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Extension Services in the Transition from Post-Communist Agrarian Systems: The Case of the Plant Protection Stations in Ukraine*

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ABSTRACT This paper addresses the transition of Ukrainian Plant Protection Stations (PPS) from technical agencies in the Soviet command economy to a public service for farmers in an emerging market economy. It opens with an overview of the circulation of agricultural knowledge and information in Soviet agriculture. During the transition, the fundamental knowledge-based problem for agricultural sector actors has been to recognize distinct private and public sectors which balance market incentives with the maintenance of social welfare and allow for adaptive decision-making with respect to technical, environmental, social, and financial trade-offs. Two annual surveys of plant protection stakeholders designed to improve development and delivery of appropriate pest management information have demonstrated some success in the delivery of technical information services for a privatized agricultural sector. The analysis concludes, however, that recognition of the need to evaluate technical, environmental, social, and financial trade-offs of market-based alternatives has yet to be developed.

Transformation of the Soviet command economy into a market economy is not as simple as once believed (Grabher and Stark;

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1997; Wedel 1998). To illustrate this point we examine the experience of the L'viv *Oblast*[1] Plant Protection Station (PPS) and its pest management information services. The PPS has been transformed from a technical agency in the Soviet command economy to a public service in an emerging market economy. This transition renders problematic the legitimacy of its primary product, scientific and technical knowledge.

For agricultural sector actors, the fundamental knowledge-based problem has been to recognize and assume distinct private and public sector roles and behaviors that allow for adaptive decision-making of market entities (production and commercial units) with respect to technical, environmental, social, and financial trade-offs. It has not been enough to simply master new technical information. On one hand, market actors must learn the institutional norms and behaviors which inform effective application of technical knowledge in management decision-making. On the other, the transition from a predominantly single source of information (the state) to an information marketplace requires that public sector information providers learn to effectively compete for the farmer's attention.

After 1989, Western nations rushed in to facilitate the transition to capitalism in Eastern Europe. The hypothesis on which these actions were based was that privatization of resource ownership would assure the transition to a market economy. The major thrust of donor assistance to the Ukrainian agricultural sector has been "marketization" with two foci: (1) land titling for farm workers (with limited restructuring in the internal organization of farms; in some cases individual private farms have been formed); and (2) privatization of the input and output markets (subsidizing the entry of large multinational firms in the agro-chemical industry, privatizing the grain storage network, and creation of commodity exchanges). To the extent that successes have been achieved, they have been in the establishment of individualized or corporate ownership of the physical infrastructure of the farming sector and supplying these new "owners" with production inputs. This has not been enough. Privatization in itself does not assure a free market

[1] *Oblasts* are roughly equivalent to small U.S. state government administrative units with some limited administrative autonomy.

system without a complementary open and free flow of information and the knowledge necessary to apply it.

Most studies of the agricultural transition in the ex-Soviet Union have focused on: the shift from collectivized to privatized ownership of physical infrastructure (Csaki and Lerman 1997; Lerman and Csaki 2000; Ash 1998); addressing attitudes toward private farming (Bonanno et al. 1993; Ash 1998); and how this transition has affected the social welfare of the large farm-based population (Perrotta 1998). Analysts of Soviet agriculture have noted that agricultural workers were poorly trained and lacked the skills either to carry out the full range of agricultural production activities or to deal effectively with input and product markets (Wegren 1993). Few studies have addressed the issue of how these new "owners" of the means of production would learn how to farm. With the exception of a USDA program (Beeler 1999), donor programs have largely assumed that those raised on a farm would have the requisite knowledge and skills. This assumption takes little account of the structure of Soviet agriculture and the real division of labor which existed between knowledge-based workers and the majority of field workers in the kolkhozes and sovkhozes (collective and state farms) of the Soviet Union, nor even of the quality of knowledge possessed by knowledge-based workers.

Discussing the difficulty of theorizing the transition from Communism in East Central Europe from a political economy perspective, Offe (1991) highlighted the "dilemma of simultaneity" faced by post-communist societies. While Western European and Latin American states passed through successive phases of nation-building, free market development, and democratization over the course of centuries, post-Communist societies have confronted these phases simultaneously. In their analysis of transformations in Eastern Europe, Stark and Bruszt (1998) argue that the transition from socialism to capitalism is dependent upon the distinctive characteristics of the point of departure for the transition, defining a particular pathway for the development of capitalism. The path dependent nature of the transition is confirmed by Inglehart (2000) in his cross-cultural analysis of survey research findings linking culture and democracy. D'Anieri, Krauchuck and Kuzio (1999) qualify this reasoning in the case of Ukraine by noting that Ukraine has been faced with "a quadruple transition," including not only

democratization and marketization, but also nation-building and state building (given Ukraine's colonial status within the Soviet Union). The point is that transitions do not begin *ex-nihilo*.

