

Agricultural laborers and technological innovation (TI): a case study of horticultural production in Sinaloa, Mexico

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Abstract

This article details a case study of agricultural laborers and the TI effects on their working conditions and the labor process. By way of introduction, there is first a theoretical discussion, seeking new approaches to this issue, and an overview of the Mexican labor market. The case study consists in a survey carried out in 2001 in the state of Sinaloa in Mexico, of 142 non-qualified workers employed in horticulture production, one of the most competitive and well-organized exporting agricultural sectors in Mexico. TI operates at the most modern levels in this market sector and is used by business as a strategic part of the production process.

Introduction

This paper investigates the complex social network present in the generation and application of TI to intensive agriculture and its relation to the labor market, focusing also on its operation in respect of the working conditions of agricultural laborers and their perceptions of TI. To begin with there is a brief theoretical assessment of the existing literature on the subject, with the classical proposals of flexibilization and segmentation, and alternative approaches to an understanding the new employment and labor conditions in contemporary agriculture, such as Long's (2001) agency, Callon's (1995), Latour's (1987) and Elzen's (1996) social networks, Ruivenkamp's (2005) bio-power, and Feenberg's (2005) operational autonomy. It is not a coincidence that this paper reports a case study of horticultural production in the state of Sinaloa, Mexico, where TI combines with the notorious presence of migrant laborers employed for unskilled work.

This theoretical assessment is followed by a brief characterization of the employment situation and agricultural labor market in Mexico, contextualizing the horticultural laborer and production situation, at both national and

which a range of occupations is defined. The secondary market is less developed, with an incipient social labor division and each laborer employed in several activities.

There are interesting analyses that reflect on the situation of the researcher and the researched as a relation of power, in which the laborers show a certain capacity to exercise it and elaborate an ironic interpretation of their situation. Latent ethnocentricity on the part of the researcher when approaching workers can bias the information obtained, which 'calls into question the utilization of the research data and the ideal models as sustainers of power' (Torres, 1997, p.31).

In his study in Autlán, Mexico, Torres comments on how easy it is to see the huge differences in living conditions between workers and bosses, with the campsites where the former live being precarious and in bad condition. He emphasizes, however, that laborer situations are not static, but flexible and spontaneous. This leads him to conclude that 'it is more useful to analyze what the laborers do and to see how they attribute different meanings to their lives, than to propose abstract models' (Torres, 1997, p.35). These proposals are based on the notion of 'agency' introduced by Long (2001), the capacity of the social actor to have an effect on his own destiny. Torres acknowledges also the stigmatization and characterization with which these laborers are regarded. Seefoó (2005) utilizes a similar approach for his analysis of the risk situation produced by pesticides in strawberry production laborers in Zamora.

Regarding TI, Mexican enterprise agriculture is seen by Lara and Carton de Grammont (2000, p.127) as going through a productive reshaping in which new technologies are playing a fundamental role. This reshaping 'does not follow a single path, but combines a variety of methods of production and labor organization' (2000, p.130). Business strategies, mainly in the exporting sector, are extremely versatile and adjust to local conditions. The introduction of new technologies and new ways of organizing labor affects the situation of the rural labor market.

Concerning rural laborers and new business strategies, there is a contradiction between flexibility, understood as easily substitutable and movable labor force, given its qualifications, and the segmentation of labor, which serves to prevent mobility. Neither workers nor labor positions are easily interchangeable, and some groups are systematically excluded and condemned to unemployment or to the occupation of precarious jobs. Segmentation is the structured result of the solution to labor force problems, driven by the interests and conditions of companies, for which these can opt to create internal labor markets. In Mexican horticulture, this means that

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depends on the set of conditions that either put obstacles or facilitate the unfolding of translations' (González, 2004, p.52). In the case of agricultural labor in Mexico, the absence of a written contract, which results in uncertainty and a lack of guarantees for the laborer, combines with the laborer situation in respect of race, language, and formal education, which result in economic and social weakness, could also be a cause for low productivity and inefficient use of TI. In spite of this, evidence in the case study suggests translation, as companies succeed in remaining competitive through the use of TI and cheap labor.

