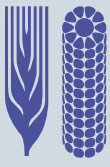
E C O N O M I C S

Working Paper 99-06

Changing Competitiveness of the Wheat Sector of Kazakhstan and Sources of Future Productivity Growth

Jim Longmire and Altynbeck Moldashev



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Changing Competitiveness of the Wheat Sector of Kazakhstan and Sources of Future Productivity Growth

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Contents

Executive Summary

Economic incentives in Kazakhstan have been radically reshaped since the Soviet era ended in 1991. In the first phase of transition, the economy and agricultural sectors declined by 40-50%. Overall economic growth refused in 1996, and agriculture is likely to enter a recovery phase soon. The economy of Kazakhstan is undergoing rapid structural change, and agriculture is experiencing strong inter-sectoral competition. The change to market-oriented and commercially-driven agriculture has altered fundamentally the incentives faced by Kazakhstan's wheat farmers. They have reduced use of inputs sharply because of the need to pay market prices for fertilizer, fuel, and other inputs, while severely curtailing investment in machinery and their farms generally. There is considerable potential for productivity improvements and adoption of new technologies in the wheat production and marketing sectors. Farmers are likely to resume investment only slowly and are likely to adopt only those changes that are low cost and which are based on low-input methods of production. Assessed under 1998 conditions, these wheat growing methods are about 20% more competitive than the energy and input-intensive technologies of the Soviet era. Because of the new commercial pressures brought on by the opening of the Kazakhstan economy to global markets, the production methods of the Soviet era are no longer relevant to Kazakhstan's wheat farmers. A fundamental change of thinking and approach to the situation faced by farmers is required in research, extension, training and education. The new commercial circumstances of agriculture call for strategic analysis of the future for Kazakhstan's farming and of related policies, research and education. Action is required in these areas to reinvigorate Kazakhstan's agriculture, and programs should commence as soon as possible. The future for wheat in Kazakhstan is promising, providing there is concerted and strategic change in the mindsets, culture, and approaches of those working in and supporting the wheat industry.

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Changing Competitiveness of the Wheat Sector of Kazakhstan and Sources of Future Productivity Growth

Jim Longmire and Altynbeck Moldashev

Introduction

Background

Agricultural production in Kazakhstan has declined sharply since 1990. There have been major reductions in the livestock sector and the crop sector, especially for spring wheat. From being a major net exporter of food products within the USSR during the 1980s, Kazakhstan faces the prospect of being only just self-sufficient in food during 1998-99.

The Kazakhstan economy experienced serious economic contraction from 1990 to 1995. Since then, the economy has slightly recovered, but it faces a major uncertainty with the collapse of the Russian economy. The drought of 1998 has also slowed economic activity. The transition from a socialist economy within the Soviet Union to a more open and market-based economy has been difficult for Kazakhstan, as for most transition economies. Kazakhstan's people are unfamiliar with aspects of a market economy and this adds to future challenges faced by the country.

Kazakhstan has a large land area and considerable opportunity for agricultural production and exporting. Whether this opportunity can be realized will depend on a number of factors, especially adapting to the new commercial circumstances faced and reinvigorating the agricultural sector. This study is focused on those factors, especially as they relate to the changing competitiveness of wheat production in Kazakhstan. Of special interest is the future for the wheat sector and how different research and development strategies may affect that future.

Overview of Kazakhstan[1]

Kazakhstan is the most northerly of the Central Asian nations (Figure 1). It has vast steppe lands and a society which blends Kazak and Russian cultures with lesser influences from other European and Central Asian groups. Ethnic Kazaks represent around 50% of the population and Russians just over 30%, with many nationalities making up the remainder. Kazak is the official language but Russian is the *lingua franca*. Kazakhstan's independence was proclaimed on 16 December 1991. The national currency is the Tenge.

Kazakhstan's 16 million people occupy a land area of 2.7 million square kilometers.

Figure 1. Map of the Republic of Kazakhstan.

[1] The primary source for this section is the 1998 Kazakhstan Annual Country Profile (Shorauly and Mahat 1998).

This is 40% larger than Mexico's land area, about the same as Argentina's and some 10% less than India's. Kazakhstan occupies almost 70% of the land of Central Asia but its population makes up less than 30% of the region (Uzbekistan's population being half as large again as Kazakhstan's). Kazakhstan's physical features are dominated by the vast steppes. There are three major inland seas (Caspian, Aral and Balkhash) fed by rivers in the south. The rivers in the north flow into Western Siberia and on to the Arctic Ocean. Apart from the Tian Shan mountain range along the southeast border with China and Kyrgyzstan, and forest and mountains to the east, there are no major physical barriers along the country's borders.

Kazakhstan's modern history is tied closely to that of Russia and the Soviet Union. Soviet industrialization and development occurred strongly in Kazakhstan with the building of many mines, industrial plants, railways, highways and cities as well as the plowing of the steppe "Virgin Lands". The development of large collective farms, or 'agro-industrial complexes' was also a feature. Kazakhstan as a modern nation has inherited many institutions and structures of the command economy of the Soviet Union.

The climate of Kazakhstan is depicted in Figures 2 and 3. These show the average monthly temperature and average monthly precipitation for representative locations in northern and southern Kazakhstan, respectively. Generally, annual precipitation is low (less than 300 mm) across much of the northern steppes. Precipitation is even lower in central and southern arid areas. However, nearer the east and southern mountains, precipitation increases and this is reflected in Figure 3.

Some key development indicators for Kazakhstan are presented in Table 1. Generally, these paint a picture of an economy which is urbanized, diversified and energy intensive. Most development indicators compare favorably with other Central Asian nations and with low and middle income countries of the world. Despite the generally favorable picture, inequality and poverty have increased in the 1990s (World Bank 1998).

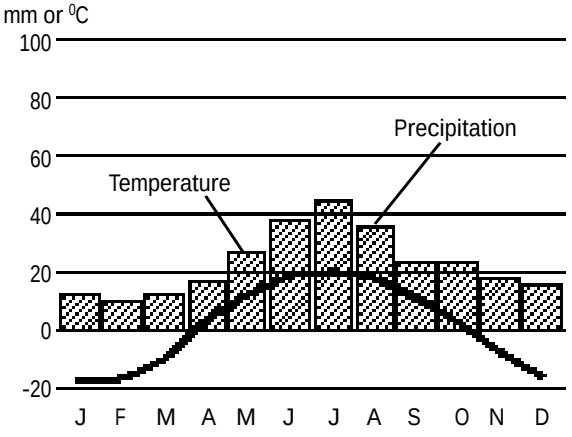

Figure 2. Average monthly precipitation and temperature, five locations of northern Kazakhstan.

Note: Total annual precipitation is 227mm. Mean annual temperature is 1.6 degrees C. Locations are Astana, Kostanai, Aktobe, Pavlodar, Petropavlovsk.

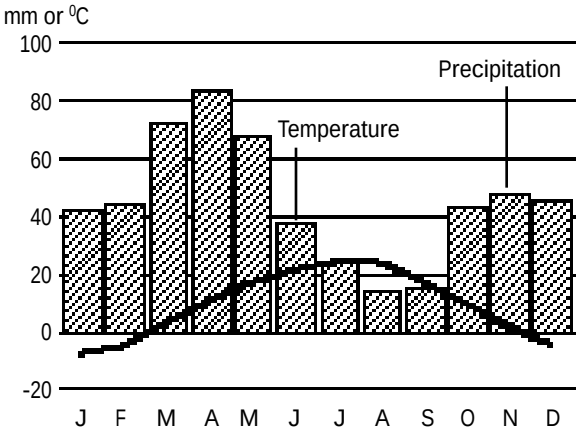

Figure 3. Average monthly precipitation and temperature, two locations of southern Kazakhstan.

Note: Total annual precipitation is 531mm. Mean annual temperature is 9.5 degrees C. Locations are Almaty and Chimkent.

Objectives

This is the first economic study of Kazakhstan's wheat sector supported by CIMMYT. To some extent it is exploratory in nature. However, the specific objectives for the study are:

1. To assess the competitiveness of wheat in Kazakhstan with emphasis on the profitability and possible expansion of wheat exports.
2. Identify future sources of wheat productivity growth, including an assessment of the technologies in the shelf and in the pipeline.
3. Evaluate the constraints to technology development and adoption, including an assessment of the education, research, and extension system.
4. Assess the current policy environment and identify the policy instruments that would enhance wheat productivity growth.
5. To assess the agricultural research /education/extension system and provide recommendations for strengthening it.

The study involved a three-week field trip in September-October 1998 and considerable background research using international data sources. Some of the data obtained are unlikely to have been seen outside the country before. Some other are simply a compilation of information available from international agencies and data services. Nevertheless, the main developments concerning wheat, its competitiveness and potential for future productivity have been distilled.

Table 1. Key development indicators for Kazakhstan, compared with other central Asian countries and all low-income and all middle-income countries, latest available data (World Development Report 1998)

Indicator	Unit	Kazak-stan	Kyrgyz-stan	Tajik-zstan	Turkme-nistan	Uzbek-istan	Low Income	Middle Income
GNP per Capita PPP-Based	US$	3,290	2,040	930	1,410	2,450	1,400	4,550
Population	million	16	5	6	5	24	2,048	2,855
Population Growth Rate	% p.a.	-0.4	0.7	1.8	3.4	2	2.1	1.3
Population Density	Per Sq.km	6	24	42	10	55	65	40
Urban Population	%	60	39	32	45	42	28	49
Agricultural Share of GDP	%	13	52	n.a.	n.a.	26	31	12
Services Share of GDP	%	57	29	n.a.	n.a.	47	42	50
Trade Relative to of GDP	%	65	86	228	n.a.	69	42	52
External Debt	% of GNP	14	37	24	18	9	n.a.	n.a.
Development Assistance	% of GNP	0.8	13.9	5.6	0.5	0.4	3.5	0.4
Female Share of Workforce	%	47	47	44	46	46	36	41
Commercial Energy Consumption per Capita	Kg oil equiv.	3,337	513	563	3,047	2,043	198	1,139
Carbon Dioxide Emissions per Capita	Tons	13.3	1.2	0.6	6.3	4.3	0.7	3.7
Net Energy Imports	% of total use	-16	41	60	-137	-6	-20	-37
Life Expectancy At Birth (yrs)	Male/Female	60/70	62/71	66/72	62/69	66/72	58/60	66/71
Infant Mortality Rate	Per 1000	30	36	38	50	35	113	43
Telephone Main lines	Per 1000 people	118	75	42	74	76	11	78
Annual Freshwater Use	% of total	50.3	23.4	19	2280	504	n.a.	n.a

Source: World Development Report 1998.

Agriculture in the Kazakhstan Economy

Changing Size of the Economy

Prior to the breakup of the Soviet Union, Kazakhstan had an average income per capita (PPP-basis) which was about one quarter that of the USA, some 20% below Russia's, exceeding Ukraine's and the highest of the Central Asian Republics (World Bank 1997, Table 1). In 1987, countries with a similar average income per capita to Kazakhstan included Brazil, South Africa, Jordan and Malaysia (*op cit.*).

Since independence, Kazakhstan's economy has declined significantly (Figure 4). While there has been some recovery since 1995, average income per capita remains well below levels at the beginning of the decade. Other Central Asian nations have experienced similar economic declines (Figure 5), as have other large countries of the CIS, including Russia, Ukraine and Belarus (Figure 6).

Transition and Future Prospects

Considerable analysis has been undertaken of the causes of decline of output in the transition economies since independence (World Bank 1996; De Broeck and Kostial 1998; Fischer, Sahay and Vegh 1998; Christoffersen and Doyle 1998). A number of contributing factors are proposed:

1. Disorganization of production, marketing and trading links since independence
2. Inherited sectoral misallocations from the Soviet system, including excessive capital accumulation
3. Credit and investment contractions since independence
4. Excessively high rates of inflation

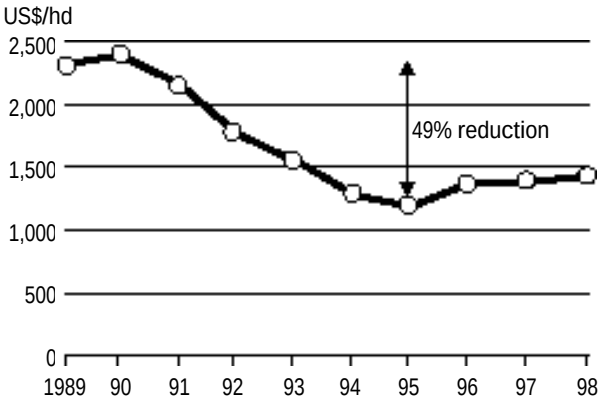

Figure 4. Gross national product per capita, Kazakhstan, 1989–1998, US$-Basis.
Source: World Bank, World Development Indicators Database.