According to Busch (1984) and Kloppenburg (1991), the institutional structure of political and economic forces conditions the generation of legitimate scientific and technical knowledge. Important though this insight is, it is insufficient to explain the mechanism(s) by which the transformation of information services occurs. Busch and Juska (1997) ask us to move beyond the traditional political economy approach described above and draw on actor network theory (Latour 1987) to better understand the associated micro-processes shaping the new institutional forms. The question posed is: how have existing networks of production, distribution and consumption been reproduced or transformed to include new actors, products, technologies, and knowledge (in particular, the western pesticide industry).

This study will show that the centralized and hierarchical nature of the Soviet agricultural system constituted an actor network producing standardized scientific and technical knowledge ("immutable mobiles", Latour 1986). Although some of the messages have changed, re-translated to serve a new institutional setting, the network is still largely in place. It will be shown that this actor network (following Latour 1987; and Bockman and Eyal 2002) easily adapted to the production and legitimation of "immutable mobiles" dominating the global market economy and thwarting the development of locally adapted knowledge systems. This was possible because de-construction of the Soviet agricultural system was only partial. While privatization ostensibly opened the 'black box' of institutional infrastructure for agricultural production in Ukraine, powerful network actors, both old and new, rapidly closed it back up with a new interpretation aligning their interests.

We begin by situating agricultural information services in the context of the Agro-Industrial Complex of the Soviet command economy. Knowledge, as conceived within the Soviet system, is then contrasted with how it is conceived within Western market economies using the example of pest management practices. The role and functioning of the Ukrainian Plant Protection Stations is then introduced followed by data from a survey of pest management stakeholders of the L'viv *Oblast* PPS. Information seeking and

decision-making characteristics are examined as a means to improve development and delivery of technical pest management information. The ensuing discussion highlights the priorities of various stakeholders as well as the extent to which new information is changing pest management decision-making practices.

Historical and Contemporary Context

The Agro-Industrial Complex in the Soviet Union was organized through the Ministry of Agriculture. The command economy was dominant. Production orders were issued from Moscow establishing quotas for agricultural output and disseminated throughout the Republics (Ash 1998). At the outset of each agricultural year, collective and state farms received these production orders from their local agricultural administrations according to the regional plan. Production inputs were supplied consistent with these plans and, at harvest, the consequent output transferred to the State at set prices.

Agricultural Information Services in the Soviet Union

The centralized production system carried over into the provision of agricultural information as well. Isolation characterized the situation of agricultural producers. The primary source of agricultural information was the instructions accompanying the production orders. Farm managers made few technical decisions with even planting and harvesting dates set centrally (Ash 1998). Their job was to mobilize the labor force to complete the assigned tasks. Agricultural education was characterized by state-controlled curriculum, system-wide uniformity of programs, and no client orientation (Udin and Acker 2000). Agricultural research was centralized in the Academy of Agricultural Sciences. Research results and databases were consolidated by publishing houses in Moscow and sent to locally based libraries, institutes and the agricultural administration. Information was hierarchically distributed, with little concern for local climatic or ecological conditions (i.e., "immutable mobiles"). Questions were processed through administrative channels (Gachie 1996).

While a highly complex system, agricultural research was centralized through top administrators in Moscow, rather than responsive to local production constraints and opportunities (Csaki

1998). The agricultural development strategy of these state administrators tended to be capital intensive, biased "toward mechanical and against biological technical change regardless of factor endowments" (Fan and Ruttan 1992). In support of production goals, research focused on increasing output with little regard for economic efficiency. "The lack of knowledge to tackle the problems of market-based agriculture is one of the most significant negative aspects inherited from the former socialist system" (Csaki 1998:5). Wong and Ruttan (1990) demonstrated that agricultural information was little more than instructions since yield increases were largely due to increases of inputs (fertilizer and machinery), rather than the impact of agricultural research. As knowledge-based workers, farm managers and their agronomists were trained to instrumentally decipher and implement those instructions, the primary objective being to achieve their production quota. Local knowledge and choices were squelched by this centralized system of legitimate technical knowledge.

Transformation of the Ukrainian Agricultural System

The Ukrainian land reform process began before independence with the Ukrainian Land Code of December 1990 opening the possibility for leasing (Ash 1998; Van Atta 1994). Real progress in land reform was not achieved until 1992, with the transfer of land and farm infrastructure from State to collective ownership (Csaki and Lerman 1997). This ostensibly eliminated the State monopoly on land and created a diversity of organizational forms. Former collective farms have been reorganized into collective agricultural enterprises (CAE, the generic form), farmers' unions, associations, cooperatives, partnerships, joint stock companies, and state farms. For the most part, the structural features of these new "forms" differ little from their Soviet predecessors. These farms are very large and hierarchical, nearly total institutions, often the only institution organizing the life of one or more villages. They are internally structured by a division of labor involving worker brigades of up to several hundred members. Consequently, farm managers have possessed considerable power as they have been responsible for the administration of economic, political and social matters in the transition to a market economy at the local level.

