emphasis on the pressures due to dwindling price supports, input supports, and
export promotion. Moreover, some see globalization as a potential threat to social welfare. Our research revealed cultural discomfort with the shift away from traditional agricultural activities that took place under some initiatives. For example, traditional truffle gatherers in Italy expressed concern that they are required to harvest only on the processor-owned tree farms, on an hourly-wage basis.

Table 1

<table>
<thead>
<tr>
<th>Initial Development Status</th>
<th>Approach</th>
<th>Short Term Results</th>
<th>Long Term Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ballyhoura</strong></td>
<td>The region is sparsely populated with small, primitive farms. Computers and internet technology were very rare and unfamiliar to residents. No tourism. Declining EU subsidies.</td>
<td>In general, Ballyhoura emphasized higher value commodities, adding value, service sectors, and IT solutions.</td>
<td>IT and new entrepreneurial ideas were foreign to residents. Traditions seemed too deeply ingrained to allow for adaptation.</td>
</tr>
<tr>
<td><strong>Extremadura</strong></td>
<td>Landlocked, rural, and historically dependent on cherry production. Little or no IT or biotech in use. Minimal tourism. Declining EU subsidies.</td>
<td>Extremadura emphasized expanding cherry production, but also diversified into processing and new product marketing.</td>
<td>Leadership in markets for cherries and cherry products has been maintained.</td>
</tr>
<tr>
<td><strong>Umbria</strong></td>
<td>Sparsely populated, primitive agricultural methods, minimal tourism. Declining EU subsidies.</td>
<td>One corporation has expanded production using new technologies.</td>
<td>Increased production and sales.</td>
</tr>
<tr>
<td><strong>Mississippi</strong></td>
<td>Poverty, large farms, high subsidies, research extension services infrastructure. Declining federal subsidies.</td>
<td>Low Value Production enhancements.</td>
<td>Technical success.</td>
</tr>
</tbody>
</table>

**Methodology**

**Sources**

This qualitative survey was conducted using primary and secondary sources. Primary sources included community members, both participants and non-participants in the rural development initiatives under study. Secondary sources included scholarly and mainstream literature and interviews with regional experts as well as academic experts and practitioners in knowledge transfer and rural development. Dozens of interviews were also conducted with international funding agencies such as the EU, the OECD, the
World Bank, and the local companies and agencies operating the local development projects, including Ballyhoura Development and Urbani.

Definitions

There are many interpretations of "knowledge transfer." In a narrow interpretation, it sometimes refers to the activities of agencies specifically established with "knowledge transfer" as their mandate. This may include agricultural extension services at publicly funded universities as well as activities of other publicly funded agencies. These services were established specifically to help ensure the transfer of technology and pure research to applications within the economy.

In a broader interpretation, knowledge transfer may refer to the local adaptation of knowledge from outside the community, regardless of its source or by what means it arrived. For example, the adoption of information technology in a rural village previously unexposed to technology would be "knowledge transfer" in this sense.

For the purposes of this exploratory study, all definitions of knowledge transfer were acceptable. This decision was made early on because it allowed us to learn more about – rather than determine – how communities and experts are thinking about this concept. The examples we researched, therefore, reflect a variety of interpretations.

Case Studies

Agriculture. In each rural development case study, we looked for innovations in agricultural cultivation, harvesting, and processing technology involving computers, mathematical modeling, genetic modification, and marketing. We also looked for the means by which the knowledge transfer took place. Was it a deliberate and formal transfer facilitated by a government agency responsible for such activities? Or was there a private market response by individual investors or a company?

Tourism. We quickly learned that tourism has proved a popular alternative to agriculture, and observed that development of tourism involved knowledge transfer. People undertook the shift from the demands of farming to those of tourism, the latter requiring a need for local knowledge and skills in hospitality, marketing, and management. In some cases, these skills were self-taught. In other cases local and non-local agencies provided brochures reminding residents of their own heritage and natural resources, or provided training in hotel management.

Information technology was another popular alternative to traditional livelihoods. Young entrepreneurs from urban centers usually spearheaded knowledge transfer in this field. The EU's "Computer Driving License" initiative was the most ambitious example of computer training knowledge transfer we found. The dissemination of new IT skills and their application to economic activity was a clear case of knowledge transfer.
II. Case Study - Agriculture, IT, and Tourism in Ballyhoura (Ireland)

Introduction

The story of Ballyhoura is that of a community that found itself in an economic slump and took innovative steps to reverse the trend. A region of smallholding farmers, Ballyhoura was dependent on dwindling subsidies and had no ready economic alternative. Today, with some outside help, Ballyhoura has discovered opportunities in the same globalized knowledge economy that formerly threatened it.

Background

Ballyhoura is an agricultural region of 57,264 people in the south of Ireland, encompassing 50 villages in County Limerick and County Cork. Ballyhoura relies largely on small-scale livestock farming. Sixty-seven percent of total employment in Ballyhoura is within the agricultural sector, that of processing produce, and services to agriculture.

Ballyhoura had reached an economic low point in 1990. There were dozens of derelict buildings in the town of Kilfinane alone – a town of 766 people. Small farms were closing down as large farms struggled to compete in European and international markets and to take advantage of the EU’s diminishing Common Agricultural Policy (CAP) subsidies. As in other parts of Europe and North America, agricultural employment as a percentage of total employment had fallen to a fraction of what it was fifty years before. Although agricultural output had risen in recent years, this rise in productivity of inputs was unaccompanied by increased employment. Community solidarity was down and the pubs were empty.