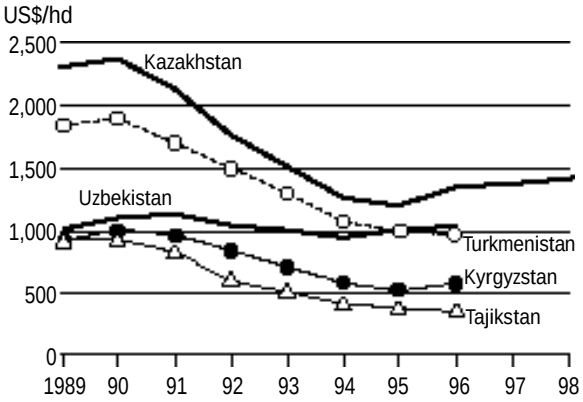

Figure 5. Gross national product per capita, Central Asia, 1989–1998.
Source: World Bank, World Development Indicators Database.

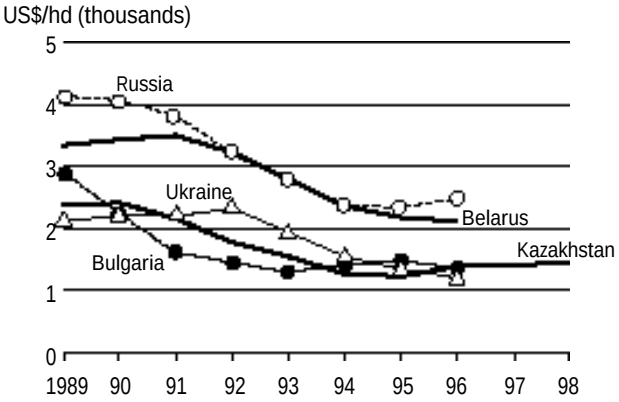

Figure 6. Gross national product per capita, Former Soviet Republics and Bulgaria, 1989–1998.
Source: World Bank, World Development Indicators Database.

5. Short-run impact of structural adjustment programs

6. Measurement error.

The slight upturn in economic performance since the mid 1990s indicated that the worst of the transition was over for economies of the CIS. However, the Russian economic crisis of 1998 has added considerable uncertainty to the immediate economic outlook. The latest forecasts of the IMF for transition economies are summarized in Table 2. Major declines are predicted for 1999 for Russia and Ukraine and these are likely to affect Kazakhstan's rate of growth (which the IMF did not forecast for 1999). Thus the immediate prospects for the Kazakhstan economy are dimmed by the Russian crisis and its likely impact.

For the long-term, Fischer, Sahay and Vegh (1998) emphasize that the fast reforming transition economies are likely to take about 20 years to reach the per capita income levels of OECD countries. Kazakhstan is not adjusting as rapidly as some transition economies closer to Western Europe so a long period of recovery from the economic shocks of the 1990s may lie ahead.

Table 2. IMF forecasts of real GDP 1997 to 1999, transition countries

	Annual percentage change in:					
	Real GDP			Consumer Prices		
	1997	1998	1999	1997	1998	1999
Kazakhstan	2.0	-1.5	..	17	8	8
Kyrgyzstan	6.5	6.0	4.6	26	12	10
Tajikistan	1.7	3.4	4.0	88	64	19
Turkmenistan	-25.9	3.6	12.1	84	17	26
Central Asia and Transcaucasia	2.2	2.1	3.1	31	20	12
Russia	0.7	-5.7	-8.3	15	26	56
Ukraine	-3.2	-1.7	-3.5	16	11	32
Belarus	10.4	7.0	2.0	64	53	75
Bulgaria	-6.9	5.0	3.7	1082	23	7
Romania	-6.6	-5.5	-2.0	155	60	31

Source: IMF, World Economic Outlook 1998.

Other Economic Developments

The broad indicators for the Kazakhstan economy since 1989 are presented in Table 3. Several points merit attention. First, there has been a net emigration from Kazakhstan of the order of 700,000 people since the country's population peaked in 1992. The emigrants are mainly ethnic Russian.

Table 3. Key economic indicators for the Kazakhstan economy, 1989-1998

Year	Population Million	GNP per Capita US$	Rate of Inflation % p.a.[1]	Index of Employment '93=100	T-Bill Interest Rates % p.a.	Exchange Rate Tenge per US$	Exports US$ billion	Foreign Investment US$ billion
1989	16.6	2310	5.8	…	…	…	…	…
1990	16.7	2360	18.8	…	…	…	…	…
1991	16.9	2130	87.5	…	…	…	…	…
1992	17.0	1750	1710	…	…	…	…	0.1
1993	17.0	1530	1370	100	…	2.6	4.21	0.5
1994	16.8	1240	1980	93.6	214.3	35.5	4.28	0.8
1995	16.6	1180	276	81.6	49.0	61.0	5.77	0.9
1996	16.5	1350	39	78.6	28.9	67.3	6.52	1.1
1997	16.4	1360	17	65.2	15.2	75.4	6.80	1.2
1998	16.3	1400	14	55.6[2]	15.0[2]	78.5	7.00	1.7

Source: World Bank, World Tables, IMF, International Financial Statistics, International Herald Tribune, Kazakhstan, 3 June 1998, Kim et al (1998).

[1] The annual inflation rates are based on the implicit GDP deflator from 1989 to 1993. Thereafter they are based on the Consumer Price Index. The 1998 figure is an estimate from the International Herald Tribune 3 June 1998.

[2] Estimates based on mid-May 1998 figures.

Second, inflation reached very high levels between 1991 and 1995 creating considerable uncertainty in the economy. Since then inflation has declined considerably. In its early years, the Tenge devalued rapidly against the US dollar and other non-CIS currencies. The rate of devaluation has fallen considerably in recent years.

Third, exports have grown strongly since 1994 and this has contributed to economic growth. Foreign direct investment has also grown strongly, more than doubling between 1994 and 1998.

Growth of industrial production for different sectors of the Kazakhstan economy between 1995 and 1998, 1st quarter is presented in Figure 7. The fuel and energy-intensive non-ferrous metallurgy sectors have grown strongly when other sectors have declined to varying degrees. Major structural changes are occurring within the economy, driven especially by growth in the energy sector.

Trade

Kazakhstan is an open trading economy. In 1996, trade as a share of GDP was 65% for Kazakhstan (World Bank 1998). Kazakhstan's trade has been strongly oriented to Russia (Figure 8). Natural trade links are towards Russia to the north, north-east and west as well as along traditional routes to Central Asia and western China. However, Russia's economic crisis of 1998 is likely to lead to Kazakhstan diversifying trade towards other markets.

Kazakhstan's other major trading partners are in Western Europe, Central Asia, Eastern Europe and other CIS countries. Central Asian trade is relatively small given the proximity to Kazakhstan. The Central Asian economies are small in terms of total size of economy (total GNP in 1996 of US$80 billion on a PPP basis) compared with Russia (US$ 620 billion), other CIS countries (US$220 billion), Eastern Europe (US$ 630 billion) and Western Europe (US$7760 billion).

The agricultural sector has a comparatively small share of total trade of the Kazakhstan economy (Figures 9 and 10). Agriculture and food represent less than 10% of total trade of the Kazakhstan economy. Agriculture's share of total exports has declined since the early

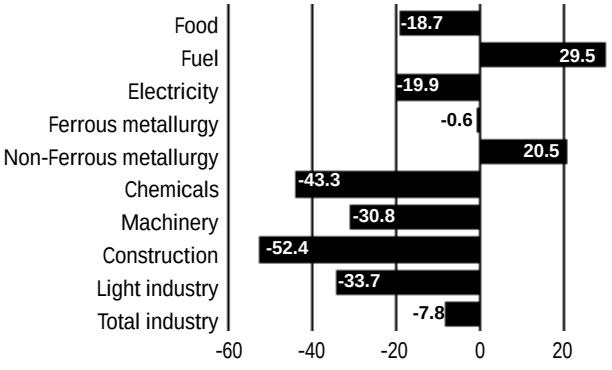

Figure 7. Growth of industrial production in Kazakhstan, 1995–1st quarter 1998.
Source: Kazakhstan Economics Trends.

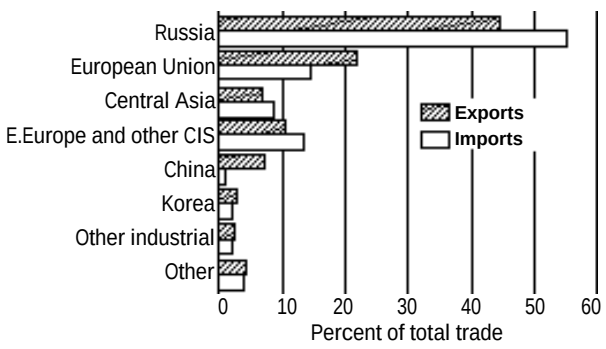

Figure 8. Share of Kazakhstan's trade with other countries, 1996.
Source: IMF, Distribution of Trade Statistics.

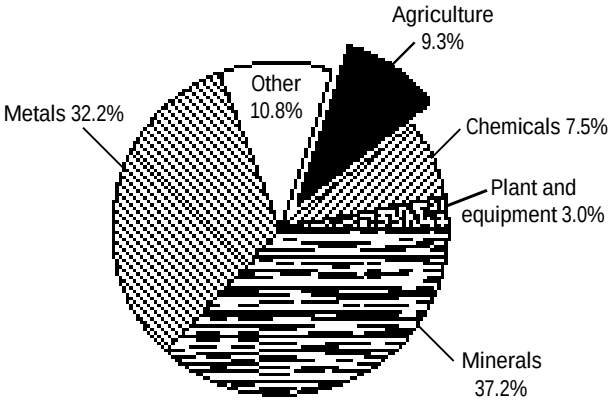

Figure 9. Structure of exports of Kazakhstan, 1996–1997.
Source:Kazakhstan Economics Trends, First quarter 1998.

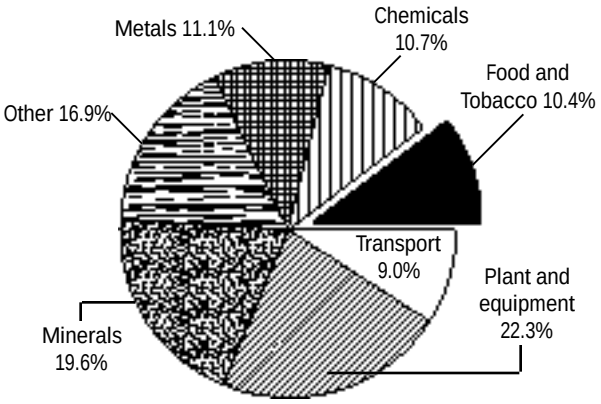

Figure 10. Structure of imports of Kazakhstan, 1996–1997.
Source:Kazakhstan Economics Trends, First quarter 1998.

1990s. In contrast, oil and gas's share has grown rapidly. For example, oil and gas condensate exports doubled in value (US$ terms) between 1995 and 1997 and contributed 24% of total exports in 1997, compared with 16% in 1995 (Kazakhstan Economic Trends 1998, p.41).

Agriculture in the Economy

Agriculture's share of the economy in 1996 and 1997 was between 12-13% (World Bank 1997, Table 12 and 1998, Table 11). The dominant sector is services, whose share of the economy in the same two years was 57%. The first five years since independence saw a major structural change in the Kazakhstan economy. Estimates are that agriculture's share of the economy in the early 1990s was more then 25% (World Bank 1994).

Indices of total food production and of total agricultural production for Kazakhstan and selected countries are presented in Tables 4 and 5. The declines in production appeared to have ended about 1995. However, drought in 1998 and other adjustments have led to another major decline.

Table 4. Index of food production in Kazakhstan, Central Asian and other Former Soviet Union countries, 1992-1998

	Index of Food Production 1989-1991=100						
Year	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Kazakhstan	115	99.5	84	67.4	65.5	65.7	55
Kyrgyzstan	103.3	95.3	91.1	88.5	96.8	94.3	95.6
Tajikistan	79.5	73.3	71.3	67.3	68.2	65.6	68.1
Turkmenistan	84.6	91.8	111.4	117.5	94.7	104.1	103.2
Uzbekistan	108.2	109.7	111.9	115.5	109.1	108.7	110.7
Russia	88.9	84.2	73.4	65.8	68.7	68.2	56.9
Ukraine	72.5	71.8	59.2	62	55.1	58.1	52.8
Belarus	76.9	78.1	59.7	58.5	59.8	58.9	59.7
Bulgaria	88	70.7	70.6	80.9	65	61	61
Romania	79.6	97.8	94.8	102.9	92.9	100.6	94.6

Source: FAOStat.

Table 5. Index of agricultural production in Kazakhstan, Central Asian and other Former Soviet Union countries, 1992-1998

	Index of Food Production 1989-1991=100						
Year	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Kazakhstan	112.8	98.1	83	66.8	64.4	63.8	54
Kyrgyzstan	101.6	95.3	87.4	81.7	87.4	86.2	88
Tajikistan	70	68.8	67.4	60.8	57.7	57.5	59.2
Turkmenistan	89.2	94.6	102.6	105	66.9	78	85.2
Uzbekistan	97.9	100	99.5	101.5	93.2	93	91.7
Russia	88.8	83.9	73.1	65.4	68.2	67.6	56.5
Ukraine	72.6	71.8	59.2	61.8	54.8	57.8	52.5
Belarus	77	78.1	59.8	58.8	59.9	59	59.8
Bulgaria	87.4	69.8	69	78	63.8	60.5	60.5
Romania	79.2	96.8	93.8	101.7	91.9	99.5	93.6

Source: FAOStat.