The next step, transferring property rights to individuals, has only been partially fulfilled. Since 1996, few new private farms have been established. According to a World Bank survey in 1996 less than half of land shares and about two-thirds of asset shares had been assigned to farm employees (Csaki and Lerman 1997). Despite the apparent variety in farm structures, only 33,000 individual private farms and 12 million household plots were formed accounting for about 15 percent of agricultural land. By 1998, a World Bank/USAID study of farm restructuring found that the internal structure of the new farm enterprises had changed very little (Lerman and Csaki 2000). The number of private farms had actually been decreasing from a peak of 35,927 in 1997 as many could not survive and more successful individuals increased their holding size (Puhachov 1999). As of 1 July 1998, 10,600 kolkhozes and 2,100 sovkhozes had been reformed (Agrarian Policy Analysis Unit 1999). Nearly two-thirds were formally designated as collective agricultural enterprises (CAEs). Of the 11,883 CAEs existing on 1 January 2000, over 90 percent had been reorganized by 27 March 2000 (Van Atta 2000), thus completing the formal shift from collective to private ownership.

For the most part, however, functional privatization of land has been blocked by farm administrators and their parliamentary supporters whose positions as ex-Soviet knowledge users/information shapers would suffer from such change (Synovitz 2000). Furthermore, the farm populations are also uncertain about the implications of a reformed farm sector on their livelihoods (Bonanno et al. 1993; Ash 1998). For the vast majority of farm workers, conditions have not substantially changed with these transformations in ownership formalities. Centrally managed enterprises predominate and the vast majority of individual shareholders have not received formal title to their land (allowing them to farm or lease their land independently), nor have work discipline and relations within the collectives changed (Lerman and Csaki 2000; Krot 2000).

Supporting Infrastructure

Although the Ukrainian agricultural sector had been a primary producer and source of research in the ex-Soviet Union, Ukrainian

agricultural infrastructure (inputs, information, etc.) had been hierarchically organized through Moscow. With the formation of the new state, managers in the Ukrainian Agro-Industrial Complex quickly moved to consolidate their position of national dominance.

Control and regulatory responsibilities have remained with the new State, and large quasi-autonomous units have remained vacillating between monopolistic and oligopolistic control in the supply of most inputs (primarily fuel, fertilizer, and machinery). Privatization of agricultural infrastructure including the divestiture of Ukragribusiness (the State supplier of agricultural inputs) has only been partial. Interestingly, pesticides have been largely jettisoned to the private sector (Kobuta and Noha 2000). Nevertheless, competition within the system has remained limited due to market orders of the State for bulk agricultural products (ostensibly to repay production loans for fuel and other inputs), and the oligopolistic position of international pesticide producers. The important aspect regarding the technical support of pest management decision making is that these chemical companies, relying in part on donor subsidies, have been financing a marketing intense, loss-leading strategy to secure a position in this potentially lucrative market. At the same time public sector pest management information providers are under-funded and unable to offset the companies' information campaigns.

Pest Management in Ukraine

In order to understand the knowledge-based problems involved in the transition to market agriculture in the ex-Soviet Union, we focus on those forces conditioning the generation and transfer of scientific knowledge. For agricultural sector actors, it has not been a matter of simply mastering new technical information. Technical information is shaped by the institutional structure. Actors also must learn the institutional knowledge of how to effectively apply that information. This institutional knowledge involves a transformation in the behavioral norms associated with new roles in the agricultural sector. In theory, roles associated with the execution of bureaucratic instructions within the Agro-Industrial Complex should be replaced by roles which require behaviors consistent with free association and exchange between complementary and competing entities in a

market-based economy. Despite the fact that many technical operations may require only minor functional modifications, the social meaning of these operations must be re-interpreted in order for the new actors to effectively function under market conditions.

Let us consider the differences between information in the Soviet Agro-Industrial Complex and information in a market economy. Information in the command economy (where state and market coincide) came in the form of production orders. Production quotas were accompanied by instructions and the inputs necessary to achieve those quotas. The objective of production was to achieve one's quota. There was little decision-making discretion, and no variability in costs associated with input use. Pest management was a technical activity involving the execution of instructions. This information was updated during the season with pest forecasts to avoid catastrophes that would impede the agricultural region from achieving the quota. In contrast, information in the market economy comes in the form of market signals. Costs and benefits must be weighed, and trade-offs considered by individual producers in the purchase of inputs and the application of various techniques. The objective of production is to produce a profit. Both technical and economic efficiency of alternative production practices must be considered and choices made. These choices not only require increased amounts of technical information about alternatives (i.e., information which allows market-based actors to make evaluations of technical, environmental, social, and financial trade-offs), but also the knowledge of when and how to apply that information in the institutional setting of a free market.