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1 Ballyhoura occupies only parts of counties Limerick and Cork, and does not include the cities of Limerick or Cork. The major towns of Ballyhoura are Kilfinane, Kilmallock, Hospital, Ballylanders, Mitchelstown and Charleville. (The Irish Times, 8/11/99)

2 While average farm size in the Mississippi Delta region is 3,000-4,000 acres, average farm size in Ireland is 75-80 acres.

3 According to Sonny Ward, Chairman of Ballyhoura Development, as reported by The Irish Times, “Local agency secures 344 jobs,” August 11, 1999, City Edition

4 O'Faolain, Nuala, “Naturally Efficient,” The Irish Times, Pg. 9, August 15, 1996
EMPLOYMENT IN AGRICULTURE AS PERCENTAGE OF TOTAL CIVILIAN EMPLOYMENT

<table>
<thead>
<tr>
<th>Country</th>
<th>1985</th>
<th>1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>3.1</td>
<td>2.7</td>
</tr>
<tr>
<td>EU (15)</td>
<td>10.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Spain</td>
<td>18.3</td>
<td>8.4</td>
</tr>
<tr>
<td>Ireland</td>
<td>15.9</td>
<td>10.4</td>
</tr>
<tr>
<td>Italy</td>
<td>11.2</td>
<td>6.8</td>
</tr>
<tr>
<td>UK</td>
<td>2.3</td>
<td>1.9</td>
</tr>
<tr>
<td>France</td>
<td>7.6</td>
<td>4.5</td>
</tr>
<tr>
<td>Germany</td>
<td>4.6</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Source: OECD, Economic Accounts for Agriculture, 1999 Edition

Figure 1

Map 1
Table 2

| AGRICULTURAL OUTPUT AT CURRENT PRICES | Converted using PPPs
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Millions of US dollars</td>
<td>1991</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>US</td>
<td>183,704</td>
</tr>
<tr>
<td>EU (15)</td>
<td>236,885</td>
</tr>
<tr>
<td>Spain</td>
<td>31,677</td>
</tr>
<tr>
<td>Ireland</td>
<td>4,706</td>
</tr>
<tr>
<td>Italy</td>
<td>42,353</td>
</tr>
<tr>
<td>UK</td>
<td>21,233</td>
</tr>
<tr>
<td>France</td>
<td>48,927</td>
</tr>
<tr>
<td>Germany</td>
<td>32,580</td>
</tr>
</tbody>
</table>

Source: OECD, Economic Accounts for Agriculture, 1999 Ed.

The Initiative

It was at this time that Ballyhoura residents combined efforts to change things. Local initiatives to attract tourism with farm study tours and rural tourism based on outdoor activities led to the formation of local development groups. A Community Consultative Committee was formed to address concerns about the future of the region in light of agricultural stagnation, the stepping down of CAP subsidies, quota restrictions, and the outflow of Ballyhoura's people to cities. The Community Consultative Committee conducted a comprehensive "skills audit" of 21,777 adults. This showed that very few residents had the training necessary to adapt to service-sector labor market demands. But the survey itself was a community building exercise, an experiment in knowledge transfer, and a call to action, as Ballyhoura successfully drew on resources from outside the community. More than 300 voluntary groups and 500 volunteers, with technical advice from University College of Dublin, undertook assessment of needs and launched remedial action.

In the succeeding years, local development groups pursued and eventually acquired large scale EU LEADER funding, matched by Irish government and private sector investment. In Ireland, £13.9 million from the Irish government and additional private sector investments matched £20.8 million in EU funds. £2.88 million of these funds went to LEADER projects in the Ballyhoura region, where they were used for vocational retraining, rural tourism development, IT sector development, SME development, agriculture innovation and diversification, environmental protection, and international knowledge sharing.


6 Ballyhoura Development, Ltd., "LEADER Progress Report," Monitoring Committee, 12/00
Dairygold Co-operative, suggested the cultivation of seed potatoes, for which there was already a local demand, then being met by imports.

Today, Dairygold advises on market demand, output levels, and quality standards. The Department of Agriculture provides quality control and disease testing with Teagasc training farmers. The community and farmers groups have helped coordinate cultivation practices and seed purchasing procedures. Farmers have organized a small co-operative of their own and are planning the purchase of a refrigeration unit.

The Organic College. A highlight of the initiatives is an t-Ionad Glas, which translates to “Organic College” in Gaelic, a newly founded institution in the town of Dromcollogher. Founded in 1991, the College is affiliated with the local community college. Students come from all over Europe to pursue one- or two-year certificates and diploma programs in organic horticulture, organic farming, or organic enterprise. These programs are now recognized by the Irish Organic Farmers and Growers Association and the National Council for Vocational Awards. The College recently began a “Sustainable Development” program focusing on sustainable agricultural projects, debt repayments, bio-patenting, fair trade, agri-business and transnational companies. The College also conducts research on organic crop suitability. Tests, like the one depicted above, have been conducted on organic varieties of garlic, clover, amaranth and quinoa.