Declines occurred in both the livestock sectors and the crop sectors. This is indicated by the large falls in livestock numbers and in total cropped area (Figure 11). Total livestock numbers fell by 55% from 1992 to 1998. Of this, intensive livestock (pigs, rabbits and poultry) declined by more than 60%. The declines during the 1990s represent a major downward adjustment of the farm sector overall.

Some scientists argue that the steppe lands had been degraded during the Soviet era and a much lighter use of the land base was needed (Gossen 1998). However, the adjustments have been across livestock and cropping, especially intensive livestock. From 1990 to 1995, domestic investment for the economy overall declined by an average 16% per year and virtually ceased for many industries (World Bank 1997, Table 11). The lack of incentives to invest during this era may have been a major factor behind agriculture's adjustment. The reduction in livestock numbers reflects a major drawing down of their capital stock, boosting current consumption of meat at the expense of future output (Jarvis 1974). Net trade in livestock products remained relatively steady during the 1990s indicating that changes in livestock production were closely related to changes in domestic consumption of livestock products.

Kazakhstan's agriculture became much less intensive during the 1990s. This has meant much lighter use of inputs on the land being cropped and lighter grazing pressure on pastures. An indication of the reduction in use of inputs is that inorganic fertilizer use in recent years has been about 20% of the 1990 level. Kazakhstan was roughly self-sufficient in fertilizer in the early 1990s but has become a net exporter in this item with the reduction in use on farm (Figure 12). As well as fertilizer, farmers have cut back on other input use drastically. Tractors, harvesters and other farm equipment have been receiving minimal maintenance. There has been very little investment in farm machinery which generally is aging and deteriorating.

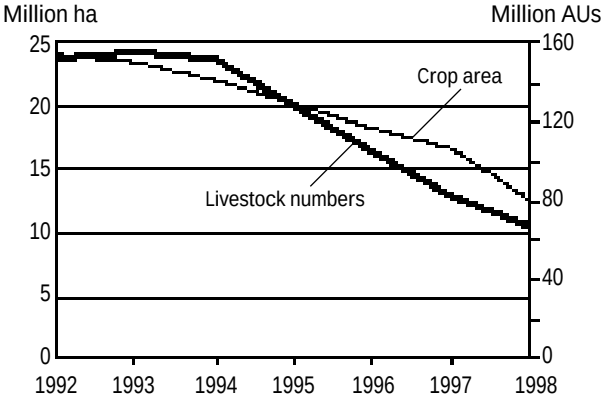

Figure 11. Total crop area and total livestock numbers, Kazakhstan, 1992–1998.

Source: FAOStat. Total livestock number is calculated in Animal Units (AUs) and includes all farm animals and poultry. An AU for a sheep has a value of "1" and for cattle the value is "8".

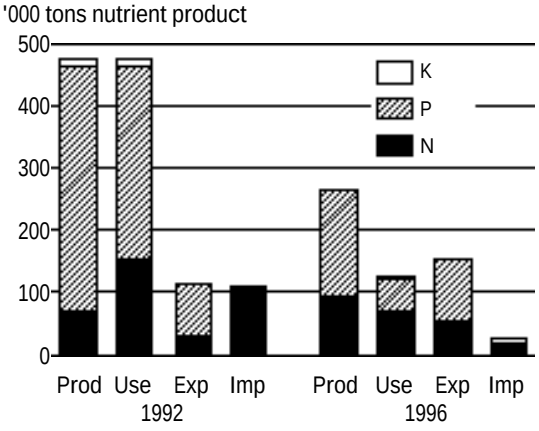

Figure 12. Production, use and trade in fertilizers, Kazakhstan, 1992 and 1996.

Source: FAOStat.

Changing Structure of Farms[2]

Under the Soviet system, four types of farming entities existed:

(1) state farms (sovkhozes)

(2) collective farms (kolkhozes)

(3) household plots of rural families, mainly workers on (1) or (2)

(4) land plots of urban households (gardens and dachas).

In 1990 there were 2188 state farms and 402 collective farms. State farms averaged 80,000 hectares in area, of which 15,000 was arable. The average number of people living on a state farm was 4,000. Collective farms averaged 30,000 hectares in area, of which 5,000 was arable.

Since 1993, major changes have occurred in farm structure. All collective farms were privatized and most state farms have been privatized. Those state farms remaining occupied about 4% of total cropped area in 1997 and were retained specifically for research and elite seed production. By 1997, the new types of farming entities (and share of cultivated area) were:

(1) partnerships and joint stock companies (21%)

(2) cooperatives (48%)

(3) other private enterprises (9%)

(4) peasant (family) farms (17%)

(5) private land (0.5%)

(6) state farms (4%).

Thus cooperatives and joint stock company farms now occupy a large share of the total area cropped. These came from privatizing the state and collective farms, so have similar farm sizes to those prevailing in the Soviet area. Some state farms were allocated to smaller family farms. The number of family farms increased from 16 thousand in 1993 to 62 thousand in 1997. These had an average area of 435 hectares, and that arable was 82 hectares.

The process of privatizing the state properties was complex and involved considerable change to legislation during the 1990s. (Kim *et al*. 1998). Also land is still valued administratively and not in an open market situation. Although title to land is issued, banks are not prepared at this stage to use this as collateral for loans to farmers. Consequently, farmers have faced serious credit difficulties and a lack of funds for purchasing inputs and undertaking farm operations.

[2] This part draws heavily upon Chapter II of Kim *et al*. (1998), who in turn drew heavily upon Asian Development Bank (1996)

Farmers have responded to the lack of credit in several ways. First, they use barter extensively. They exchange farm output for farm inputs and other necessities. This can be done with a forward pricing exchange, so that farmers may agree with local input suppliers to exchange grain after harvest for inputs (e.g. fuel) used before planting. In this situation farmers lose bargaining power and may pay high implicit interest rates in the exchange.

Second they save on inputs. Amongst other input reductions discussed above, cutbacks have occurred in the number of persons working on farms. The unemployment rate in rural areas increased from 5.9% in 1994 to 11% in 1996 (Kim *et al*. 1998) and may have worsened since because of further cost savings by farmers. Another important factor has affected farming in Kazakhstan. Under the state and collective farms, there was considerable specialization of task by individuals. As the number of people working on farms has declined, the farm workers have had to do tasks with which they are unfamiliar. This may be an important change as far as on-farm operational efficiency goes and may take some time before people have learnt a new approach to operating farms.[3]

Economic Interpretation of Agricultural Changes

A simple economic model can assist in explaining the move from the more-intensive farming during the Soviet era to the less-intensive farming of Kazakhstan today. This is depicted in Figure 13. A general production function for agriculture is shown in which output (Y) is related to two factors: (1) the level of farm inputs other than land (X) and (2) the accumulated net investment in agriculture over time (I).

In the Soviet era, state and collective farms were allocated and obtained inputs at minimal artificial prices. Farms were paid a small procurement price for output, however. This was 150 Rubles/t for wheat during the 1980s, which depending on the exchange rate ranged from US$30-70/t. In 1991, the procurement price in Kazakhstan was US$10/t (Kim *et al*. 1998, Table 3-4). In these circumstances, state farms pursuing their own interests would be operated at a level of inputs which maximized yields, depicted by A in Figure 13. For bureaucratic reasons farms may have been allocated inputs taking them beyond A, especially in dry seasons.

In the 1990s, two key events have occurred. First, farmers pay market prices for purchased inputs and receive market prices for output. The incentive through the 1990s has been to reduce inputs strongly as a consequence. This would have taken use of inputs to B but for the second key event. This is the virtual ceasing of investment in agriculture, which has shifted the production function downwards. Another

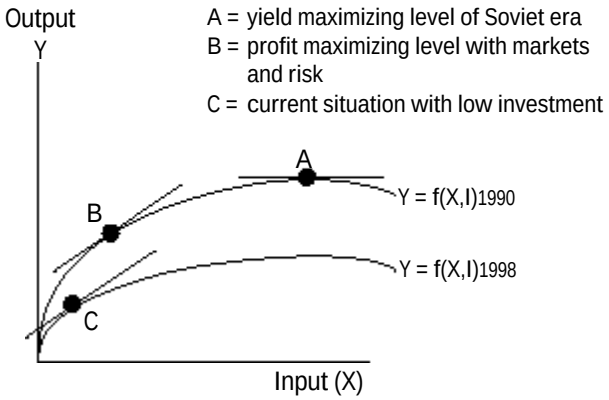

Figure 13. Changes in Kazakhstan agriculture since the Soviet Era.

[3] This point was made in discussion with Hans Braun, CIMMYT wheat scientist for Central Asia and Caucasia.

factor shifting the production function downwards is the long-term degradation of the farm land. Kazakhstan's farmers are depicted to be operating at C in the late 1990s.

It is very important to separate the move to a much less-intensive form of production, A to B, from that involving a lower level of productivity, B to C.[4] Given that farmers now face market prices and considerable price and production risk, their cutback in use of inputs, relative to that of the Soviet era, is to be expected and is probably a lasting shift. It is almost inconceivable under a market system that farmers would purchase inputs and apply them at levels of the Soviet era. Farmers face much higher prices of inputs now than the implicit or artificial prices they faced during the Soviet era.

The loss of productivity from low investment in Kazakhstan agriculture during the 1990s and from land degradation need not necessarily be lasting. Whether the productivity lost can be recovered will depend on policies and prices of wheat, as well as agricultural research and development, land management practices, and related farming circumstances.

Several implications flow if the above analysis reflects the situation of Kazakhstan's agriculture today. Firstly the lower intensity of agriculture is probably driven largely by the move to a market-based economy. Kazakhstan's farmers face considerable price and production risk and do not have strong credit and financial support for dealing with the risks they face. This is likely to continue as a feature of agriculture well into the future, although policy changes to improve the price and financial situation may encourage higher input use. Secondly, there has probably been a significant loss of productivity because of low investment in agriculture during the transition. This is transient and may be recouped with appropriate policy, research and development and marketing changes. Thirdly, the recommendations and technical performance of agriculture that were relevant during the 1980s are no longer relevant. Scientists should develop technologies relevant to a less-intensive form of cropping and agriculture. Fourthly, the reduction in the livestock sector implies lower domestic demand for feed grain which has implications for Kazakhstan's wheat export potential.

Inter-Sectoral Competition in the Kazakhstan Economy

In addition to the above changes, agriculture has been facing strong inter-sectoral competition from growth of the energy sector in Kazakhstan. Major reserves of oil and gas have been discovered in the Caspian Basin. There are proven reserves of 15.5 billion barrels of oil and this estimate could readily double within the next decade (International Herald Tribune 1998). Oil production was 26 million tons in 1997 and is forecast to grow to 80 million tons a year by 2005. In addition to rapidly growing oil output, other energy and minerals production is anticipated to grow strongly (International Herald Tribune 1998, Financial Times 1998, The Economist 1998). Associated with this production growth has been a major increase in direct foreign investment in oil and gas, exploration, drilling and transportation.

[4] Partial productivity of the variable inputs would be higher at B than A, because of diminishing returns.

Developments within other sectors can have an important impact on agriculture's competitiveness. Although data are not available, virtually none of the direct foreign investment in recent years would be for agriculture. Whatever there has been would be very small in comparison with the investments in oil and gas and minerals processing.

There are strong indications that Kazakhstan's agriculture has lost competitiveness in recent years because of the growth of the energy and mining sectors. The loss of competitiveness of the agricultural sector can arise when growth of the energy sector leads to an increase in the real exchange rate (the inflation-adjusted exchange rate). In other words, the value of the local currency, the Tenge, is higher than it would have been without the growth of the energy sector. Thus export prices of grain, when converted to local currency, are weaker than would be the case without the growth in the energy sector.

The real effective exchange rate is the best indicator of any change in competitiveness caused by this inter-sectoral competition between agriculture, other exports and the energy sector. Unfortunately, the IMF does not report the real effective exchange rate for Kazakhstan. However, the rate was calculated and reported in Kazakhstan Economic Trends (1998, Table 6.1). From 1995 to 4th Quarter 1997, there was a 17% real appreciation of the Tenge against the 15 major trading partner currencies of Kazakhstan (*op cit.*).

Further evidence of the real appreciation of the Tenge can be obtained by comparing the real bilateral exchange rate with the US Dollar's movements in real terms. In Table 6 the real bilateral rate of the Tenge against the US Dollar is reported, along with the real effective exchange rate of the US Dollar. Two points should be noted. First, the real bilateral rate against the US Dollar has appreciated strongly since 1995. This implies that the Tenge has been devaluing at a rate less than the difference in the rate of inflation between the Kazakhstan and US economies. Second, this has occurred at a time when the US real effective exchange rate has appreciated and at a time when the US Dollar rate has been very strong in international currency markets. The conclusion is that the movement in the real value of the Tenge in recent years has made exports less competitive in recent years.