A fundamental concept of integrated pest management is that of "economic threshold." The general idea is that any particular pest infestation may involve damage to a crop. Since action to combat such an infestation has a cost, it is only considered significant when losses to the crop are such that it would be worth more to pay for a pest management action (i.e., the point at which the "economic threshold" is passed). While Ukrainian agronomists frequently described the point at which crop losses would be experienced in an absolute (i.e., technical) sense, repeated interviews and discussions with farmers, managers and agronomists throughout Ukraine demonstrated a nearly complete lack of such a (i.e., financial) conception.

Since discretionary use of information was minimal in the Soviet system (even when information was available) and there was no marginal variability in costs associated with input use, pest management remained largely a matter of instrumental execution of instructions within a bureaucratic context. Consequently, the chosen method was chemical input intensive, as opposed to management intensive. With the demise of the Soviet state, pest management (i.e., the use of pesticides, perceived as a set of unvarying technical instructions and inputs) was the chief component in agricultural production opened up to the market sector in Ukraine. However, it is no longer enough for farmers to grow a given quantity of output. Whatever is produced must generate a profit (i.e., an income for the producing unit) -- cost has become a factor with technical implications. Management intensive operations (with increased choices and consequent need for information) are essential for market effectiveness, but there is a high risk that they will not become the norm.

Multinational agro-chemical firms (while competing among themselves for market share) are vying to replace the monolithic Soviet Agro-Industrial Complex with their own system of bureaucratic inputs and instructions. Given the recent under-funding and deterioration of the agricultural research establishment in Ukraine, a major source of income for agricultural researchers comes from the field testing of new agricultural chemical products and producing recommendations for their use. The potential for such a transition directly from Soviet legitimation of farming knowledge to corporate legitimation (maximizing profits to input suppliers) is real since it would involve little modification in the roles and behaviors of farm actors.

PPS Roles and Behavioral Expectations

The Plant Protection Station (PPS) occupies a central position in pest management because it is charged with assessing pest management problems, interfacing with private sector input suppliers, carrying out national and *Oblast* policy, and providing information on pest management, pesticide use and safety, efficiency, and efficacy for the farming community.

The structure of *oblast* Plant Protection Stations follows that of the administrative structure with the lowest level being the *raion*[2] level offices. At the *raion* PPS, farmers may contact agronomists and forecasters to ask questions. The *oblast* PPS office infrequently publishes booklets containing pest management information and recommendations, based primarily on outdated and unadapted research or more recent chemical company publications. Forecasting stations servicing two to four *raion* each scout for the appearance and development of pests in crops, primarily grain crops, but sometimes including vegetables and fruits. This scouting information is reported to the *raion*-level PPS and the *oblast* office, and warnings are issued to large farms and private farmers' associations. Pest forecasts, and other extension information, are often sent to farmers by mail. Occasionally, radio broadcasts or newspaper releases are made.

The *oblast* Plant Protection Station as a public institution derives its authority and funding from the Central State Station for Soil Fertility and Plant Protection at the national level in Kyiv. The PPS is virtually the only public sector entity providing pest management information. With respect to the farming community, the PPS provides the only balance to the rapidly accelerating marketing efforts of the pesticide companies and their distributors. The PPS relationship to chemical companies is both adversarial and symbiotic. In this cash poor economy, international chemical companies and their distributors are the major source of resources to conduct farmer education and training. The main objective of this training from the perspective of these companies is to sell as much of their product as possible without due regard for farm profitability, human health effects and environmental impacts. On the other hand, the PPS is in a potentially powerful position to furnish evaluative information for farmer decision-making since pesticide companies are in a highly competitive environment and looking for endorsement. Nevertheless, as are all government employees, the PPS staff is poorly and infrequently paid. PPS staff members thus seek additional income through second and third jobs, impinging on

[2] *Raion*s correspond to U.S. county level units of government administration.

their ability to perform at the highest levels. The potential for corruption under such circumstances is high (see Mace in Polokhalo 1997:165-170).

Despite a nationally centralized administration, local agricultural administrators at the *oblast* and *raion* levels may also make demands on the *Oblast* PPS in their attempt to achieve production objectives for the *oblast*. For local political reasons, PPS staff accommodates these demands. During discussions leading to this paper, one *raion* agricultural administration chief remarked that the PPS was responsible to him for the teaching of new technologies to farmers as well as coordinating and controlling chemical use (conceived as a technical exercise). PPS *raion* (field) staff officially report to the *Oblast* PPS Office, but many *oblast* and *raion* agricultural administrators consider PPS personnel as subordinate to them. This means that PPS staff often receive conflicting instructions. In addition, local agricultural administrators contribute little or no support for the PPS workload.

Survey Methodology

This study is situated in L'viv *Oblast* in the far western region of Ukraine. Apart from being the predominant Ukrainian-speaking region, L'viv was not subject to agricultural collectivization until annexation into the Soviet Union after World War II. As part of Poland during the inter-war years, small farms and peasant agriculture predominated. Under Soviet rule, cultural integration of the region was never fully achieved (Aberg 2000). Consequently, L'viv has become the most supportive of private farming of all Ukrainian *oblasts*.