A summer program for children ages five to twelve was also set up within the College. The program, “Greenfingers,” filled a need for childcare, but also helped educate children to foster an interest in agriculture and the environment.
Goat Cheese. Other new farm-based enterprises include a new goat cheese facility. Tom Biggane and his family have saved their farm by making cheese themselves rather than selling the milk to a cheese-making facility in Galway. The Biggane family learned that the best markets are gourmet purveyors like Neal’s Yard in England, and that the market preference is for aged cheese. The Bigganes had to plan for the extra time required for cheese making and aging, but the value-added is beginning to pay off. Now in operation for two years, the Bigganes have seen many of their neighbors abandon farming for factory jobs. They are glad to have found a way, with support from LEADER and Ballyhoura Development, to keep their farm viable.

IT

The Glenroe-Ballyorgan and Kildorrery communities were considered to be at the greatest risk locally of losing agriculture sector jobs; Ballyhoura Development calculated that the changing economic and policy context of agriculture would cost 2,500 agriculture jobs. And so when fifteen public and private, non-profit, and commercial entities came together to assess and address Ballyhoura’s IT needs, investments were made in helping residents develop their IT skills in order to pursue non-agricultural economic activities. A number of initiatives are now underway.

- The Irish government’s Training and Employment Authority now provides £45,000 annually for a mobile IT training program called “Computrain,” which has trained 800 residents in 14 communities in basic computer skills since its inception in its first year. Subsequent to that program, participants take 12-hour courses on e-commerce and web site design geared toward SME development in the service sector (e.g., tourism) and manufacturing (e.g., crafts).

- A new centralized computer training facility, specializing in TQM (Total Quality Management), has been established in Dromcollogher.

- The Irish telecom Eircom is installing 500 high-speed telephone lines (a 34Mb asynchronous transfer mode link) in the village of Churchtown in County Cork. This in-kind contribution is estimated to be worth at least £50,000. Initially, 2Mb will support a proposed telemarketing job creation initiative led by the Churchtown Village Renewal Trust and funded by Ballyhoura Development Ltd. The high-speed lines will be available to subscribers who reside within one kilometer of the unit, expected to be in place in the summer of 2001.

- “Virtual call centres” and data processing enterprises are being planned. A virtual call centre is a facility to which major international companies such as Lufthansa and Dell can route their customer service calls. This service to European and international companies can be a good opportunity to outsource services from cities.

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12 http://www.fas.ie/
where wages and cost of living are higher. Such facilities already exist in the urban centers of west central Ireland, but are new to its more remote areas.

### International e-Business

Data processing is an industry that has already begun to thrive because of the Internet. In India for example, there is a large market in medical transcription. Hospitals in the U.S. and elsewhere scan their doctors' hand-written notes and e-mail them abroad in the evening, just as the workday begins in other parts of the world. The notes are transcribed and input electronically, or coded as data, and e-mailed back to the hospital by morning. Parts of Ballyhoura are considering this model as well as a similar model for insurance forms, applications and claims.

Local service agencies are also working to develop new kinds of non-farm employment in the informatics industry even when the jobs do not themselves require technology skills. In September 1999, TRIL (Technological Resources International Limited) Recruitment Agency contacted the Employment Development Officer requesting assistance in recruitment of people to work on temporary contracts with TRIL in Dell Computer Components - Limerick. TRIL offered to supply transport (25 miles from Kilmallock to Limerick) and to pay employees while in transit. The two Development Officers in the Kilmallock office acted immediately, using contacts already established through other initiatives (e.g. Local Authority Housing Estates Survey). Within weeks, 85 people interviewed at the Kilmallock office. Seventy-five people, eight of whom were travelers, were offered six-week contracts with Dell. The direct benefit to the town was estimated at £85,000.

In October, two groups of 25 people were given temporary full-time contracts, while an additional 30 were given part-time contracts with Dell. In association with TRIL, a further 16 were linked to Fullerton & Cook Ireland, Annacotty; Asdium, Ballysimon Road; Banta Global, Turnkey and Dell, Raheen. Given this success, a meeting was organized with the Human Resource Manager in DELL and resulted in the establishment of a social economy business unit in Inclusive Employment Services.  

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Although not everyone can become a computer programmer, Ballyhoura’s experience is that even semi-skilled and unskilled workers may be able to find employment opportunities with IT firms. Many of the Dell jobs referred to above involved very little technology.

**Tourism**

A central tourism marketing organization, Ballyhoura Failte, was established. A website now guides prospective tourists to Ballyhoura’s activities and accommodations (www.ballyhouracountryholidays.com) – hill and cave walking, angling, farm tours, equestrian facilities, golf and other outdoors pursuits, among pristine countryside settings. A formal network of walking paths, often traversing working farms, is continually being expanded.

An Integrated Development Plan was created to set goals co-operatively and to define means to achieve them. Several local and national rural agencies helped to develop materials and provide training. Ballyhoura now has B&Bs, self-catering, hotels, and hostels – many newly-established to meet increasing tourist demand. Local events include the annual Lough Gur Storytelling Festival and the Kilmallock Arts Festival; the latter involves exhibitions, poetry recitals, children's drama, choral recitals and a unique “Limerick Rambling House” event. Eco-tourism and Agri-tourism are clearly areas of growth potential – and Ballyhoura is also very proud of being the birthplace of the maternal ancestors of the Kennedys of U.S. political fame.  