What has caused the Tenge to appreciate in real terms? Kazakhstan's economic managers adopted a stabilization program in January 1994 including a flexible exchange rate regime. However, there appears to be some intervention supporting the Tenge. In addition, influences strengthening the real exchange rate in recent years have been the general economic settings for the economy and the growth of the energy sector.

Table 6. Real exchange rate Indices of the tenge compared with the real effective exchange rate of the US dollar, 1995-1998

Year	Real Effective Exchange Rate Kazakhstan[1] 1995=100	Real Bilateral Exchange Rate US$/Tenge[2] 1995=100	Real Effective Exchange Rate USA[3] 1995=100
1995	100.0	100.0	100.0
1996	107.0	118.0	105.4
1997	112.8	131.2	115.3
1998	…	142.4	121.9

Source:

1 Kazakhstan Economic Trends (1998, Table 6.1).

2 Calculated by Spreadsheet from IMF data using the formula: RBER = $e_{Tenge/US\$} \cdot (CPI_{US} / CPI_{Kaz})$; where $e_{Tenge/US\$}$ is the nominal exchange rate and CPI is the Consumer Price Index. The result was inverted and calculated to a base value of 1995 =100.

3 IMF, International Financial Statistics.

The Wheat Sector of Kazakhstan

Wheat Agro-Environments

Two broad agro-environments can be identified for wheat production in Kazakhstan, (1) the northern spring wheat environment and (2) the southern winter wheat environment. The climatic patterns typical of these environments were shown in Figures 2 and 3. The broader environments for spring wheat and winter wheat are shown in Figures 14 and 15, adapted from USDA (1994).

In the northern region (generally between 48-55 degrees latitude N) spring wheat is grown on steppe lands under dryland conditions. Precipitation generally averages less than 300 mm per annum and mean winter temperatures are near -20 degrees C. Precipitation falls as snow through the late fall-early spring period and winds over the open plains can readily cause snow to drift from open fields. The soils of the northern growing areas range from grey forest soils to podzolic chernozem to grey to black chernozem to chestnut to brown semi-desert soils (Committee for World Atlas of Agriculture 1969). These soils in virgin state were never as high in clay content and organic matter as the heavy black earth chernozem soils of Russia and Ukraine. Furthermore, cropping during the past 40 years has lowered the organic content of the soils by 5-30% (Gossen 1998). However, their potential fertility is high (Shegebaev 1997).

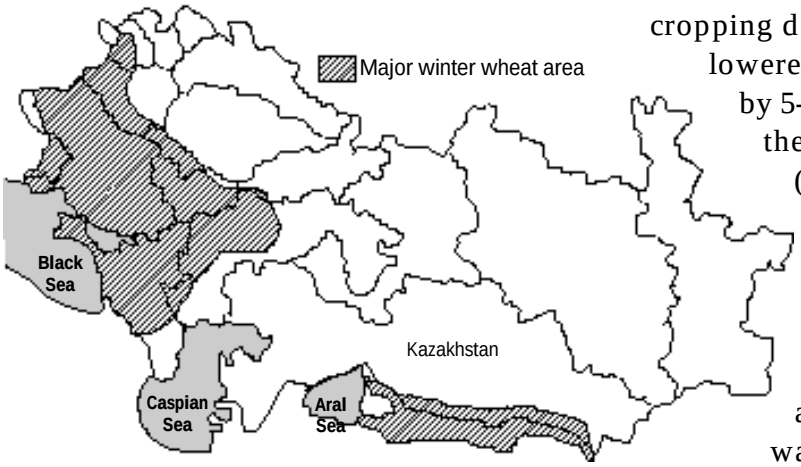

Figure 14. Former Soviet Union: Winter wheat.
Source: USDA (1994).

In the southern region (generally between 42-48 degrees latitude N) winter wheat is grown under irrigated and rainfed conditions. Irrigation water is from rivers fed by mountain snows and where dryland winter wheat is grown it is generally with higher precipitation than in the north. Because winter temperatures are less extreme in the south, winter wheat is grown. The soils are lighter in the south, ranging from loessic to brown semi-desert soils to light silty loams and other alluvial soils (Committee for the World Atlas of Agriculture 1969).

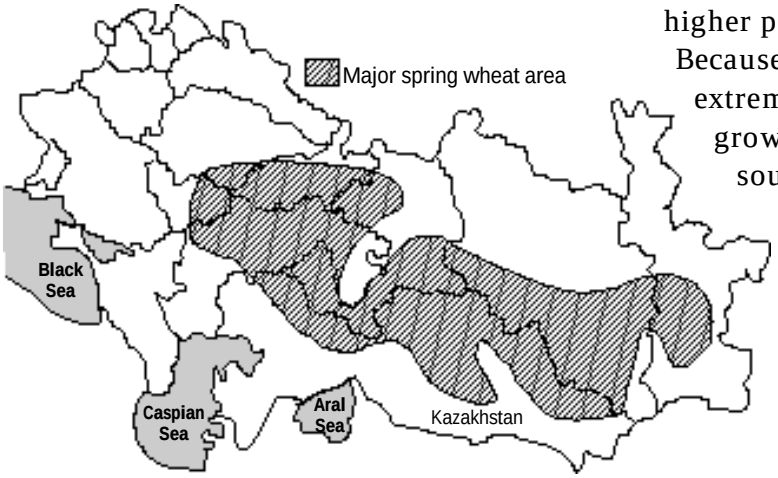

Figure 15. Former Soviet Union: Spring wheat.
Source: USDA (1994).

Because of the comparatively dry conditions and inherent soil fertility, the spring wheat areas grow wheat of high protein content. The protein content usually ranges from 15-18%, the grain has high gluten strength and is superior in quality to wheat produced in other regions of Asia and Europe (Shegebaev 1997). Thus the spring wheat of Kazakhstan has the potential to compete closely with Dark Northern Spring wheat of North America and premium wheat of Australia.

Scientists of Kazakhstan have identified a large number of micro-environments (about 60) within the broad agro-environments introduced above. They reported that they aimed to release particular varieties of wheat for each micro-environment under the Soviet system. Data on the area planted to different varieties were not available. However, the number of widely adopted varieties in farmers fields is likely to be well less than sixty.[5] Kazakhstan served as a major breeding location for other wheat production environments of the Soviet system so considerable interchange of germplasm occurred with Russia and other Soviet republics.

When the privatization of land occurred earlier this decade Kazakhstan's government set aside large areas for publicly-owned farms for research and seed production. This places the country in a good position to multiply the seed of recommended varieties. However, these seed farms have not sold as much seed as hoped, because of lack of demand and shortages of funds and resources for the farms. A program of varietal development would need to ensure that these farms are geared up for future seed production. Farmers retain large amounts of seed from their wheat crops and have not been treating that seed. Elite farms also assist with seed multiplication.

Other Crops and Livestock

While wheat is the principal crop of Kazakhstan, other crops and livestock remain important in the farming systems. The allocation of land to different uses is presented in Figure 16. Despite the large area of land plowed under the Soviet agricultural development program, most of Kazakhstan remains permanent pasture. This ranges from dry desert rangelands to steppe grasslands. In addition a sizable area remains under woodlands and forest. Of the total arable area of 32 million hectares, some 55-60% is cropped. The balance is fallow or temporary pasture.

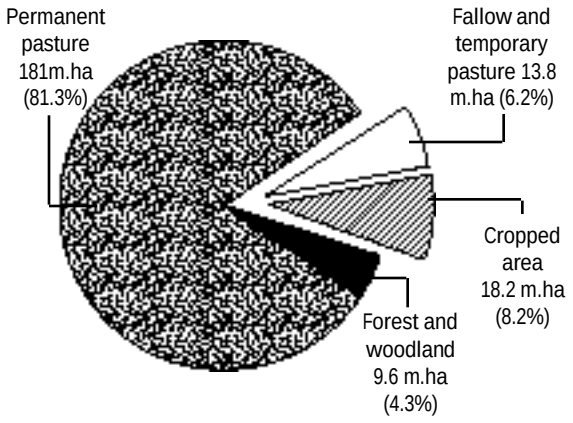

Figure 16. Allocation of agricultural and pastoral lands Kazakhstan 1996 (million ha).
Source: FAOStat.

[5] Data on adoption of particular wheat varieties were not obtained as part of this study. Scope exists for a low-cost survey of wheat varietal use in Kazakhstan. If varietal adoption follows the patterns of other countries, the main varieties in farmers' fields probably number less than twenty (CIMMYT 1993).

The area devoted to different crops is presented in Table 7. The next most important crops for Kazakhstan are barley, oilseed crops, potatoes and cotton. Livestock numbers are presented in Table 8. As well as a major decline in crop area since independence, there has been a major decline in livestock numbers.

Wheat Production Developments

Comparisons between levels of wheat production in recent years in different European and Asian regions and countries are presented in Figures 17 and 18. Both Central Asia's wheat production and that of Kazakhstan are dwarfed by China, the European Union and South Asia. Nevertheless, Kazakhstan's wheat sector is important to Central Asia. Kazakhstan is the dominant wheat producer of Central Asia and ranks third behind Russia and Ukraine in wheat production amongst CIS countries. Kazakhstan is the most important high protein wheat producer of Asia and Europe.

Table 7. Land use by crop, Kazakhstan 1992-97

million hectares

	1992	1993	1994	1995	1996	1997	1998
Wheat	13887	12750	12620	12552	12280	11512	9534
Barley	5718	6972	6053	4826	3640	3182	2900
Rice	121	112	102	95	89	85	80
Maize	126	117	138	86	86	69	60
Other Cereals	2624	2160	1680	1186	1015	772	715
Sub-Total	22466	22111	20593	18745	17110	15619	13289
Oil Crops	538	413	447	518	468	341	341
Potatoes	247	244	218	206	189	176	180
Cotton	112	110	111	110	106	104	103
Sugar Beet	85	69	56	41	32	11	12
Vege-tables	108	89	104	108	105	129	129
Fruit	66	51	70	75	131	117	117
Total	25624	25080	23593	21798	20137	18495	16169
Wheat's Share (%)	54	51	61	58	61	62	59

Source: FAOStat

Table 8. Total livestock numbers, Kazakhstan 1992-98

thousand head

	1992	1993	1994	1995	1996	1997	1998
Cattle	9084	9576	9347	8073	6860	5425	4307
Buffalo	120	110	105	105	100	100	100
Horses	1666	1704	1777	1636	1557	1310	1083
Asses	45	45	40	40	40	40	40
Camels	145	149	155	141	130	111	97
Sheep	33908	33732	33312	24273	18786	13000	9969
Goats	692	688	897	859	799	679	415
Pigs	2794	2591	2445	1983	1623	1036	879
Rabbits	117000	115100	116300	89900	74900	58800	56000
Chicken	58000	51000	48000	32410	20650	15300	15890
Turkeys	459	433	388	266	156	117	102
Total Animal Units (million)	151	154	152	126	106	83	67

Source: FAOStat. Animal units were calculated as follows: Cattle = 8 AUs, Buffalo = 10, Horse = 10, Ass = 5, Camel = 15, Sheep = 1, Goat = 1, Pig = 2, Rabbit = 0.1, Chicken = 0.1, Turkey = 0.6.

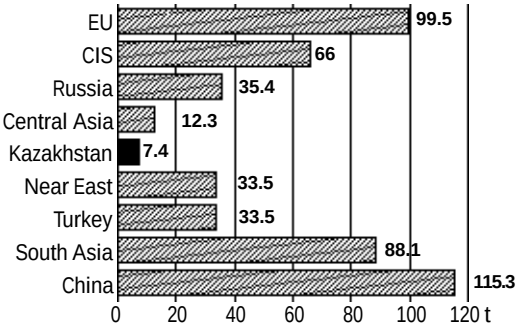

Figure 17. Wheat production in Asia and Europe, average 1996–98.

Source: FAOStat and Intl Grains Council Market Report No. 293.

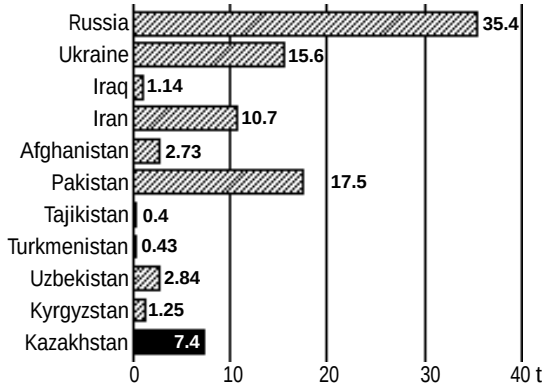

Figure 18. Wheat production in selected countries near Kazakhstan, average 1996–98.

Source: FAOStat and Intl Grains Council Market Report No. 293.