Five *raions* northeast of the city of L'viv were selected as the survey site because of the greater familiarity with pesticides in that region. In each of these five *raions,* fourteen individual private farmers and fourteen Collective Agricultural Enterprise (CAE) managers/agronomists were drawn systematically from lists obtained from the agricultural administration of each *raion*. The sample of 70 individual private farmers and 70 CAE managers/agronomists represented 20 and 43 percent of each population, respectively in 1997. In addition, 40 non-farming stakeholders representing interested government and private sector pest management

stakeholders (agricultural administration agronomists, university faculty, *Raion* Plant Protection Station Staff, Sanitation and Ecological Service Staff, and pesticide dealers and distributors) were also selected.

The initial survey was conducted in August 1997 to provide the L'viv PPS with a better understanding of its clientele. The survey questionnaire addressed pest management information needs, current information seeking practices, the perceived value of various information sources, willingness to pay for information, current pest management practices, and key demographic characteristics. Questions were close-ended, using scalar ratings with from three to five categories (such as: never used; of no use; some use; and very useful). Interviewers were recruited from among university students and received two days training. They were instructed in the survey goals, the objectives and meaning of each question, and practiced applying the questionnaire among themselves. A questionnaire pretest was conducted and refinements in the questionnaire were made.

The L'viv Plant Protection Station noted the preliminary findings from the first year's survey and developed a strategy to better serve their clientele. The centerpiece of this strategy was a Potato Pest Management Guide targeted to individual private farmers. Three hundred copies of the first edition of the Potato Pest Management Guide were distributed in the survey region. In order to further refine their strategy, the L'viv PPS invited stakeholders to a workshop designed to collaboratively determine what information products clients desired and how much they would be willing to pay for them. Forty-seven stakeholders participated in the workshop. Nearly half were individual private farmers and managers and specialists of collective agricultural enterprises from the five *raions*. The remainder was *Raion* and L'viv *Oblast* PPS personnel, forecasting and service agents, research and educational institution faculty, pesticide distributors, and agricultural administration officials from the *raions* and *oblast*. The national Chief of the Central State Station for Soil Fertility and Plant Protection also participated. Working in small groups and in plenary sessions, the participants prioritized a list of plant protection information service needs and developed an action plan to achieve those needs (L'viv Plant Protection Station 1998). Part of the action plan included a price policy for pest management information services.

Table 1: Characteristics of Farm Operations Surveyed, 1997.

Farm Type	Average Size of Farm (hectares)[1]	Average Area Cultivated (hectares)[1]	Primary Crops[2]
Collective Agricultural Enterprises (CAEs)	1518.0 (821)	1110.6 (628)	small grains (99%) sugar beets (76%) forage crops (47%) corn (24%)
Individual Private Farms	22.7 (24)	21.9 (23)	small grains (94%) sugar beets (63%) potatoes (34%) vegetables (33%)

[1]Numbers in parentheses are the standard deviations.
[2]Numbers in parentheses are the percent of farms growing each crop.

In 1998, a second round of surveys used the originally sampled farmers and specialists. Those unavailable at the time of the second survey were replaced by equivalent farmers in the same village. Eighty percent of the original sample was included in the follow-up survey. The original questionnaire was modified to include questions concerning contents, use and value of the Potato Pest Management Leaflet circulated in the five targeted *raions*. The original questions on farmer information seeking practices, information needs, the perceived value of various information sources, and willingness to pay for information were repeated (with modifications suggested from the original survey findings) to determine if the workshop and potato pest management leaflet had an effect on farmer perceptions.

Results

Farmer and Technician Characteristics

The farm operations represented here fall into two basic groups: large collective agricultural enterprises (CAEs) and small individual private operations (see Table 1). In 1997, CAEs averaged around 1500 hectares, whereas individual private farms average around 23 hectares. Cultivated areas averaged 73 percent of the total area for

Table 2: Personal Characteristics of Plant Protection Service Stakeholder Group Representatives.

PPS Stakeholder Groups	Age	Years Working in Agriculture*	Years of Education*
Collective Agricultural Enterprises Managers	42.0	19.2	15.7
Individual Private Farmers	42.3	15.0	14.4
Non-Farm Agricultural Specialists	42.1	17.1	15.0

* T-test for difference in means significant at the .01 level.

larger farms and 96 percent for the smaller farms. While nearly all farms grow small grains and often sugar beets, corn and forage crops are more common on the larger collective farms, and potatoes and vegetables on the smaller individual operations.

In 1998, the size of individual private farms increased significantly, on the order of 50 percent, over the size found in 1997, to an average of 35 hectares. This is consistent with other reports on the consolidation of individual private farming enterprises and diminishing numbers of individual farms being established (Puhachov 1999 documents the general trend for Ukraine).