Irish tourism revenue grew at an average rate of 21% from 1995 to 1997 and was expected to continue this trajectory (as of 12/98). During this same period, Ballyhoura (excluding the Limerick City area) tourism revenue increased by 88% to an estimated £4,975,545 in 1998.

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15 U.S. Ambassador to Ireland, Jean Kennedy Smith, and her sister Pat Lawford gave a big boost to community spirit when they returned to their roots in Lough Gur, County Limerick. (Kelleher, Lynne, “Kennedys Tour Ballyhoura,” Irish America, February 28, 1995)

Progress

Ballyhoura still faces many serious challenges to sustained prosperity and stability. Forty percent of the value of net agricultural output is in the form of income transfers (i.e., subsidies), and over a third of farms depend on off-farm income. According to the Ballyhoura Area Integrated Development Plan 2000-2006, drafted in 1999, there are 16,034 disadvantaged people in Ballyhoura Country. (See Table 3.)

Table 3

<table>
<thead>
<tr>
<th>Disadvantaged Cohort</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployed (excluding long-term)</td>
<td>1635</td>
</tr>
<tr>
<td>Long-term unemployed</td>
<td>851</td>
</tr>
<tr>
<td>Travelers (Average 7 x 23 households)</td>
<td>161</td>
</tr>
<tr>
<td>Disabled</td>
<td>1057</td>
</tr>
<tr>
<td>Lone Parents</td>
<td>342</td>
</tr>
<tr>
<td>Other Women (Social Class6/7)</td>
<td>2246</td>
</tr>
<tr>
<td>Farmers at risk of becoming unemployed</td>
<td>2500</td>
</tr>
<tr>
<td>Youth at risk of becoming unemployed</td>
<td>4734</td>
</tr>
<tr>
<td>Elderly on low incomes (Social Class 6/7)</td>
<td>1660</td>
</tr>
<tr>
<td>Parents with poor parenting skills</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17816</strong></td>
</tr>
<tr>
<td>Less 10% allowance for double counting</td>
<td>1782</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16034</strong></td>
</tr>
</tbody>
</table>

Source: Ballyhoura Development, Ltd.

Moreover, Ballyhoura's newly important IT sector faces an uncertain future. Although exports of IT and communications-related goods and services have more than tripled in Ireland since 1990, a plummeting demand for technology has adversely impacted East Asia, and Ireland may suffer too.

However, Ballyhoura has established new revenue generating activities, and the community now possesses the confidence, the tools, and the social infrastructure to continue addressing their needs and enhancing their quality of life.

Lessons from this case

It is noteworthy that this community recognized that structural changes, not incremental changes to existing activities – were necessary for future viability. Furthermore, this community set out to acquire the ideas, skills, technology and information channels to make real changes. Locally driven prospective and strategic planning helped ensure community buy-in and durable results.

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Knowledge transfer saved this traditional and remote agricultural community, without destroying its agrarian community lifestyle.

III. Case Study – Practical Learning in Valle de Jerte LEADER area (Extremadura, Spain)\(^\text{20}\)

**Introduction**

El Valle de Jerte is an example of an agricultural community that continues to adapt technology and other aspects of the knowledge economy to keep its agriculture sector competitive and its sources of rural income diversified. Although Valle de Jerte’s agriculture is dominated by cherries, new varieties have been developed, and new value-adding activities such as processing are being undertaken. Meanwhile Valle de Jerte’s tourism industry has virtually been built from scratch in recent years and is now a significant source of local income.

**Background**

The Extremadura region lies landlocked in central Spain, sharing its western border with Portugal. The Jerte Valley is located in the northeast corner of Extremadura and is characterized by the steep slopes of the Gredos Mountains surrounding its fertile valley. This region suffered after 1950, as did most rural areas in Spain, from abandonment and migration to the cities. In these rural regions of Spain, the agricultural workforce declined by 2.5 million from 1960-1975.\(^\text{21}\)

**The Initiative**

Since the mid-1980s rural areas in Spain have begun a process of stabilization and recovery. This process has included improvements in infrastructure, social services, and economic diversification. Diversification of the economy has led to a general decline in the importance of agriculture across rural Spain (see Table 2) while other sectors have grown, such as construction, services, and tourism.

**Agriculture**

The importance of agriculture never waned within the Jerte Valley, which is famous for its cherry production. Eighty percent of the Valley’s population is dependent upon cherry production, and 3,500 family farms produce an output of 16,000 tons of cherries annually.\(^\text{22}\) The Valley consists of 16 cherry-producing villages, each with its own

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\(^{20}\) Farrell, Gilda, Samuel Thirion, LEADER II: Research, Transfer, and Acquisition of Knowledge in aid of Rural development, Feb. 2001.


farming cooperative. A rise in competition within the cherry industry has led farmers of the Jerte Valley to consider how to reinforce their market share.

Map 2

The Jerte Valley formed a coalition of its 16 cherry-growing cooperatives, called the "Agrupacion de Cooperativas," to raise the quality and volume of the Valley's cherry production. The organization has been operational since 1992 and is the main partner of the Jerte Valley LEADER group. In 1991 the European Commission approved funding up to 147 million Ecus for an operational program to consolidate research, technology, and innovation in Spain. Extremadura qualified for this support.