I will approach the study of the agricultural labor market and TI considering both the micro level of horticultural production in Sinaloa and a brief overview of the macro context of employment. The interconnections of the actor-network with the generating actors and disseminators of TI are also considered, in an attempt to identify some of the translations made for the achievement of employment and TI use, based on the perceptions of interviewed worker. This will follow Callon (1995, p.59) on the irreversibility of network development, which combines with network enlargement and variety to comprise the three concepts with which the author proposes to describe the tension between local action and global change.

I take into account the criticism made of the actor-network when it is thought of in isolation from its socio-historical context. Farshad and McMichael (2000, p.18) have dealt with this issue, reprising Law, in that social agency is never localized in isolated individuals, an actor being rather 'a modeled network of heterogeneous relations' (González, 2004, p.56). Hughes' multidisciplinary orientation and socio-technical systems, referred by Bowden (1995, p.76), explicitly distinguishes among various entities (or social actors). In the present case these would be: waged laborers, horticultural enterprise producers and their families, researchers of multinational enterprises that produce seeds and inputs, research institutions, buyers and consumers in the USA and Mexico.

Hughes himself (2005), when analysing the repercussions of recent genomic developments in society, suggests that the discourse on DNA has been constituted in the centre of a system whose main objective is commercial ambition and which only serves to reinforce the tendency to deify. The discourse under which the new genomics, fundamental to agricultural genetic engineering, has been presented has thus itself been constituted as an exercise of the new bio-power (Ruivenkamp, 2005, p.14). In the present case, this kind of discourse is present in the way TI is sold and used in Sinaloan enterprise horticulture.

Elzen et al (1995) suggest that the redirection of technology, from high-tech to low-tech, has benefited waged agricultural workers in Mexico. This is a hypothesis that needs to be tested. Its such a consideration

Hypothesis: In the present case, the hypothesis will be that

- Biopower, as a form of power, is a result of the actions of biological firms, is produced by the desired control of their conditions of production. The situation of workers is closely related to the technology used. The technology is designed to facilitate production processes.
- Economic and social agency, language, poverty, and education - are related to the agency and the technology used.
- Translation - network development, enlargement and variety in horticultural companies is a result of the need for a sufficient number of workers. The employer individualizes the workforce to produce more jobs, an ambitious goal.

Following the work of Callon and Latour (1993) and Long (2001), this section provides a brief description of the

Employment, migration, semiproletarianization

The current situation in Mexico has resulted in the creation of a new sector. It has been observed that the rural sector has been decreasing since the 1990s.

¹ The Social Security Institute (IMSS) is a public institution, although in the country

are incorporated to the economically active population. Job creation levels are not enough for this supply, with, for example, just 628 773 jobs created in the formal sector between January and September of 2001, according to IMSS reports.

Banamex-Accival² reports that the reduction in the creation of jobs is sharpest in the manufacturing sector, mainly in the transformation - and (foreign-financed, *maquiladora*³) assembly industries, and less so in commercial establishments, where it is not clear whether there has been a deceleration (González, 2001, p.15). These manufacturing jobs are badly paid, with wages at between 30 and 45 USD per week for over 90 working hours, few social benefits and no possibility of improving labor conditions through trade unions (Martínez, 2001, p.10). Of the 40.7 million people employed in the country, 17.7% are in the primary sector, 24.9% in the secondary and 57.4% in the tertiary (with 0.4% unspecified). At least 70% of the total working population receives an income that amounts to less than 450 USD per month (the legal minimum is just 150 USD monthly), with some workers not even getting paid at all and 63% working without benefits (Márquez, 2003, p.30).

While it may be the case that the income figures are genuinely low, it is also true that they are exacerbated by the measurement system for employment. Official statistics in Mexico assume a person to be employed if he or she has worked just two hours or more in the week prior to survey. This also means that unemployment is probably significantly higher than that officially reported. The figure for the open rate of unemployment (ORU) currently stands at around 4.35% of the economically active population. Concerning age, the group that finds it hardest to gain employment is that of the youth. The unemployment rate among 12 - 19 year-olds is about 10.8% (11.9% female and 10.2% male),⁴ while that for the group aged between 20 and 24 reaches 8.6% (10.4% female and 7.4% male) (Pescador, 2004, p.30).