For the most part this is a relatively young group of farm operators, ranging in age from 21 to 66 years old with an average age of 42 (see Table 2). Farm operator's age is positively associated with experience farming and the number of years making farm management decisions (Pearson's Correlation at .736 and .353, respectively). Farm operator's age is not associated with the type or size of farming operation. On the other hand, average years of farming experience is significantly higher for those on the larger collective farms (19 to 21 years) than for private individual farmers (12 to 16 years). Perhaps even more important, however, is the fact that individual private farmers have significantly fewer years of formal education (T-test significant at the .01 level). The significance of this difference becomes readily apparent as we consider information seeking practices.

A slight decrease in average years of farming experience among those individual private farmers still remaining in 1998 was found. This is consistent with the findings of Bonanno et al. (1993) that those interested in private farming tend to be younger. Plant protection specialists tended to be older with higher levels of education.

Pest Management Information Seeking Practices

The most important information sought by all stakeholder groups concerns health and safety issues. Differences in information seeking practices emerge when farming practices themselves are examined. CAE managers and non-farm agricultural specialists are much more concerned about the timing of pesticide applications, new methods and new products than individual private farmers. While few express frequent interest in information on biological control methods, non-farm agricultural specialists are most likely to be seeking new scientific information and pest forecasts. Individual private farmers are least concerned about these latter issues. In 1997, general information concerning new chemicals, and new scientific and reference materials was frequently specified by stakeholders in open-ended questions, followed closely by information on prices. However, only price information received a high ranking for frequency of information seeking in 1998. Interestingly, the cost of alternatives that westerners would closely associate with prices was significantly lower for both types of farmers. Only individual private farmers have a significantly positive correlation ($r = .48$, at the .01 level) between prices and the cost of alternatives. The more generalized expression of information needs by individual private farmers suggests, nevertheless, that they lack information about the potential range of pest management decision-making options. Non-farm specialists are considerably less concerned about price information and most concerned about potential options.

Non-farm agricultural specialists devoted the most time to information seeking, over 60 percent spending several hours or more each week. CAE managers are also routinely involved in information seeking with nearly half of them spending at least

several hours each week. On the other hand, less than a third of individual private farmers spent more than a few hours a week seeking pest management information.

Despite differences in the frequency of information seeking and the greater diversity of information sources at the disposal of CAE managers, the different stakeholder groups share many information sources. The primary methods of gaining information are visiting the Plant Protection Service and searching newspapers and magazines. Again, differences in the most frequently used sources of information should be noted. The PPS, the traditionally legitimate source of pest management "instructions," is most frequently sought out as an information source, particularly by CAE managers and non-farm agricultural specialists. Individual private farmers are more restricted in their access to information sources, being primarily dependent on reading newspapers and magazines. In contrast with large CAE managers, individual private farmers depend very little on the agricultural administration and are less likely to have a farm agronomist or the attention of pesticide salespersons. Consequently, they are more dependent on radio, television and information from neighboring agronomists and farmers. Non-farm agricultural specialists supplement routine information seeking at the Plant Protection Service and in newspapers and magazines with visits to pesticide producer and distributor representatives. Non-farm agricultural specialists appear to use a wider range of information seeking methods that include asking chemical firm representatives, pesticide distributors and agricultural university faculty.

Pest Management Decision Making

All farmer respondents use pesticides, over 80 percent claiming to do so regularly. Table 3 presents an analysis of decision-making influences on the two predominant pest management practices. Both involve the use of pesticides. The first is to spray pesticides on according to calendar date. The second stresses efficiency in pesticide application predicated on up-to-date, site-specific knowledge of pest populations and crop conditions. What stands out in this analysis is the pivotal role of pesticide dealers' advice, positively encouraging the use of a fixed schedule for pesticide application and discouraging spraying for only economically significant

Table 3: Determinants of Pesticide Spraying Practices, Two Regression Models.

Independent	Dependent			
	Spraying on a Fixed Schedule		Spraying for an Economically Significant Pest Problem	
	Full Model	Reduced Model	Full Model	Reduced Model
Age of Farm Decision Maker	.071		-.092	
Education of Farm Decision Maker	-.031		.141	.177*
Type of Farm	.221**	.255**	-.121	
Pesticide Dealer's Advice	.380**	.368**	-.251**	-.226**
Agricultural Agent's Advice	-.064		.086	
Amount of Time Seeking Information	-.108		-.095	
Diversity of Information Sources	-.087		-.184*	-.171*
Adjusted R^2	.235	.233	.091	.086
Model Significance	.000	.000	.006	.002

pest problems. Although there is a positive correlation between the agricultural agents' advice and that of pesticide dealers (r = .495), the decision to spray on a schedule or when there is an economically significant problem is unrelated to agricultural agents' advice. Spraying on a fixed schedule is more common for individual private farmers, whereas spraying for an economically significant pest problem is only positively associated with higher levels of education and curiously negative with diversity of information sources. A negative correlation between pesticide dealers' advice and identification of an economically significant pest problem reinforces the

Table 4: Percent of Stakeholders According to the Amount They Would Be Willing to Pay On a Monthly Basis for Useful Pest Management Information.