The area, yield and production of wheat and all cereals in Kazakhstan is presented in Table 9.[6] The area, yield and production of spring wheat and winter wheat in Kazakhstan is presented in Table 10. The area of wheat from 1960 to 1998 is shown in Figure 19. The area peaked in 1965, and was steadily declining during the Soviet era. Gossen (1997) highlights some of the biological considerations in the decline, especially the drawing down of soil organic matter in the steppe soils. Since 1990, the wheat area declined by more than 4 million hectares, a reduction of just over 30%.

While the area of wheat in Kazakhstan declined rapidly since independence, that of Central Asian countries has grown substantially during the 1990s. From 1992 to 1998, the wheat area of Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan combined grew from 1.25 million hectares to 2.8 million hectares.[7]

The spring wheat area has been the main source of the decline of the total wheat area

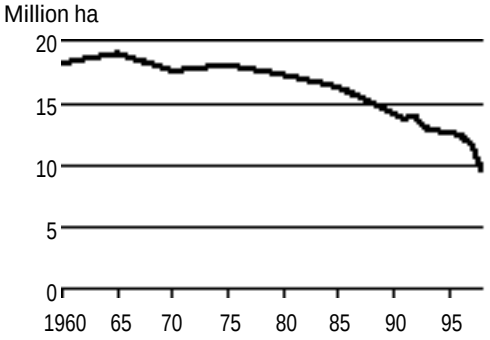

Figure 19. Total wheat area, Kazakhstan, 1960–1998.
Source: Government of Kazakhstan and FAOStat. Note that the data were available only at 5-year intervals from 1960 to 1985.

Table 9. Area, yield and production of wheat and all cereals, Kazakhstan, 1960-1998

	Wheat			All Cereals		
Year	Area mha	Yield t/ha	Production mt	Area mha	Yield t/ha	Production mt
1960	18.05	0.85	15.34	22.01	0.85	18.71
1965	18.84	0.31	5.84	24.52	0.31	7.6
1970	17.52	0.98	7.17	22.69	0.98	22.24
1975	17.91	0.47	8.42	25.55	0.47	12.01
1980	17.09	1.09	18.61	25.34	1.09	27.51
1985	16.16	0.94	15.11	25.13	0.96	24.16
1986	15.60	1.07	16.74	24.56	1.15	28.31
1987	15.31	1.05	16.11	24.53	1.12	27.44
1988	14.88	0.82	12.16	24.29	0.93	22.56
1989	14.39	0.85	10.78	23.81	0.85	20.24
1990	14.07	1.34	16.20	23.34	1.34	31.28
1991	13.45	0.51	6.89	…	…	…
1992	13.88	1.32	18.28	22.60	1.32	29.77
1993	12.75	0.91	11.59	22.25	0.97	21.63
1994	12.62	0.72	9.05	20.71	0.79	16.45
1995	12.55	0.52	6.49	18.88	0.50	9.51
1996	12.28	0.63	7.68	17.19	0.65	11.24
1997	11.51	0.78	8.96	15.85	0.78	12.38
1998	9.53	0.52	5.00	13.29	0.50	6.68

Source: Kazakhstan State Committee for Statistics, FAOStat.

Table 10. Area, yield and production of spring wheat and winter wheat, Kazakhstan, 1960-1998.

	Spring wheat			Winter wheat		
Year	Area mha	Yield t/ha	Production mt	Area mha	Yield t/ha	Production mt
1960	…	0.84	…	…	1.00	…
1965	…	0.31	…	…	0.42	…
1970	...	0.96	…	…	1.39	…
1975	…	0.47	…	…	0.61	…
1980	15.85	1.08	17.12	1.25	1.15	1.44
1985	15.17	0.93	14.11	0.99	1.02	1.01
1986	14.54	1.06	15.41	1.06	1.25	1.33
1987	14.16	0.98	13.88	1.15	1.95	2.24
1988	13.96	0.77	10.75	0.92	1.48	1.36
1989	13.29	0.70	9.30	1.10	1.32	1.45
1990	12.87	1.11	14.29	1.20	1.64	1.97
1991	12.25	0.46	5.59	1.20	1.08	1.30
1992	12.66	1.31	16.54	1.19	1.46	1.74
1993	11.44	0.84	9.65	1.13	1.71	1.93
1994	11.62	0.70	8.17	1.00	0.88	0.88
1995	11.75	0.50	5.87	0.80	0.78	0.62
1996	11.62	0.62	7.16	0.66	0.77	0.51
1997	10.87	0.75	8.20	0.64	1.41	0.90
1998	8.90	0.51	4.50	0.60	0.83	0.50

Source: Kazakhstan State Committee for Statistics, FAOStat.

[6] The longer term historical perspective on crop production in Kazakhstan is well reviewed in Gossen (1997) and agriculture in the Soviet era is detailed in Committee for World Atlas of Agriculture (1969).

[7] Data from FAO for 1998 imply the area is 1.9 million ha, but latest information with CIMMYT's wheat specialists direct from Central Asian countries is that the area was 2.8 million in 1998.

of Kazakhstan. The spring wheat area has approximately halved since its peak of the mid 1960s and declined by about 4 million hectares between 1990 and 1998. The much smaller winter wheat area was relatively stable around 1-1.2 million hectares during the Soviet era, but has since fallen to around 600 thousand hectares.

The average yield of wheat in Kazakhstan from 1960 to 1998 is presented in Figure 20. The upwards trend in yield during the Soviet era was slightly more than 2% per annum, with considerable variation about the trend. At 1990, the trend yield was about 1.1 t/ha. However, since independence, average yields have declined considerably. Because of major droughts in 1991, 1995 and 1998 and record yields in 1990 and 1992, identifying a trend through the 1990s is difficult. However, it appears from visual appraisal of the data, regression analysis of yields against time during the 1990s and Gossen (1997) that the expected yield in 1998 was 650-700 kg/ha.

The average yields of spring wheat and winter wheat are presented in Figure 21. The yields are fairly closely correlated (r =.7) indicating that the weather and economic influences in the spring wheat areas tend to have a similar impact on winter wheat yields. Winter wheat yields are higher than those of spring wheat by about 50%, on average.

Comparisons of Kazakhstan's average wheat yield with those of other Central Asian countries and with Russia are presented in Figures 22 and 23. Note that wheat yields for other Central Asian countries have risen since 1992, an interesting contrast with yields in Kazakhstan. The other Central Asian countries grow winter wheat and in irrigated and in higher-rainfall locations than Kazakhstan.

Why Kazakhstan's winter wheat yields have not risen in line with other Central Asian countries is an interesting question. The evidence suggests that policies, technologies, and other factors at play in Kazakhstan have not been dominant in other Central Asian nations.

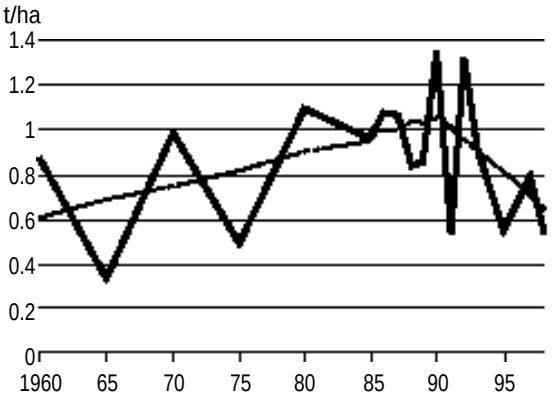

Figure 20. Average wheat area, Kazakhstan, 1960–1998.

Source: Government of Kazakhstan and FAOStat. Note that the data were available only at 5-year intervals from 1960 to 1985.

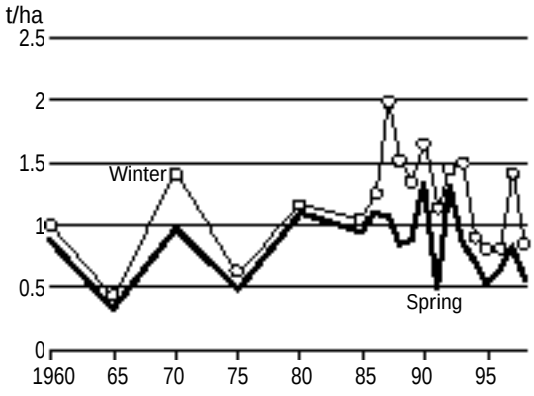

Figure 21. Average yield, spring wheat and winter wheat, Kazakhstan, 1960–1998.

Source: Government of Kazakhstan and FAOStat. Note that the data were available only at 5-year intervals from 1960 to 1985.

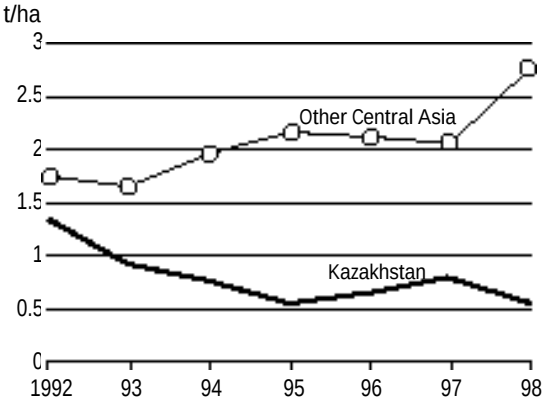

Figure 22. Average wheat yield, Kazakhstan and other Central Asian countries, 1992–1998.
Source: FAOStat.

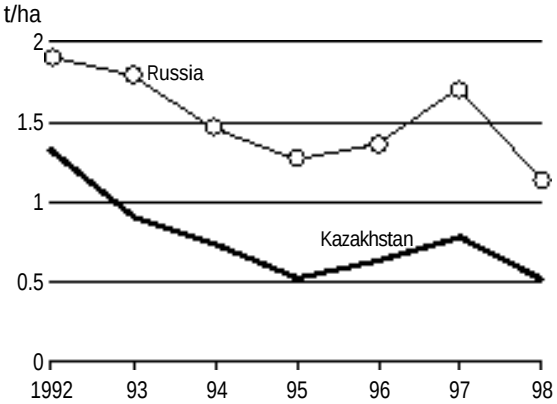

Figure 23. Average wheat yield, Kazakhstan and Russia, 1992–1998.
Source: FAOStat.

Contrast that with the close correlation in movement in average yields between wheat in Kazakhstan and in Russia. Factors at play affecting wheat yields in Kazakhstan appear to be similar to those in Russia.

The combined effects of declines in area and in yield of wheat have led to a major drop in wheat output. The drought-affected crop of 1998 was estimated to be 5.5 million tons (FAO 1998, IGC 1998). However, removing the drought impact, production would have been approximately 7-8 million tons in 1998.[8] This can be contrasted with average levels of production for the 1970s and 1980s of around 15 million tons.

Wheat Production Technology

Wheat production technology has changed dramatically in Kazakhstan in the past ten years. Low profitability and higher risks for farmers have altered the wheat cropping system in various ways. For both spring wheat and winter wheat, farmers have minimized the inputs as follows:

1. One plowing only
2. One harrowing only (sometimes omitted)
3. Plant without fertilizer, and with lighter planting rate, 120kg/ha in spring wheat area
4. No sprays
5. Minimal maintenance on machinery
6. No treatment of seed
7. Retain all seed.

[8] Based on a trend yield of 700 kg/ha and 10-11 million ha as compared to the actual yield of 520 kg/ha on 9.2 million ha.

Typical crop rotations for spring wheat and winter wheat are presented in Table 11. While there is considerable variation around these typical patterns, the farmers have moved towards less intensive rotations which involve less intensive stocking of the land used for grazing also. Stocking rates are not high in Kazakhstan presently. The total grazing livestock numbers amount to just under 60 million animal units (an animal unit is equivalent to one sheep in terms of feed requirements). With these on some 15 million hectares of arable land which is fallow / grazing and some 80-100 million hectares of steppe pastures ranging into desertic pastures and shrubs, the average stocking rate is about one sheep per two hectares.

Costs of producing spring wheat at two levels of intensity of technology are presented in Table 12. These are compiled using input prices that prevailed in 1998. Estimated trend yields are employed also. Machinery costs were calculated using procedures similar to those employed in Byerlee and Longmire (1985). The opportunity cost of land in this calculation was taken to be the return from the land in its alternative pastoral use, sheep production. The stocking rate for sheep was taken to be one sheep per two hectares. The net return to sheep per hectare was calculated to be US$8.40.