Low wages have been a constant in Mexico over the last decades and recently the problem has worsened: in 2000, nine out of ten Mexicans received less than 750 USD monthly, with the lowest wages received by peasants, builders and retail industry workers, which amounts to a little over than 16 and a half million people. 87% of peasants have an income that allows only for

² Mexico's largest bank, now part of City Bank

³ *Maquiladora* refers to exports foreign-based manufacturing industry, to companies that outsource labor intensive production processes to Mexico. Employment in *maquiladora* operations is not only low waged and unstable, but also the area of greatest growth in recent years.

⁴ *Although in official statistics people of 18 years and older can be counted as economic active, in practice economic activity starts at early age, 12 year and older.*

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ment option for rural laborers. There are both pendular migrations (from the place of origin to the crop-growing area and back), and permanent migrations. These latter have been facilitated by technological innovations that result in a year-round demand for labor in several regions. The increase in the use of hydroponia and greenhouses has allowed tomato harvesting periodically through the year making the old seasonal contingencies redundant (Barrón, 2000, p.162). It is in these cases and in flower production where the labor force used is mainly constituted by women (Barrón, 1999; Lara, 1998; Massieu, 1997). Urban-to-rural migration is a new phenomenon, which for workers of rural extraction implies competition where before there was none (Kay, 2000, p.131). International migration is very important, mainly to USA and recently to Canada.

Agricultural labor specifics

There are two main groups of products in Mexican agriculture, which have different labor force requirements: basic crops and horticulture. The labor requirements for each kind of farming are different: maize, for example, requires 30.1 days per hectare, while tomatoes need 120. It has been estimated that grains absorb 65.9% of the harvested surface and 50.5% of the total number of laboured days; fruits and vegetables, however, absorb just 8.2% of the harvested surface, and 20.3% of the total number of laboured days (Zuloaga et al, 1994). The labor force demand for agricultural activities depends on variables such as the agricultural surface, type of the crop (basic or horticultural), intensity of soil use of (number of harvestings) and technology employed.

In Mexico the rural population that requires additional earnings to those offered by the planted plot, or that is completely dependent on the earnings from its waged employment, comprises approximately 4.5 to 5 million people. Horticultural production absorbs only a limited proportion of these, since, although an intensive activity in terms of labor force, it only uses 3% of the cultivable surface (Santiago-Ruvalcaba, 1995, p.140).

The difficulty of measuring the number of agricultural laborers is shown by the variation of their number according to the source: in a study by Barrón (1996, p.275), which compares the data provided by the Population Census of 1990 to those provided by the Employment National Survey (ENS) of 1991, a difference of 2.8 million people is found, which represents over half of the lower (census) figure, and a third of the higher (ENS) figure. The census reg-

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few years just 17 families have been in control of 55% of the best land, hiring the larger number of laborers and concentrating income, which, in 1997, reached 360 million USD. Among these families, the Bátiz, the Canelos, the Carrillo, the Demerutis, the Tarriba, the Bon and the Andrade stand out (Guerra, 1998, p.24). Sinaloa is the leading producer in the country of vegetables for export, mainly tomatoes to the USA. Because of this, export vegetable production is also the most important generator of employment: 'In optimal conditions, horticulture in Sinaloa employs, for the production of vegetables between September and April, from 200,000 to 300,000 agricultural laborers on an irrigation surface of up to 70,000 hectares.' (Guerra, 1998, p.23). The Culiacán Valley is the area that boasts the highest horticultural production in the state, and also the greater concentration of agricultural day workers, between 100,000 and 180,000, whose main labors are to seed, plant, harvest, weed, pack and fumigate tomatoes, chilies, cucumbers, egg plants and pumpkins. Mexico, although one of the main countries of export tomato production in the world, has lost some of its competitiveness as a producer over the last few years, falling from 2.6% of the world export vegetable production by value in 1995 to 1.86% in 2004. As a tomato exporting country, Mexico has remained stable with 20.8% of the world exports in 1995 and 20.5% in 2003 (Martínez, 2005, pp.38, 49). Sinaloa remains the main national producer of tomatoes, despite having lost some ground, with 58.6% of the total national production in 1989 and 36.6% in 2003, when there was a decrease in the national production from 1,592,728 tons to 1,336,496 respectively (Martínez, 2005, p.60).