	Collective Agricultural Enterprise Managers		Individual Private Farmers		Non-Farm Agricultural Specialists	
	1997	1998	1997	1998	1997	1998
Nothing, not interested	0.0	1.6	7.8	1.6	7.7	8.1
2-3 *hryvnas*	29.3	54.0	31.4	50.0	34.6	24.3
4-10 hryvnas	31.0	27.0	37.3	29.0	34.6	45.9
11-20 *hryvnas*	15.5	6.3	13.7	9.7	3.8	13.5
over 20 *hyrvnas*	24.1	11.1	9.8	9.7	19.2	8.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of Cases	58	63	51	62	26	39

central role of scheduled pesticide treatments for a major portion of stakeholders. The predominance of scheduled pesticide applications indicates pest management decision-making in the absence of field-level information. Pest management decision-making among the studied farmers does not appear to be subject to market-driven influences or the current best practices of integrated pest management. This is particularly the case for individual private farmers. Reliance on pesticide distributors for pest management decision-making information seems to assure maintenance of this status quo.

Willingness to Pay for Pest Management Information

The 1998 survey asked respondents if they had seen the Potato Pest Management Guide and whether it provided information which they desired. Over sixty percent of potato growers found the guide to be very useful. Many non-potato growing farmers and three-quarters of non-farm agricultural specialists also found the guide to be a valuable information source.

Results from both the 1997 and the follow-up 1998 surveys demonstrate that farm and non-farm stakeholders would be willing to pay at least nominal sums on a monthly basis for objective and useful pest management information (Table 4). In 1997, over a third of CAE managers said they would be willing to pay 10 *hryvnas* or more per month for useful information. Individual private farmers have a lower threshold, but even as the prospect of actually paying for information approached, nearly half would pay at least 4 *hryvnas* per month (about two US dollars[3]). There were no statistically significant differences in the distribution of responses among stakeholders. The higher number of responses and the lower central tendency found in the 1998 survey suggests a recognition of the growing reality of paying for alternative information services and the outset of negotiations over their price.

Discussion

Institutional change in the agricultural system of Ukraine has been limited. There has been some shift in factor supplies (from Russian chemical suppliers to Western sources). Product demand has been affected by reduced purchasing power on the part of the population and declining farm productivity. Consequently, the state has retained control over the supply of production to the market. There has been no technical change in production systems. The institutional change that has occurred (privatization) came about without fundamentally restructuring the system or displacing significant actors in the re-constructed system. Recent events in Ukraine confirm that factor markets for land have yet to be consummated and that democratic policy dialog is suffering. The institutional matrix of science, market and the state that shapes legitimate forms of knowledge has only marginally shifted. Indeed, the separation of state and economy, the basis for creating distinct private and public sectors is seminal at best, and the knowledge and skills necessary to

[3] Just before the second survey in 1998 Ukraine's currency suffered another inflationary shock due to the banking crisis in Russia. Monthly news and specialty magazines were costing from two to four *hryvnas* at that time.

animate the production units within that structure have not evolved according to Western expectations.

Nevertheless, the L'viv PPS has been successful in developing and delivering a technical information service for the newly privatized agricultural sector. However, it has yet to be recognized as providing adaptive decision making information. It should be noted that this study in L'viv *Oblast* presents a 'best case' scenario in that remembrances of market practices still exist and are being revived. Elsewhere in Ukraine, only the transfer of physical ownership has occurred. Recognition of the need to evaluate technical, environmental, social, and financial trade-offs of market-based alternatives has yet to be developed.

With respect to technical information, the L'viv PPS has succeeded in developing quality pest management information for their clientele in the *oblast.* However, this market is segmented. The scale of production and mix of crops differs between the large collective-type farms and the small, individual operations. This means that information needs differ. The information needs of the large operations have been in the technical sense, at least partially, served by the PPS. The small individual operations, with their family labor force and lower levels of education, have been less well served. It would appear that the non-farm sector, given their overall positive evaluation of the multiplicity of information sources, feels best served by the current system.

Those making pest management decisions on CAEs are concerned with large-scale production of small grains, sugar beets, and to a lesser extent, forage crops and corn. They are better educated and have more years of farming experience than their counterparts on the small, individual farms. Nearly 90 percent of them are spending at least a few hours every month seeking pest management information. These information-seeking activities primarily involve the PPS, which is considered as very useful for their purposes and consistent with historical information legitimation and transfer practices. Information from the PPS is supplemented with routine reading of magazines and newspapers. Pest management decisions are most influenced by the timing of pesticide application by other farmers and according to the advice of their agronomic staff. Pesticide dealers advice has some influence but does not appear to be determinant for the majority. Many would be willing to pay

more than nominal amounts for the routine supply of useful pest management information.