In the switch to less-intensive wheat production during the 1990s, farmers have almost halved the production costs per hectare. In fact, many farmers might have saved even more than this by using old equipment and thus having lower

Table 11. Typical crop rotations for spring wheat and winter wheat, Kazakhstan

Year	Spring Wheat Intensive	Spring Wheat Extensive	Winter Wheat
1	Wheat	Wheat	Wheat
2	Fallow/Grazing	Fallow/Grazing	Sugar beet/maize
3	Wheat	Fallow/Grazing	Barley
4	Fallow/Grazing	Wheat	Wheat/Grasses
5	Wheat	Fallow/Grazing	Grasses/Potato
6	Barley	Fallow/Grazing	Grasses/Fallow
7	Wheat	Wheat	Wheat

Table 12. Cost per hectare of operations under intensive and low-input cropping technology, spring wheat, north Kazakhstan, 1998

Operation	Intensive Technology			Low-Input Technology		
	Number or Amount	Cost per Hectare Tenge	Cost per Hectare US$	Number or Amount	Cost per Hectare Tenge	Cost per Hectare US$
Ploughing	1	931	11.63	1	931	11.63
Snow Furrowing	1	388	4.85	0	0	0
Harrowing	2	776	9.69	1	388	4.85
Seed (kg)	150	1440	18.00	120	1152	14.40
Planting	1	388	4.85	1	388	4.85
Fertilizer (kg nutrients)	50	1600	20.00	0	0	0
Spraying	2	776	9.69	0	0	0
Agrochemicals		1200	15.00	0	0	0
Harvesting		1354	16.92		1354	16.92
Drying and Storage (t)	1.1	440	5.50	0.7	280	3.50
Financing Inputs @ interest rate	20%	750	9.37	20%	286	3.57
Land Cost		669	8.36		669	8.36
Miscellaneous @ 5%		443	5.53		211	2,63
Total		11152	139.40		5658	70.72

Source: Spreadsheet file.

depreciation and finance costs for machinery than in the tables. How costs per ton produced alter under different scenarios is analyzed later in this report.

Wheat Marketing and Transport

The marketing system for wheat in Kazakhstan relied heavily on procurement by government until the mid-1990s. However, this method of selling has declined considerably as indicated in Figure 24. By withdrawing from purchasing most of the wheat produced, the government was seeking to encourage the development of a private marketing system for the grain. One form of selling of grain that has grown rapidly is barter. Generally, farmers do this with local input suppliers. The latter then sell the grain on to the private trade. The private trade has grown as state involvement has declined. However, because of low wheat prices in 1998, the government announced that it would purchase up to 1 million tons in 1998 marketing season at US$80/t for the current season.

There are more than ten grain trading companies in Kazakhstan, and they own elevators and grain processing facilities (Kim *et al*. 1998). Kazakhstan has about 11 million tons of elevator storage capacity, with both horizontal and vertical storage facilities. The country has considerable infrastructure for grain transport. Railways and roads were an investment priority during the Soviet era and these remain in reasonable working condition. Infrastructure generally has been receiving little investment in recent years, although the Government announced in 1998 that a new terminal would be built at Aktau, on the Caspian Sea, to encourage growth in exports of wheat to Iran.

The grain marketing system is still evolving and farmers in 1998 raised considerable concerns about domestic wheat marketing. One concern is that the marketing of grain has become concentrated amongst a small number of private grain trading firms. Another concern was the size of transaction costs involved in marketing of grain, including taxes. Considerable scope exists for analysis of grain marketing and for training about grain marketing in Kazakhstan. The marketing institutions are weak and considerable development is needed, with respect to information, grading, quality and pricing.

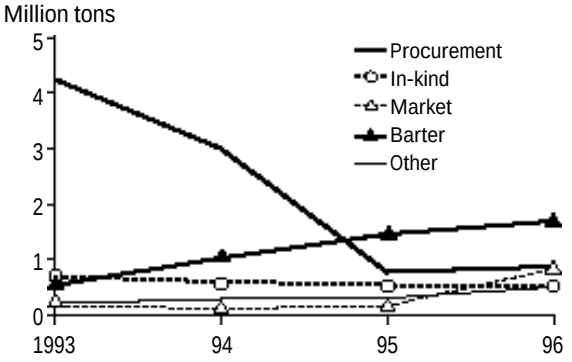

Figure 24. Changing use of wheat marketing channels by farmers in Kazakhstan, 1993–1996.
Source: KSRIAE.

Price Determination in the Kazakhstan Wheat Market

Kazakhstan is usually a net exporter of wheat. The commodity balances for wheat for selected years are presented in Table 11. Note that these data are from US Department of Agriculture sources and may differ from figures available from the FAO or other sources. Also the last four years of the tables have estimates which are not verified with latest stocks data. They are indicative of the situation for Kazakhstan's wheat market generally.

Table 13. Commodity balance sheets for wheat in Kazakhstan, 1987/88 to 1998/99

Marketing Year	Opening Stocks	Production	Imports	Total Supply	Exports	Domestic Use:	of Which Food	of Which Feed	of Which Seed	Closing Stocks
	thousand tons									
87/88	1,500	16,108	100	17,708	6,850	9,139	1,900	3,500	2,300	1,719
88/89	1,719	12,162	300	14,181	4,500	8,291	1,800	3,300	2,200	1,390
89/90	1,390	10,783	250	12,423	2,900	8,087	1,800	3,300	2,200	1,436
90/91	1,436	16,197	100	17,733	5,000	9,408	1,900	3,800	2,100	3,325
91/92	3,325	6,889	300	10,514	1,400	7,364	1,800	3,000	2,100	1,750
92/93	1,750	18,285	125	20,160	5,800	9,569	2,050	3,500	2,050	4,791
93/94	4,791	11,585	0	16,376	5,500	7,001	2,000	2,000	2,000	3,875
94/95	3,875	9,100	0	12,975	4,500	5,971	1,900	1,500	1,900	2,504
95/96	2,504	6,490	3	8,997	2,663	5,399	1,800	1,200	1,890	935
96/97	935	7,680	11	8,627	2,140	5,330	1,800	1,100	1,849	1,156
97/98	1,156	8,960	10	10,126	3,073	5,154	1,800	1,000	1,696	1,900
98/99	1,900	5,000	10	6,910	1,500	4,408	1,800	900	1,288	1,002

Source: 1987/88 to 1994/95 - U.S. Department of Agriculture, Website http://usda.mannlib.cornell.edu/data-sets/international/95008/A/
1995/96 to 1998/99 - authors' estimates. Stocks data are calculated as the residual and may differ from actual stocks.

Because Kazakhstan is a net exporter of wheat, export prices are the main force determining the prices paid for wheat on farm. Marketing margins and transport costs drive a wedge between the export price obtained (on rail or truck at the border) and the farm price paid. The exchange rate also influences the difference between export prices and on-farm prices. U.S. dollars are used as the basis for pricing export grain and Kazakhstans' farmers think in terms of U.S. dollars as readily as local currency.

Wheat Prices

The prices received for wheat sold by farmers through all marketing channels is reported in Figure 25. These are a weighted-average of prices obtained through the four main marketing channels, including barter. Real prices in local currency are also shown. There was a sizable decline in real prices from 1996 to 1998. This is also reflected in Figure 26, which shows the Kazakhstan prices received converted to US dollars.

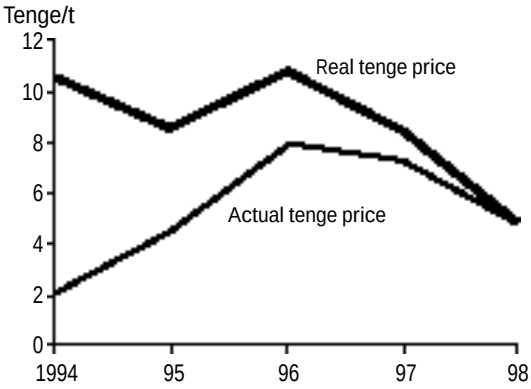

Figure 25. Average wheat price received by farmers, all marketing channels, Kazakhstan, 1994–1998.
Source: Government of Kazakhstan, State Statistical Office.
Note: Real prices are calculated using the CPI as the deflator.

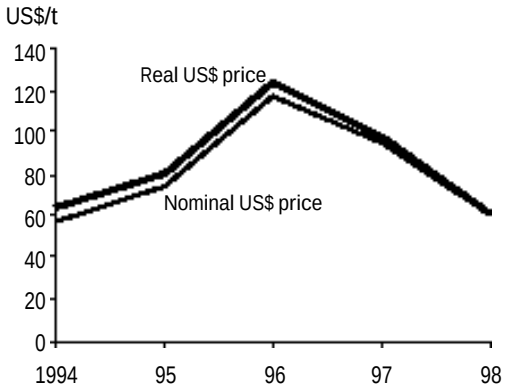

Figure 26. Average wheat price received by farmers, all marketing channels, Kazakhstan, 1994–1998, U.S. dollar terms.
Source: Government of Kazakhstan, State Statistical Office.
Note: The real US$ price of wheat in Kazakhstan has been calculated using the US index of inflation.

The decline of wheat prices received in Kazakhstan from US$100/t to US$60/t from 1997 to the drought year of 1998 concerned farmers considerably. The US export price of Hard Red Winter (HRW) wheat declined from US$147/t in the July-September quarter of 1997 to US$111/t in the same quarter 1998. Kazakhstan farm prices declined with world wheat prices. However, production of wheat in Kazakhstan declined considerably in 1998, so that Kazakhstan became approximately self-sufficient in wheat. In this case prices might be expected to increase relative to the world price, if anything. Two factors might explain the decline. Firstly, demand may have contracted sharply because of general financial uncertainty, the collapse of Asian and Russia's economies and declining livestock numbers. Secondly, grain traders may have been widening margins to boost profits and to cover additional risks.

Analysis of how the price paid to Kazakhstan farmers in 1998 compares with international prices was then undertaken. The first analysis involved pricing wheat on farm in northern Kazakhstan (at Shortandy, north of Astana) using the US export price of HRW wheat. The ocean freight rate employed was for grain from the US Gulf to St. Petersburg. Rail freight rates were obtained from Kazakhstan Rail's freight division. Moscow was used as the deficit consumption location and thus the point where prices peak. The results are shown in Table 14. For an export price at the US Gulf of US$116/t the on-farm parity price at Shortandy is US$93/t. This is considerably above the price of around US$60/t that farmers were receiving.

A second analysis was undertaken to compare prices received by farmers with bread prices in Kyrgyzstan, one of the export destinations for Kazakhstan wheat. The analysis is reported in Table 15. In this case, standard allowances were used for value adding at

Table 14. Pricing high quality wheat on farm at Shortandy, Akmola Oblast, in competition with imported HRW wheat from the USA in the Moscow market, September 1998

Item	US$/t	Tenge/t
Export price, U.S. Gulf, Hard Red Winter Wheat	116	9280
Freight cost, U.S. Gulf to St. Petersburg	22	1760
Import price, St. Petersburg, c.i.f.	138	11040
Transport cost, St. Petersburg to Moscow	15	1200
Landed price, Moscow	153	12240
Transport cost, Tabyl to Moscow	28	2240
Border price, Tabyl	125	10000
Transport cost, Shortandy to Tabyl	6	496
On rail price, Shortandy	119	9504
Loading at rail	3	240
Transport cost, farm to Shortandy rail	3	224
Trade commission and fees (10%)	10	800
Less quality adjustment	10	800
On-farm parity price	93	7440

Source: IGC (1998), Kazak Rail, Kim *et al.* (1998), spreadsheet analysis.

Table 15. Pricing wheat on farm at Shortandy, Akmola Oblast, using the bread price in the central market, Bishkek, Kyrgyzstan, September 1998

Item	US$/t	Tenge/t
Retail price of bread, Bishkek, US$0.30/kg	300	24000
Less retailer's margin, 30%	210	16800
Less baker's margin, 20%	168	13440
Less wheat to flour conversion, 83%	139	11155
Plus bran etc. by-products of milling, 17%	154	12345
Less local miller's margin, 15%	131	10493
Less local agent's margin, 10%	118	9444
Local transport Bishkek, rail to mill	3	200
Local price of wheat on rail, Bishkek	116	9244
Less rail freight, Shortandy to Bishkek	18	1440
On rail price, Shortandy	98	7804
Loading at rail	3	240
Transport cost, farm to Shortandy rail	3	224
Trade commission and fees (10%)	9	720
On-farm parity price	83	6670

Source: Kyrgyz Agricultural Market Information System, p.3, *The Central Asian Post*, 28 September 1998. Marketing margins are set conservatively and actual costs may be less than the margins employed.

different levels of the market. In this analysis the on-farm parity price is US$83/t, again well above prices received by farmers in 1998 despite using marketing costs in the analysis which were probably more than actual.

What price of wheat might Kazakhstan expect to receive for wheat in the future? To consider this, long-term trends in world export wheat prices were constructed. The prices in real terms (base 1998) and the trends for those prices over the past twenty years are presented in Figure 27. Three types of wheat were included, US HRW No 2, US Dark Northern Spring No 2 14% protein, and Australian Prime Hard 14% protein. At October 1998, the real price of US HRW was about US$150/t. While the prices and trends of DNS and APH wheat were above those of HRW, the latter was used as the basis for estimating prices to be received in the future by Kazakhstan's farmers.

IFPRI estimated the likely long-term movement in real wheat prices under different conditions (Rosegrant, Agcaoili-Sombilla and Perez 1995). They projected a decline in real prices in the baseline scenario from 1990 to 2020 from US$156/t to US$132. Employing this rate of decline and applying it to a base price of US$150/t in 1998, the real US export price to be expected in 2005 is US$144/t and in 2010 is US$140/t. While considerable variation around this level is highly probable, it provides a basis for gauging the future competitiveness of Kazakhstan's wheat sector. These translate into real US prices on farm in northern Kazakhstan of US$104/t and US$100/t, respectively, assuming the same differential between Kazakhstan and US prices as in 1998.