From its origins, Sinaloan horticulture has been aimed at exportation. The first enterprises appeared at the beginning of the twentieth century, when Sinaloa was better connected to the USA than to the rest of the country (C. De Grammont, 1990). As the state had a low population a labor force scarcity developed, and in the 40s some enterprises began to stimulate migration from the southern states, mainly Oaxaca and Guerrero. The first poor peasant indigenous laborers began to work in Sinaloan horticulture in the harvest period (November to March, approximately), a migration that has continued for decades until now.

Horticulture production profitability rests, more than anything else, on cheap labor. Similarly to the situation in flower production, the latest technological innovation (greenhouse environments, tissue culture laboratories, hydroponia and fertilization-irrigation), which involves high investment, is compensated for by the low proportion in costs represented by wages. The

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with producers in Florida, the main competitors for Sinaloans in the USA. American producers made an important technological leap during the 80's by incorporating systems that use plastic padding (plasticulture), along with the use of gas to ripen green tomatoes and an expansion of greenhouse production. The largest innovation was the introduction of green-ripe tomatoes, which managed to displace Mexican tomatoes with their better taste but shorter shelf life.

During that decade, technological changes in Sinaloa were slow. Although some new techniques were introduced, such as lasers to level terrain, and machinery to semi-mechanize the harvest, the results were poor and costs high, and technology did not transform radically. In the sapling producing greenhouses things continued much the same, despite more widespread automated irrigation and an increased importation of substrates from Canada. In packaging, the chains of selection were modernized with the introduction of more efficient machines and the use of gas for harvesting green tomatoes, technique that improved commercialization conditions, but not production ones.

Floridian producers acquired indubitable competitive advantages over the Sinaloans during this period, as a result of which Sinaloan enterprises were obliged restructure in the 90's. The main change was the introduction of the plasticulture cultivating system, accompanied by a system of fertilization-irrigation. The plastic padding decreases undergrowth, preserves humidity (saves up to 300% water), loosens the soil and has a disinfectant effect, since it protects the plant from parasites and allows an optimum nutrient use. Its application was initiated in the years 1985-1988, during which the plasticulture production surface area grew from 500 to 3,600 hectares. It is now used by all the big enterprises, combined with a drip irrigation system that allows simultaneous irrigation and fertilization. Another innovative element is soil handling with laser leveling systems.

Another big technological change is related to the varieties that are cultivated. In recent years, producers have adopted varieties that have a long shelf life. The Flvr Svr tomato, from Calgene, which was the only transgenic crop to be commercially authorized in Mexico in 1995, was cultivated in Sinaloa, but didn't have the commercial success expected in the US market (Massieu, 1996, pp.36-41). A new variety of 'round-red' tomato with a long shelf life, the *divine-ripe*, obtained by conventional improvement, adapted much better to the agro-ecological characteristics of Mexico's northwest and allowed Sinaloan producers to recover in the US market during the 1994 - 1996 peri-

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Culiacán municipalities in 2001 are presented here.¹² 142 day laborers were interviewed, 60 from the Culiacán Valley and 82 from the Guasave municipality.¹³

Laborers surveyed at the Guasave and Culiacán camps originate mainly from Guerrero and Oaxaca (southern states with indigenous populations) and Sinaloa (see Figure 1).

FIGURE 1 - PLACE OF ORIGIN OF AGRICULTURAL DAY LABOURERS

Most of the laborers are young (under 30). The largest age group is constituted by people in the 21 - 30 age range, which confirms the tendency already identified in 1998 by Guerra cited above, although in that case the largest group was the under 18s (Figure 2).

¹² The number of day labourers interviewed corresponds to what is named a convenience sample, that is to say, rather than demanding a minimum number of interviews according to statistical representativity criteria, the largest number of day labourers possible were interviewed, given funding conditions. The funding was obtained from the CONACYT (National Science and Technology Council) financed project, Socioeconomic Impacts of Biotechnology, realized by the Society and Biotechnology Group of the Universidad Autónoma Metropolitana-Azcapotzalco. The number of day labourers interviewed represents 0.04% of the approximate total of the maximum number of migrant labourers (300,000) that migrate to Sinaloa seasonally for the harvesting of vegetables, mostly tomatoes. Charts are presented in absolute numbers rather than percentages as this gives a better general impression, given the limitations of the sample, although percentages are given in the text.