Individual private farmers are also concerned with producing small grains and sugar beets, but on considerably smaller parcels of land. Pest management decision-making involves balancing limited resources with more labor intensive production practices, including the production of potatoes and vegetables, on many of these farms. These farm managers are generally less experienced and have lower levels of education than their counterparts on the large farms. Less time is spent in information seeking and this appears to be focused on learning about what pesticides are available and how to use them. While visiting the PPS or the agricultural administration is done by a few, the majority of individual private farmers rely heavily on the mass media (newspapers, magazines, radio and television) and neighbors for their pest management information. When it comes to making pest management decisions, however, the advice of pesticide dealers is considered most important and fixed application schedules are most often followed. Many would be willing to pay at least nominal amounts for the routine supply of useful pest management information.

Non-farm sector stakeholders are highly motivated information seekers with greater access to a wide range of pest management information sources. Over sixty percent are spending several hours per week in information seeking activities. These activities focus on reading newspapers and magazines and contacting the PPS and are supplemented with information from pesticide producers, distributors and agricultural faculty. Although these knowledge-based workers are not responsible for making farm level pest management decisions, they too, are willing to pay for the routine supply of useful pest management information.

Conclusions

This study did not set out with the intention of addressing the institutional knowledge of agricultural sector workers. Our experience in Ukraine, however, led us to the conclusion that market economy knowledge of the norms, roles and behaviors of farm-level decision makers was seriously lacking. In attempting to understand why the

institutional knowledge of farm operators was problematic we explored two issues: the transition to a capitalist market economy; and the actor networks shaping the generation and dissemination of agricultural knowledge.

The neo-liberal transformation of the Soviet command economy envisioned that privatization of market structures would spontaneously create the norms and behaviors necessary to mobilize actors in the transformed system. This has not occurred. In recognition of that failure, leading neo-liberals (e.g., Harrison and Huntington 2000) have come to recognize what others (e.g., Ruttan 1984; Worsley 1984; and van Nieuwenhuijze 1984) had earlier proclaimed – the culture of institutions matters. In their analysis of transformations in East Central Europe, Stark and Bruszt (1998) demonstrated that capitalism cannot be simply defined by its opposition to socialism, but rather that capitalisms must be seen in their diversity and that there are indeed multiple pathways to capitalism. The simultaneous development of free market economy and democracy (when neither previously existed) cited by Offe (1991) and the "quadruple transition" of D'Anieri et al. (1999) characterize the institutional conditions prescribing the departure point for Ukrainian agriculture's distinctive pathway to capitalism. Entry into the global market economy has not made a major transformation in the actor network of the Soviet agricultural system, it has been largely reproduced in a new Ukrainian guise. This institutional culture has been modified by a re-interpretation of actor interests and enrollment of Western chemical company partners in the reconstructed network shaping the terms of knowledge legitimization.

Under the command economy, the state structured market relations and supplied agricultural knowledge in the form of production instructions, leaving economic actors without autonomy. That is, they had no legitimate decision-making alternatives (Kloppenburg 1991; Harris et al. 1995, following Foucault). Under conditions of a market economy, the market requires economic actors to make choices. However, the Western production and legitimation of "immutable mobiles" (Latour 1986) for pest management have come to dominate the legitimate range of choices for Ukrainian farmers (large and small). The interplay of state and market actors has shaped the conditions for certain forms of technical knowledge and bequeathed legitimacy on them. In this respect, the post-Soviet

pathway to capitalism in Ukraine appears to have converged with the globalization of Western capitalism on the eve of the twenty-first century.

The transformation in Ukraine's structure of agriculture is creating new actors willing to conduct the business of farming, and the state has opened input markets to the private sector whose marketing campaigns advocate universal scheduled application of chemical pesticides. However, the everyday experiences shaping scientific and technical problems of small private farmers fundamentally differ from those of collective or corporate farm managers, and hence, the knowledge required to solve those problems (Wolf 1998). Given the lack of understanding of the independent role for public institutions (specifically, agricultural universities and extension services) in providing up-to-date locally appropriate user-oriented information, alternative (and often less costly) methods are unlikely to be recognized as legitimate pest management tools. Following Kloppenburg (1991), this is another case where local knowledge has little room to grow as Ukraine shifts from one centralized system of legitimate technical knowledge to another. As a consequence, technical pest management decision-making information has audiences which are receptive, but unprepared to seek customized information products for market-oriented decision-making at the farm level.

Privatization of land is just one element in the transformation of Ukraine's agricultural sector into a market-driven system (and not necessarily the most essential one). The free flow of decision making information relevant to competitively successful enterprises is another equally important element. Lacking a policy for transforming the provision of the Ukrainian public sector from a command orientation to a marketplace competitor in the provision of evaluative information for competitive enterprises, donor assistance to multinational firms in the agro-chemical industry supplying inputs to farmers in Ukraine has not helped. Hierarchical control of the information system, whether by the command-driven bureaucracy of Soviet agriculture or by the oligarchic pesticide companies is not conducive to the development of a competitive, free market economy.

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