LEADER played a key role in the modernization of the cherry industry in the Jerte Valley, supplying technological advances at every stage of production—development of new products, processing of fresh fruit by-products, new preservation techniques, and new marketing strategies. Furthermore, LEADER made itself an "interface" between cherry producers and the market. In post-production, LEADER offered advice on marketing techniques and how to expand into international markets. Marketing has

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undergone tremendous growth since then. The cherry industry’s budget for advertising rose from 70 million pesetas in 1999 to 120 million in 2000.25

Production numbers have also climbed in recent years. The 2000 cherry season produced a record 24 million kilos of cherries. Exports have increased as well with 30 to 40 percent of these crops going to international markets, principally in Germany and the United Kingdom.26 In Spain generally, agricultural output increased by 14% between 1991 and 1997, while employment in agriculture fell as markedly (see Figure 1 and Table 2).

LEADER has also promoted the export of the native picota cherry and provided training activities for cherry producers, working on fresh fruit selection, variety diversification, and rationalization of production. LEADER has introduced new technology based on air and humidity (rather than on temperature alone) in order to improve the staggering of production, enabling farmers to keep fruit for a month as opposed to the standard week. Additionally, LEADER has established new nursery laboratories where grafts yield new varieties of cherry trees.

In order to diversify its product, the Agrupacion de Cooperativas began to market processed foods in addition to the harvesting of fresh fruits. Research suggested that a good market existed for brandies. As a result, the Valley began to manufacture high-quality kirsch, a cherry brandy, in addition to other varieties such as plum, blackberry, strawberry, and raspberry, all marketed under the label “El Valle del Jerte.” The Agrupacion de Cooperativas is now considered the foremost distillery in Spain that produces brandies and liquors from fruit.27 The Agrupacion employs an old-fashioned fermentation process without using additives. LEADER assisted this innovation by financing sophisticated computerized quality-control equipment.28

The results of the diversification of the economy are evident. In 2001, even as torrential rains destroyed nearly 50% of the year’s cherry crop, analysts remarked that, “The fall of their sales will be somewhat softened by the diversification that the Association of Cooperatives of the Valley has experimented with in recent years.”29 Today, cherries still account for about two-thirds of the region’s economic activity.

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26 Ibid.
The surge in the economy has produced some uneven results, however, as land is being re-valued. Family businesses have been variably affected, as values for their lands have been starkly disparate. “Six-thousand meter plots of land for cultivation of cherries can cost anywhere from 600,000 pesetas to 13 million pesetas, depending on location, the quality of the river beds, and the state of the cherry trees.”

In a recent report, the Spanish agricultural economist J. M. Sumpsi objected to the “agriculturalist” vision for rural development in Spain. Instead of reinforcing agriculture, the report argues, resources would be better spent on a more general rural vision. The critique was based on the argument that agriculture is unlikely to create employment – instead, agricultural advances will displace labor, and will simply increase production rather than diversifying it, in a vain effort to outpace falling commodity prices.

But the LEADER paradigm is different from the type of effort Sumpsi criticizes. It is based on innovation and the development of alternatives. In the cases where LEADER funds are being used for agriculture, these projects tend to involve variety development, marketing, or alternative techniques such as organic or integrated farming methods. The emphasis is on transforming backward, subsidy-dependent farms into ones that minimize environmental impact while creating sustainable employment and economic activity.

Moreover, it must be recalled that funding for agriculture is also the major theme of the recently-released 2001 UNDP Human Development Report: technology is not just for advanced economies. In the words of the report, “Technology can be a tool for – not just a reward of – development.” Some are hopeful that biotechnology and information technology can bring about a second “green revolution.” New genetic plant breeding techniques may be able to generate higher yields, making traditional crops drought, pest, and disease resistant.

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30 Ibid.
31 Tait, Joyce, Scottish University Policy Research and Advice Network, University of Edinburgh, undated, www.ed.ac.uk/rcss/supra. This box is also based on conversations with staff at Scottish National Heritage.
34 Ibid.
35 Many have a critical view of the green revolution in India, where, critics say, new biotechnology stripped the soil of nutrients, and created a dependence on biotechnology, expensive and copious inputs, and labor displacing and expensive imported machinery.
Tourism

The Jerte Valley has capitalized on the increasingly popular notion of “rural tourism.” Until the 1990s, Spanish tourism had been based principally around the country’s beaches and coastlines. But today, rural tourists seek tranquil vacations, enjoying the landscapes and traditions of country towns. “What these tourists are seeking is nature,” explained Eduardo Alvarado, councilor of the Public Works and Tourism Office of Extremadura. For the Valley, the interest in rural life, as well as the business it draws, has inspired a kind of renaissance of traditional village life and culture.

The tourism industry in Extremadura was given a boost in development by LEADER initiatives in the early 1990s. Today, the Junta de Extremadura, or Extremadura Group, oversees tourism projects.

The most common tourist enterprise is a “casa rural.” Usually located on working farms, and constructed from a renovated farmhouse or plantation home, these are comfortable, yet rustic, quarters for travelers. The Hospederia Valle del Jerte is typical: a neglected farmhouse was completely restored into a state-of-the-art hotel in 1999. But an intimate environment is highly valued; this hotel has 25 bedrooms yet tries to maintain a cozy domestic atmosphere. There are 118 listings for rural houses alone on the Extremadura Tourism homepage for the Cáceres region of Extremadura.