¹³ For this work we had the help of Jesús López Estrada, teacher from the Universidad Autónoma de Sinaloa, and his students for the Guasave case, as well as the personnel of the National Programme of Agricultural Labourers (PRONJAG) from SEDESOL. I thank all of them.

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FIGURE 3 - LITERACY AMONG THE DAY LABOURERS

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**FIGURE 4 -
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**FIGURE 6 -
PERCEPTION OF PREVIOUS KNOWLEDGE TO GET THE JOB**

Consideration of whether and how day laborers perceive technical changes is especially relevant for this research. Within the group interviewed, the response is ambivalent, since 62 perceive TI and 58 do not (Figure 7). One might suggest the hypothesis that the latter group is relatively indifferent to technical change, since their labor continues to be more or less the same, to pick tomatoes and put them into buckets under supervision during long days. It is, therefore, interesting to compare this with the kind of technical change perceived (Figure 8).

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FIGURE 8 -

A final feature that is important to emphasize is that of land ownership. Of the workers responding, 68 report possessing land in their village, and 69 not (Figure 9). That is, the group is almost equally divided in this respect. Thus, almost half of the workers interviewed are land-owning peasants, but their agricultural knowledge as producers is of little relevance to the menial tasks they perform in their jobs in Guasave and Culiacán. Of course, there are evident technological differences between intensive horticulture in Sinaloa and self-consumption agriculture that land-owners laborer practice.

FIGURE 9 - POSSESSION OF LAND BY THE DAY LABOURERS

Conclusions

From the case study reported and the different hypotheses proposed in the beginning, the problematic nature of the impact of TI on labor markets and processes is evident. I will first comment generally on the theoretical proposals outlined at the beginning, and then go on to review the main research hypothesis.

Firstly, it is very clear that the proposal by Carton de Grammont and Lara (2000) mentioned at the start is confirmed (that), in the sense that jobs in horticulture are rigid. Given the characteristics of the laborers interviewed, it is

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Concerning the second hypotheses, about how workers' economic and socio-cultural characteristics make agency difficult in the sense of Long (2001), I would say that the bio-power network is also shown in workers' education levels and technical change perception. It is difficult for them to perceive technology changes, and to have agency in their labor conditions. Nevertheless, the case reported shows there is no need of formal education in order to get unqualified and low waged jobs, as a certain degree of informal learning in the labor process is sufficient. We can see the level of illiteracy and indigenous language speaking and high level of unfinished basic education as indicating these to be factors that do not prevent people from gaining employment in these positions. Sociocultural characteristics that would be expected to exacerbate the difficulty of achieving agency are the low level of formal education, ethnicity and (in some cases) the use of another language, and the important presence of those who have land in their places of origin (these laborers may not be motivated to develop agency as they see horticulture jobs more as a complement than a central objective). Peasant production rationality allows children to work, as the complete family travels and they need children's income.

The larger number of mixed race or indigenous people do not speak any native language (i.e. have Spanish, the dominant language, as their mother tongue), and the majority also are literate (albeit with an unfinished basic education). These two elements could indicate good basic conditions both for the exercise of agency and for a perception of technical change. The direct information collected on this last aspect, however, seems to contradict this. One might suggest that, since there is an important group that does not perceive or specify the change, the routine drudgery endured by these laborers causes a certain indifference towards TI. This is not surprising if one considers that a better knowledge or perception are not conducive to (expectations of) improvement in working conditions or remuneration. It is also worthy of attention that the peasant origin of these laborers, inferred from the fact that they possess land, leads us to see that this feature starts to become relative (in the sense that it is not so important to have land in order to get the job) and that the presence of total proletariat migrant day laborers is significant. With regards to this, it is interesting to recognize the almost non-existent influence of agricultural knowledge obtained as a producer in the villages of origin in the perception of technical change in Sinaloan enterprises.

Nevertheless, concerning the third hypothesis, regarding Callon's translation concept, it is quite clear that laborers' work is strategic for modern

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