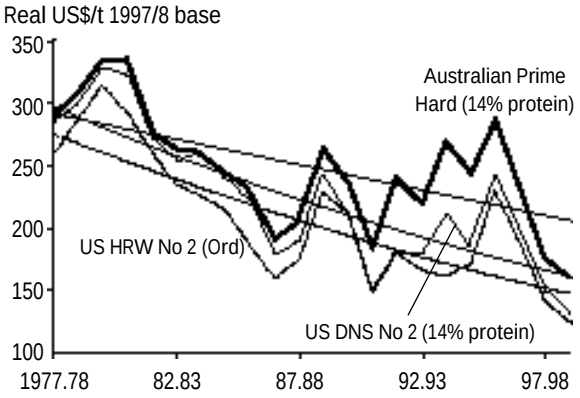

Figure 27. Long-term movements in real export prices of wheat, USA and Australia, 1977/78–1997–98.
Source: International Grains Council.
Note: Real prices are calculated using the US CPI as the deflator.
US export prices are fob US Gulf, Australia's is fob East Coast

Competitiveness of Wheat Production

Background to Competitiveness

Competitiveness is defined as 'the ability of businesses or industries to compete internationally' or 'the ability of businesses or industries in one country to compete with those of other countries' (EPAC 1991). Thus competitiveness relates to firms or an industry and not to the nation. Competitiveness should not be confused with absolute advantage, comparative advantage and competitive advantage of nations, all of which relate to competitiveness but are not the same concept (Porter 1990, Krugman 1991, Warr 1994). Also a measure of competitiveness should be a relative measure, since ability to compete is always relative to competition (Hu 1995). In the case of wheat in Kazakhstan, the competition derives from wheat exporters from other parts of the world. As well, the competitiveness of Kazakhstan's wheat sector will be affected by developments in other sectors of the economy since farmers are facing inter-sectoral competition for resources.

How has competitiveness been measured by economists? One approach has been to measure the change in prices of tradables (i.e. goods and services traded or with potential to be traded) relative to prices of domestic goods and services. As prices of tradables rise relative to prices of domestic goods and services, the competitiveness of the tradables sector will rise. Unfortunately, data limitations prevent measuring prices of tradables and non-tradables for most economies. A related method of analyzing changes in competitiveness has been widely used. This involves measuring movements in the real effective exchange rate.[9] However, this gives the general picture for the tradables sector as a group and not for specific enterprises or industries within it.

Another way of assessing competitiveness has been to measure a country's share of world exports in a particular commodity or other export item. If a country's share of total wheat exports is growing in relation to competitors, for example, this may reflect increasing competitiveness of that country's wheat sector. However, it may also reflect a policy which is encouraging exports and boosting that country's market share. In this case the gain in market share is not because the industry has gained competitiveness, it is because of a policy which is not increasing competitiveness at all. The measure of market share is a rather loose measure of competitiveness as a consequence.

Each year, two different institutes based in Switzerland compile indices of competitiveness for a wide range of countries.[10] These are based on detailed surveys of people in business and government with knowledge of the countries included. League tables are published which rank countries according to their competitiveness index. While useful, care is needed in interpreting these indices. The main caution is that 'no nation can be competitive…in everything' (Porter 1990, p.7). For further elaboration on this point see Krugman (1991).

Despite considerable development in measuring policy effects, effective protection and domestic resource costs, economists have made little progress in measuring competitiveness. Few economists have attempted the exercise. In this paper a simple approach to measuring competitiveness is employed at the farm level in Kazakhstan. Likely costs of wheat production are compared with likely prices to be received by Kazakhstan's wheat farmers. The likely prices will be determined largely by international wheat prices and marketing and transport cost differentials. Providing costs of production and marketing generally can be maintained near or below the price of competing exports in markets of relevance to Kazakhstan, her wheat growers will be competitive.

Another general caution on interpretation of the measure. Economics tells us that costs vary at the margin according to intensity of inputs and other marginal conditions. We also know that farms differ in their productivity and profitability due to many farm or firm-specific differences. The analysis in this study is for the average or representative grower and does not attempt to capture differences between farms. However, the analysis is conducted for several levels of intensity of inputs and using alternative levels of productivity and price.

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[9] The real effective exchange rate is the index for a country of the trade-weighted currency exchange rates with major trading partners, each adjusted for relative rates of inflation at home and in the partner country. The latter is compiled by the IMF and reported in their *International Financial Statistics* for most countries.

[10] The websites for the two institutes are http://www.imd.ch/wcy/brochure.html and http://www.weforum.org/publication/gcr/ .

Measuring Competitiveness

For this study, competitiveness is measured by comparing the likely prices that Kazakhstan's wheat farmers will receive for their product at the farm in the future against their likely production costs per ton. This requires translating expected world prices of wheat in the future into their on-farm parity price at a representative location in Kazakhstan. The location is near Shortandy, north of Astana in Akmola Oblast, in the heart of the spring wheat area of northern Kazakhstan. The parity pricing method was presented in Table 11 above. Moscow is taken as the deficit consumption region and Kazakhstan's wheat is priced against competing product in that market.

Likely future prices of wheat for Kazakhstan were calculated using the trend in the US export price of Hard Red Winter wheat after it was converted to real terms (using the US CPI). The trend price of US HRW (No.2) at US Gulf was approximately US$150/t in 1998. The annual average decline in the trend estimated over 1977/78 to 1997/98 was -2.9%, a decline considerably higher than found for other analyses. Future declines in the real export price were based on IFPRI's long-term decline in real wheat prices reported for their baseline projections (Rosegrant, Agcaolli-Sombilla and Perez 1995, Table 2). Applying those rates of decline in future years, the real US export price was calculated to be US$144/t in 2005 and US$140/t in 2010.

These were translated into on-farm parity prices assuming that real costs per ton in the transport and marketing chain between the US Gulf Port and Moscow and the farm in Kazakhstan to Moscow do not change.[11] The trend in real ocean freight rates from US Gulf to St. Petersburg was estimated for the years 1977/78 to 1997/78. It declined at 3.1% per year on average. However, domestic transport charges in Kazakhstan and Russia are likely to decline by a similar rate in the future as marketing and transport efficiency improves. Overall the net effect of assuming no change in real charges along the marketing chain is likely to be small because of offsets in the freight differential between the U.S. Gulf to Moscow and Shortandy to Moscow.

The on-farm parity prices calculated from the above analysis were US$104/t in 2005 and US$100/t in 2010, respectively. There was thus a US$40/t net freight and marketing cost differential between the US Gulf Price and that on farm in northern Kazakhstan. As an alternative, the approximate US$60/t differential that applied in September 1998 was employed. This leads to a second set of parity prices at US$84/t in 2005 and US$80/t in 2010. To keep the analysis of competitiveness simple, the 2010 prices were employed, US$100/t and US$80/t. The latter of these provides a stricter test of competitiveness of the wheat sector.

The costs of growing spring wheat in Kazakhstan at two levels of intensity were reported earlier in Table 12. Costs vary with the price of wheat because of the changing opportunity cost of wheat seed. At US$80/t for wheat on-farm the estimated cost of production of spring wheat is US$77.70 per hectare. This is higher than other cost estimates for low-input

[11] The quotations in the International Grain Council's *Grains Market Report* and *World Grain Situation* are for freight of heavy grain from US Gulf Port to Former Soviet Union Baltic Ports.

growing of wheat in Kazakhstan. In Kim *et al*. (1998, Table 2-8) the cost of producing wheat in 1996 was reported to be $62.80 per hectare.[12] However, this lower estimate has no cost for land and assumes that there is zero cost for machinery depreciation and finance.

To assess the competitiveness of wheat, various scenarios for wheat production were envisaged and the costs per ton of wheat produced were compared with the parity prices above. Initially, the prices of all other inputs and of the competing sheep enterprise were taken to remain constant in real terms. A variation on this case is reported later.

Competitiveness of Wheat: Base Technology and During 1998 Drought and Soviet Era

In the competitiveness analysis, costs of production per hectare and per ton were calculated for a base technology initially. A low input wheat technology typical of Kazakhstan wheat growing of the late 1990s with a trend yield of 700 kg/ha was employed. The costs were calculated in the base year using an opportunity cost of seed of US$150/t. Cost per ton of wheat produced was calculated net of the value of stubble grazing. Thus

Cost per ton = (Cost per hectare - value of stubble grazing per hectare) / yield.

Two comparisons were made with the base costs initially. First, the costs of wheat production using the 1998 drought-affected yield of 500 kg/ha were calculated. Second, the costs associated with a high-input technology typical of the Soviet era were calculated. For this, yield was set at 1.4 t/ha and two plowings, one snow furrowing, two harrowings, two sprays and 50 kg/ha of fertilizer were taken as the inputs. The costs of the Soviet-style enterprise were made using 1998 input prices for direct comparison with the base costs. The results are presented in Figure 28.

Costs per hectare of the Soviet-era technology are calculated to be almost double those of the low-input technology for growing wheat of the late 1990s. However, Soviet-era costs per ton are calculated to be about 25% above those of the low-input technology base of the late 1990s. Thus Kazakhstan's spring wheat farmers have lowered costs per ton by about 20% since the early 1990s.

Note how the drought increases cost per ton. Farmers may make more changes to practices in a drought to lower costs, although with minimal-input technology the scope for saving further is limited. All three costs per ton reported in Figure 28 are above US$100, the more optimistic parity price for farmers in Kazakhstan over the next 5-10 years. Thus wheat is uncompetitive at current yields with low-input technology and would be uncompetitive using a high-input technology akin to that of the Soviet era.

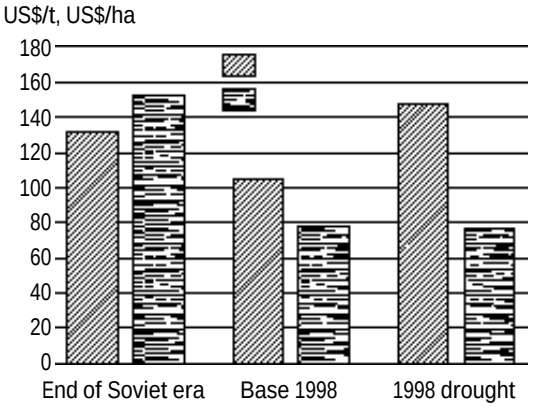

Figure 28. Cost per ton of wheat produced and cost per hectare under alternative production methods.

Note: In the base case for 1998, yields are at trend of 700 kg/ha and implicit seed costs at their trend of US$150.

[12] The cost estimate is drawn from ADB (1996).

Crop Improvement and Competitiveness

The analysis in this section involved asking what happens to competitiveness of wheat under different types of crop improvement. Two types of crop improvement were considered. For the first, mean yield improvements of 300 kg/ha were taken to arise from varietal improvement, treatment of seed and improved cropping practices which cost little (e.g. better timing of operations). Justification for this potential improvement can be gleaned from Morgounov *et al*. (1999). Thus the technology is presumed to remain low input.

For the second, a change to a medium-input technology was considered. In addition to the improvements above, 50 kg/ha of fertilizer nutrients and better weed control and snow furrowing were presumed to add an additional 400 kg/ha to yields. This would take yields to 1.4t/ha, near to long-term targets that some scientists and economists of Kazakhstan consider appropriate for the wheat sector.

The analysis of competitiveness is summarized in Figure 29. For yield gains of approximately 300 kg/ha with low-input technology, wheat in Kazakhstan is calculated to be competitive at a parity price of US$80/t. The gains are down to about 100 kg/ha if prices for farmers average US$100/t. In contrast, wheat grown with medium-input technology, including 50 kg nutrients/ha of fertilizer and one spraying for weeds, needs a much larger yield gain to be competitive.

Improved Competitiveness from Marketing Efficiency Gains

Wheat farmers in Kazakhstan could gain competitiveness in ways other than crop improvement. One obvious way is through marketing efficiency gains. Obviously, if these could deliver higher prices to farmers, the competitiveness of wheat would improve. The efficiency gains would simply lower the world price at which Kazakhstan's farmers can be competitive or make them more competitive at a given world price.

Earlier analysis of prices on farm and of world export prices suggests that a decline of marketing costs of US$10/t is possible as the marketing system evolves and matures. From the farmer perspective, every U.S. dollar saved in marketing costs per ton that is passed on, is equivalent to saving one U.S. dollar in production costs per ton. A saving in marketing costs of US$10/t would offer the same to farmers as a yield improvement of around 75 kg/ha at base yield. This gain in competitiveness could be additional to any other obtained on farm.

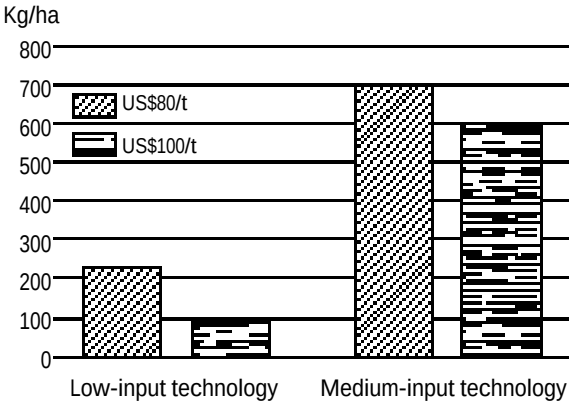

Figure 29. Yield gains needed for spring wheat to be competitive in northern Kazakhstan, at US$80/t and US$100/t of farm.