The Junta de Extremadura offers support and training for the establishment of rural houses, from the restoration of old structures to the more technical details of running a business. Furthermore the Junta monitors the process with guides for managers of rural houses and support on the subject of development.

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38 Turismo de Extremadura. http://www.turismoextremadura.com
39 Ibid.
There are several comprehensive websites on tourism in Extremadura. Perhaps the most complete comes from the Council of Tourism, which publishes guides to rural cuisine and can even create a virtual holiday on its site. The Tourism Office of the Jerte Valley has its own website as well, listing dozens of hiking trails, biking trails, horse trails, fishing spots, and other sites to see such as the local distilleries and cherry orchards.

Among the greatest attractions of the Jerte Valley are the hiking trails that wind through the Gredos Mountains. One of the most popular trails is the Carlos Quinto Trail, named after Emperor Charles V, who followed this trail through Extremadura when he decided to retire there in 1556.

The most famous attraction of the Jerte Valley is the Fiesta Cereza en Flor, the Cherry Blossom Festival, which takes place each year from the end of March through the beginning of April, hosted by a different town each year. In 2000, it was hosted by Rebollar, a village of only 253 residents that is situated among the “balconies of the Valley,” the terraced slopes used for cherry orchards. The festival is organized by the Municipal Administration of the Jerte Valley, which announces the opening of the cherry season and decides which town will host the festival.

The blossoming of the cherry trees, which lasts twelve to fourteen days, serves as a symbol of the region’s principal economic activity. The festival was founded in 1973 in an effort to unify the towns of the region. A number of events take place during the festival, among them the sampling of brandies and liquors from the region, an exposition of products, and varied folk art performances. The Cherry Blossom Festival attracted more than 15,000 people in 2001. The town of Navaconcejo hosted the event. Many people consider the “white spectacle” of the cherry trees in bloom unforgettable.

In 2000 a total of 2 million tourists visited Extremadura, earning profits of Euro 210 million for the region. Growth continues every year, and the region is attracting more international travelers than ever. In 2000, only 60% of visitors were Spanish.

Still, it must be noted that the Spanish agricultural economist Sumpsi (quoted above) has also expressed reservations about tourism, the most popular agriculture alternative supported by LEADER. He cites an “exhaustion of innovative rural development

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43 Ibid.
initiatives” in Spain. Sumpsi remarks, “New ideas are needed.” And indeed, although Extremadura does not yet show signs of having reached its capacity, other near-by regions like Navarra may have done so.

Lessons from this case

First, traditional crops can be sustained if complemented by value-adding processing.

Second, although tourism can be a welcome alternative to intensive agriculture, tourism can approach a threshold as well. Once a certain “tourist saturation” is reached, the value of a tourist experience diminishes and natural resources become jeopardized.

IV. Case Study - Technology and Truffle Cultivation in Umbria (Italy)

Introduction

Umbria stands out as an example of what niche market agriculture can become. Producing exotic, rare, and expensive goods – such as Umbria’s truffles – need not require an old-fashioned cottage industry. In fact, as the preeminent producer, Urbani, shows that a small niche in the international marketplace can be big business for a small town or rural region. Market conditions may eventually evolve, and at that point truffle producers like Urbani will also need to adapt. However, truffle production has been a stable economic engine for the region for years, and the industry’s future looks bright.

Background

Located in central Italy, approximately 900,000 people inhabit the region of Umbria. With a density of 95 inhabitants per square kilometer, Umbria is one of the least populated regions in the entire peninsula. The population is concentrated in the large urban centers, Perugia and Terni, and in the central plain and hillside areas, where 83% of the inhabitants live. The remaining 17% occupy the mountainous areas.

The truffle is a staple of Umbria’s regional economy. About 80% of all the truffles produced nationally are processed, packaged and marketed in Umbria. Since truffles are seasonal, they are rare, and command commensurately high prices; this past year fresh white truffles were $80 per ounce in the U.S. The prized white truffles, rarest of all, are found mostly in the Piemonte region of Northwestern Italy. The truffle industry contributes LIT 20 billion to the Italian economy annually.

47 www.urbani.com
48 Umbria Agriforeste, “Umbria-where the pleasure of eating is an art,” http://www.regione.umbria.it/agriforeste/eat8.htm
Urbani, the world’s largest supplier of both white and black truffles, is headquartered in
the foothills of the Apennines in the town of Valnerina. Established in 1887, Urbani
enjoys high demand and premium prices for its truffles internationally. Valnerina has a
population of 15,000 and is considered the agricultural heart of Italy. In addition to
truffle production, 25% of the working population raises cattle, sheep, and pigs.49

The Initiative

Agriculture

Calculating that even as exports increase, there is little likelihood of creating a glut,
Urbani has kept profits high by developing innovative production biotechnologies and by
marketing its technology in addition to its truffles. Urbani has the economies of scale
necessary to conduct its own R&D, but the EU and Umbria regional government also
supports the industry and has been helpful in making the link to rural tourism and local
environmental priorities like forest conservation.50

49 AEIDL, “Agri-tourist cooperation between Valnerina (Italy) and Drôme provençale (France): The
50 The project The EU project, “Eurotuber,” supports truffle production in Spain, Italy and France. But
tensions arose within this partnership regarding the relative merits of wild and cultivated truffles. The
group resolved to concentrate on quality standards and labeling to protect the European market, and
officialization to counter the black market. (Transnational Cooperation in LEADER II, LEADER European
Urbani exports an average of 100 tons of truffles per year and ships them all over the world. White truffles can fetch up to US$2,000 per pound. Urbani just added a state-of-the-art 25,000 square foot factory. They own Tartufitalia, a company that produces truffle products, and Agriculture, a 1,500 hectare farm that produces mycological truffle plants.

Urbani also engages in research at The Agricultural and Food Technology Center, formed in conjunction with the Umbrian Region. One company, Rival, undertakes advanced research of taste and aroma, and development of the truffle products. Another, I.T.C., undertakes research on new methods of truffle cultivation, as increased demand for truffles has prompted efforts to domesticate truffles.

Today, trees are bio-chemically altered to generate truffles. The roots of young oak, willow and nut trees nurtured in greenhouses are “inoculated with the spores of white and black truffles,” and their roots are then bathed in a solution of spores. The plantations are intensively managed with weeding and tree pruning. Urbani sells 30,000-40,000 “truffle trees” every year to international clients. One client in Texas purchased 65,000 truffle trees and hopes to eventually produce 3,000 kilos annually.

Another high-tech development worth noting is a Geiger-counter-like “truffle detector” developed in Toulouse, although the machine is still going through prototype tests and the overall response to this technology has not been overwhelming.

The truffles develop underground, along the tree root systems. And they must be carefully scavenged, often from several inches below the surface. Traditionally, truffle hunters, who call themselves “excavators,” are secretive, working by night or in the dark mists of winter dawns, when no one can follow them. Dogs, called truffle hounds, have become more common than pigs for truffle hunting, largely because they are less likely to eat the truffles they find.

Most individual truffle excavators still pursue their vocation with traditional means. For them, domestic plantations threaten to turn self-employment into tedious factory work. But Urbani’s plantations are not that productive yet, and so in Urbani factories, workers process the bounty from the 7,000 truffle hunters Urbani has under contract.

But there also ways in which Urbani supports traditional truffle growers and Umbria as a whole. First, Urbani provides much-needed jobs for rural people. Second, traditional growers benefit from the past and future advances in processing, packaging, and shipping technology, which give truffles a longer post-harvest life. Many locals purchase “truffle trees” as starters for their own enterprises. Finally, truffle production is an incentive for environmental protection – deforestation is a direct threat to truffle habitat, and even commercially reforested areas are often not as conducive to truffles as old growth forests. While natural forests and traditional tree planting encourage truffle growth, fast-growing poplar trees, for example, cultivated as a cash crop for making paper, do not. In light of

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52 According to Dr. Sandro Silveri, Director of Production, Agricoltura Urbani.
these considerations, the regional government of Piemonte recently offered landowners a subsidy to protect their forested land during truffle season as a way of increasing truffle territory.\textsuperscript{53}

\textit{Tourism}

The project “The Truffle and Flavor Road” is an agri-tourist cooperation between Valnerina (Umbria, Italy) and Drôme provençale (France). Designed to boost truffle cultivation and tourism, it was financed in December 1993. Results of this two-year project include a joint publication of an agri-tourist guide of itineraries and catalogue of farm vacations, and community-wide training for tourist services.\textsuperscript{54}

\textit{Lessons from this case}

First, knowledge transfer can be entirely market-led. Urbani was not a EU initiative, and subsidies are minimal.

Second, knowledge transfer can bring changes in the quality of labor, which must be addressed. If Urbani does not voluntarily limit its factory farming, traditional gatherers may make themselves obstacles to production.

Third, it is critical to pick the right niche market. Truffles seem to be a perfect choice, where the “tip-of-the-iceberg” status of the marketplace makes the possibility of overproduction seem unlikely.

Finally, creatively exploiting symbiotic relationships such as that between truffles and the forest has potential for ensuring long-term sustainability.

V. Case Study - The \textit{Gossym-Comax} Cotton Growth Model in Mississippi (United States)

\textit{Background}

Mississippi is one of the most important cotton-producing American states. In 2000, an estimated 1.3 million acres were planted, and 1.73 million bales of cotton generated US$518 million. Cotton is the third largest agricultural subsector in Mississippi, after poultry/eggs and forestry.\textsuperscript{55}

\textsuperscript{53} According to Harold Letizi, Dept. of Energetics, University of Ancona, Italy, June, 2001

\textsuperscript{54} Transnational Cooperation, Case Study: “Agri-tourist cooperation between Valnerina (Italy) and Drôme provençale (France): The Truffle and Flavour Road”. http://www.nural-europe.acidl.be/rural-en/coop/truffle.htm

\textsuperscript{55} USDA Agricultural Statistics and Mississippi Cooperative Extension Service. http://www.mdac.state.ms.us/Library/Misc/AgAtAGlance.html
Today, falling commodity prices and a decline in worldwide demand are having a significant impact on farmers in the Delta. In response, some farmers are consolidating farms and adopting new technologies to increase yields, while many smaller cotton farmers have moved to alternative crops or given up cotton growing entirely. In June 2001, Congress granted $5.5 billion to cotton farmers to compensate for low commodity prices.

The Initiative

The Mississippi State University Extension Services sought to bring their resources to bear to provide innovative assistance. MSU's sophisticated Gossym-Comax model should have met cotton farmers' needs, but it ultimately failed. This example of failed knowledge transfer highlights critical factors that help determine success or failure.

The need for optimization partially drove the adoption of the Gossym-Comax model as an experiment in computer-driven cotton growth modeling. In the early 1970s, Dr. Don Baker, an USDA scientist, was stationed at the MSU extension services and began working on growth modeling. With the contributions of hundreds of students and other scientists, the program grew to become the sophisticated Gossym-Comax model.56

Gossym-Comax is a cotton production model that pinpoints optimal cotton growth conditions by analyzing weather, soil, and plant management practices, including fertilizer and irrigation strategies. Model data input requirements include soil moisture and bulk density for each soil horizon, and weather data (including temperature, wind speed, solar radiation, and humidity). Model output includes plant height, water stress, nitrogen stress, and soil temperature and soil water potential. The model operates on daily time steps and calculates material balances for water and nitrogen.

In 1986, Andy Jordan of the National Cotton Council (a former agricultural engineer at Clemson University, who knew about these modeling efforts) encouraged the MSU scientists to try out the model on actual farms and got industrial support to finance it. Cotton Extension Specialists selected farmers individually, looking for farmers who were efficient, interested in innovating, and willing to take a risk. After the program got some media coverage, growers began approaching MSU.

There was more interest among larger landholders. There were fee-based training classes lead by MSU, but the actual program and purchase of weather stations were subsidized by companies such as John Deere. After 5 years, the USDA Extension Service made it a national program. In 1989, Congress authorized an annual budget of $500,000 for the establishment of the Gossym-Comax Information Unit in Starkville, Mississippi to distribute the Gossym-Comax system to growers and train them in its use.

56 According to Prof. Frank Whisler, Department of Plant and Soil Sciences, Mississippi State University
The model, the result of years of research and public funding, was proven to be able to inform input decisions, helping maximize yield and minimize environmental and financial costs.\textsuperscript{57}

However, the model failed in implementation. At its peak in 1990, only about 100 cotton farmers (approximately 500,000 acres) had adopted the system. The accepted explanation for the system's unpopularity is that the data entry is tedious and complicated, and that the interface is not intuitive. Adding to this problem, users were spread out across the Cotton Belt and beyond the Mississippi Delta. When national authorities started overseeing program implementation, Whisler explained, local scientists and developers lost touch with the farmers themselves.

Finally, when federal funding was removed, a plan for commercial marketing of the software failed. Farmers were not prepared to pay the annual $4,000 - $6,000 fee. As long as the subsidy persisted and the software was free, farmers continued using it. But when Congress stepped down funding, use declined accordingly.

Dan Krieg, Leidigh Professor of Crop Physiology at Texas A&M, estimates that today only 25-50 producers are still using the model on about 50,000-100,000 acres. Although there have been several more attempts to introduce an adequate software program for cotton growth, there is no model being extensively used today. The most important recent development in agriculture modeling programs has been very detailed and precise weather stations, referred to as DD60, which employ a heat monitoring system that is able to monitor single-crop growth and optimize insecticide use. The MSU Extension Service is helping cotton farmers by providing detailed weather data based on this system.

In the case of \textit{Gossym-Comax}, "knowledge transfer" failed. Many pieces were in place: political will, funding, innovative thinking, university commitment, and unambiguous laboratory results. But these achievements were squandered because the model was not practical for its target population.

\textbf{Lessons from this case}

At least three important lessons emerge from this case:

First, implementation must be as methodically engineered as the project's core elements. Marketing, outreach, meaningful community involvement from the start, benchmark and subsequent regular monitoring and evaluation, effective media relations, and appropriate staffing are just some of the determinants of successful implementation. \textit{Gossym-Comax} was missing several of these.

Second, knowledge transfer is often a bridge between basic and applied research. In the case of \textit{Gossym-Comax}, it seems that the bridge may not have been there. As much as in the physical sciences, applied research is needed in the social sciences. The developers

\textsuperscript{57} Ibid.
of *Gossym-Comax* may have been so focused on the mathematical soundness of the model, that too little attention was paid to more applied research on the end-user: behavioral factors, computer literacy among farmers, expressed interest in (technology-based) productivity enhancements, and other socio-economic factors.

Third, one may ask whether, if *Gossym-Comax* had succeeded in implementation, it might have exacerbated overproduction and low commodity price problems for farmers. Farmers need alternative kinds of agriculture and viable rural alternatives to agriculture. *Gossym-Comax*, although sophisticated, did not encourage these.

**VII. Conclusion**

The changes taking place in the context of the knowledge economy are as profound as they are varied. Agriculture and rural development have become a crucible where vanishing subsidies, free trade, technology, and traditional lifestyles come together.

Our four case studies represented a variety of approaches to development in the context of the knowledge economy. Not all have led to sustainable quality of life and economic growth.

The following seem to be critical factors:

- Technology and knowledge-driven industries considered for adoption should be commensurate with the local level of development.

- Technology and services should be used to (a) add value to existing agricultural products; (b) establish higher-value agricultural alternatives, or (c) establish non-agricultural alternatives.

- Planning for expansion of technology- or knowledge-based activities should be sensitive to effects on the environment, the quality of work, and other aspects of the quality of life.
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