A second benefit to farmers from improved efficiency of marketing would come from lower prices of purchased inputs. A decline in purchased input prices of 5% is calculated

to offer farmers a reduction in overall production costs per ton of 3.4% to 3.6% depending on the input intensity of the technology. This would offer farmers the equivalent of a yield improvement of about 50 kg/ha. Thus marketing efficiency gains of the magnitude considered feasible would offer farmers the equivalent of yield improvement of 125 kg/ha.

Broader Economic Changes

Competitiveness may be affected by broader economic factors in addition to the industry-specific ones considered above. In this section the impact of a real interest rate cut of 10% is calculated.[13] Then the impact of a 10% devaluation is analyzed assuming that Kazakhstan is a small open economy and that the exchange rate change flows through fully to prices of wheat and purchased inputs.

A 10% reduction in real interest rates for farmers would only occur if the financial system for agriculture became open, mature and secure. Farmers would need to be able to use title to land as security for loans from banks and other financiers. Such a reduction would alter their credit situation dramatically and would lower costs per ton by about US$12 from the budget calculations made. This is the equivalent of a yield improvement of just over 100 kg/ha. Each percentage point reduction in interest rates thus lowers costs by US$1.20/t, or is the equivalent of a 10 kg/ha yield gain.

A 10% devaluation would have two effects, prices of wheat would rise by 10% and prices of purchased inputs by the same percentage.[14] The costs of growing wheat for the base yield of 700 kg/ha exceed returns from grain per hectare by about US$5/t. Also, purchased inputs and machinery capital costs amount to about 50% of total costs. Seed also accounts for just over 25% of total costs for the low-input technology. These inputs all rise in price with a devaluation and virtually fully offset any benefit the farmers might expect from a declining Tenge. Thus the devaluation has a very small effect on net returns to wheat and on the underlying competitiveness of wheat production.

Sources of Future Productivity Growth

Overview of Recent Developments

Four main factors are likely to have affected the productivity of wheat in Kazakhstan in recent years, (1) the declining productivity of the resource base from unsustainable cropping over many years, (2) the virtual ceasing of investment by farmers in new machinery, inputs and technologies, (3) the decline of the public research and extension system, and (4) inefficiencies in the marketing of wheat and key farm inputs to farmers. In addition to this agriculture is facing considerable adjustment pressure from growth in the energy sector and from growth in the services sector with its strong urban orientation. Farmers, along with business people and consumers, have faced sizable risk from high

[13] The real rate of interest employed in the base technology was 20% per annum, so that for this

[14] For simplification, we have assumed that Kazakhstan farmers are price takers in both the export market for wheat and in the purchased input markets. If the farmers have some market power, the exchange rate effects will tend to be overstated.

inflation, lack of an effective financial system for agriculture and general economic uncertainty. Farmers have also seen privatization occurring in the economy and generally have lost out in this process. These factors also have probably affected farm productivity.

In considering strategies for future productivity growth in wheat the broad framework in which farmers are likely to be operating is important. On the assumption that Kazakhstan will continue on its path towards an open market-oriented economy, farmers will be facing fully-commercial conditions. Farmers will be paying prices for inputs that are market driven.[15] Generally, farmers will be receiving prices for wheat that are related to export parity.[16] This implies a very different situation to what many farmers experienced during the Soviet era.

The main implication of the above in Kazakhstan is that farmers are likely to be very reluctant to spend money on inputs and new technologies in the short term (next 2-3 years). They are likely to seek input-saving methods of crop production wherever possible. This has already occurred during the 1990s but will likely continue. The 1998 drought and the low prices received recently for wheat have drained farmers' reserves. Consequently they are likely to spend minimally on fertilizer, seed and fuel and are likely to invest little in their farms, machinery and in new technologies. A series of well-above average seasons coupled with high grain prices could lead to some renewal of spending. However, the chances of this happening are low.

Over the medium term, say the next 5-10 years, some renewal of investment in agriculture might be expected. The rapid decline during the 1990s in the capital stock and the more favorable returns that potentially will come from investment in agriculture in the future are likely to encourage such investment. How much this occurs will depend on the general economic conditions faced by farmers as well as the relative prices of grain to key inputs and the productivity of wheat. At least one international tractor manufacturer is targeting Kazakhstan as a market with long-term potential.

From analysis earlier (see p. 26) the high-input technology of wheat growing in Kazakhstan employed during the Soviet era would be about 20% less competitive under market–oriented conditions that now prevail. This has major implications for research, extension, education and for farmers. A new approach towards the rainfed agriculture in Kazakhstan is required in which the focus is on a new low-input method of farming. In the next few years, farmers are likely to adopt only those methods that are very low cost.

Improving Productivity of Soils and Natural Resources

Considerable degradation of soils of the steppes of Kazakhstan occurred when large areas were plowed and cropped during the Soviet era (Gossen 1998). Erosion increased due to both wind and water and the soil organic matter levels declined due to fallowing and limited retention of crop residues. While wheat yields were trending upwards during this

[15] The fact that many farmers may be paying for their inputs by barter or in-kind payment makes no difference to this point.

[16] Although the on-farm price can probably be increased with more efficient marketing of wheat in Kazakhstan and into export markets.

time, this was probably due mainly to increased use of artificial fertilizers, herbicides, improved varieties and use of some soil conservation technologies. However, "mining" of the soil still occurred in that the soil organic matter level was declining and soil nutrients were being drawn down. The methods were taking grain production to a point of "break down" (Gossen 1998, p. 45).

Detailed information is not available on how the recent changes in farming in Kazakhstan have been affecting the status of the soils. However, it is likely that further degradation will occur in the immediate future because of the lack of funds for investment in farming. Generally, the move to a low-input type of farming could have two effects on the resource base: (1) reduced degradation because of less-frequent cropping and reduced grazing pressure from livestock (2) increased degradation because of less investment in the land and less care of it by farmers.

Scientists need to know more about the degradation and remedies for it in farmers' fields in a low-input environment. Is it cropping the land less frequently? Is it reduced tillage and crop residue retention? What roles do other crops, livestock and agroforestry have to play? Can wheat growing be concentrated in those lands better suited to its production? Should cropping cease in marginal areas? In considering the remedies it is important not to rely on crop yield as the single performance indicator, since this can always be boosted by drawing on the natural resource or applying artificial fertilizer. A wider approach to the farming system and to monitoring the natural resource status, especially that of soils, is needed.

Principles outlined in Altieri *et al*. (1987), Edwards *et al*. (1990) and Reeves (1998) need to be followed to achieve more sustainable cropping and farming practices. Kazakhstan's scientists have been working on a number of soil conservation methods for many years. This is especially the case for wheat in northern Kazakhstan, pioneered by A.I. Baraev. They have drawn heavily on knowledge and techniques appropriate to their environments, including from Russia, Canada, and the USA (Lumpkin and Harris 1997).

Techniques tested include the use of blade plows, stubble retention, windbreak crops and snow plowing. More general agrolandscape management methods have been tested with technical success (e.g. defining areas of a farm suitable for more intensive cropping and defining areas that should be left in grass or planted to trees). The extent to which different methods have been adopted and their use by farmers in the low-input environment prevailing today is not documented. As part of future research on improving the natural resource base adoption studies should be undertaken to assess impact and change in the resource base. These should combine in-field measurement of the status of the natural resources as well as economic assessment of techniques employed.

Further research, including long-term trials and trials on-farm, is warranted to encourage farmers to use alternative soil conservation methods, alternative crop and pasture rotations, stubble retention and other means of conserving and rebuilding soils. This research is likely to have long-term payoff but may not produce much immediate impact. Nevertheless it should be considered as an integral part of a future research, extension and training program for increasing the productivity of agriculture of Kazakhstan.

Improving On-Farm Productivity of Wheat

There is considerable scope for improving the on-farm productivity of wheat in Kazakhstan. The potential methods for improvement are well documented in Morgounov *et al*. (1998) and can be categorized as:

- varietal improvement and related seed management
- agronomic and crop management improvements
- operational and logistical improvements on farm and in markets.

Varietal Improvement and Seed Management

The scope existing for wheat varietal improvement in Kazakhstan is documented in Shegebaev (1998) and Movchan (1998). The characteristics given high priority in improving spring wheat varieties are drought tolerance, higher yield potential, early maturity, immunity to diseases and superior grain quality (Morgounov *et al*. 1998, Appendix 1). For winter wheat the priorities are higher yield potential, increased disease resistance and high quality (*op cit*.). Combined with varietal improvement are the gains that can be achieved from better seed management, notably treatment on farms for seed-borne diseases. Farmers in recent years have not been treating retained seed and seed-borne diseases have been increasing in prevalence.

Long-term trials data at the A.I. Baraev Kazak Institute of Cereal Production, Shortandy, Akmola Oblast, northern Kazakhstan, shown by chart at the station, indicate that on-station wheat yields increased from about 1.5 t/ha in the mid 1950s to about 2.5 t/ha by 1990. However, from 1993 to 1998 the on-station yield averaged 1.1 t/ha. While drought has contributed to the reduced yields, more than weather has been at play. Wheat research has been facing severe funding and resource constraints during the 1990s and this is reflected in the decline of the average yield at the station.

Considerable reduction in resources devoted to wheat varietal improvement in Kazakhstan has occurred during the 1990s. For example, the Kazak Agricultural Research Institute, Almalybak, near Almaty, has experienced a reduction of scientific staff from 420 to 100 since 1990. The number of agricultural scientists in Kazakhstan has halved during the 1990s to about 5,000 in 1998. Furthermore, there were concerns among scientists visited during September/October 1998 of further serious funding cuts and related losses of jobs. While some adjustment downwards in resources devoted to wheat research in line with the general decline of the agricultural sector might be expected, the reductions have been especially severe. Consequently there is a serious morale problem in the research sector.

From the farmer perspective, wheat varietal improvements can be acquired at relatively low cost. This means there is a high chance of such improvements being adopted under the low-input farming likely to prevail in Kazakhstan. Spring wheat varietal improvements pursued have to be suited to the low input and low precipitation environment of Kazakhstan's spring wheat area or they will not be adopted. The winter wheats generally are grown in higher yielding environments and greater emphasis can be placed on yield potential in their improvement.

The purchase of improved wheat seed is the main cost involved in varietal improvement by the farmer. Seed costs are a relatively high share of wheat production costs since planting rates range from 120-150 kg / ha, even in the lower yielding spring wheat areas. Farmers do not purchase commercial seed routinely. When they do, costs can be lowered by buying smaller quantities of commercial seed and multiplying on-farm or by purchasing seed multiplied by other farmers. Seed costs of improved varieties may also be reduced by farmers planting fields for seed multiplication using lower planting rates. Varietal improvement should take a high priority in pursuit of future gains in wheat productivity. It is important though that the varietal improvement be relevant to the low-input conditions that are likely to prevail.

Seed treatment for seed-borne diseases costs about $5-6 / t of seed in Kazakhstan. With a planting rate of between 120-150kg / ha, this amounts to a cost of $0.60-0.90 / ha, about 1% of total growing costs. Farmers have not been treating seed in recent years in order to save costs. With seed treatment delivering 150-200 kg / ha yield gains (Nurmuratov 1998, p.59), at least under trial conditions, the treatment appears to deliver a sufficiently high rate of return to justify the expense, even at low prices of wheat on farm.[17]

The gains in yield and / or quality that can be obtained from varietal improvement is a question that can be resolved by research. Such research should be applied and potential new varieties taken to farmers' fields for assessment as soon as possible. The contraction of research and of agriculture during the nineties in Kazakhstan has probably led to deterioration of wheat varieties in use in farmers' fields, through varieties aging and becoming more pest and disease prone, poor seed management and presence of weed seeds. Considerable scope probably exists for gains to be made from wheat varietal improvement in Kazakhstan as a consequence. Gains from improved disease resistance alone may be sizable. Varieties in farmers' fields in northern Kazakhstan are not resistant to leaf rust, stem rust and septoria (Movchan 1998).

The area planted to varieties of wheat in Kazakhstan is not well documented. While the varieties in fields are known, their relative importance in terms of area grown is not. Scope exists for a quick low-cost varietal use survey in selected areas to obtain a better understanding of wheat varieties in use and farmers attitudes towards different varieties. This should be part of a more substantial diagnostic study in which priorities for wheat improvement can be set more clearly and baseline data can be compiled.

Agronomic and Crop Management Improvements

A wide array of agronomic and crop management improvements have been tested and shown to boost yields of wheat in Kazakhstan. The main improvements are:

- more timely planting
- better moisture management
- fertilizer application
- better crop establishment
- weed control
- improved crop rotation.

[17] If seed treatment yields 100 kg / ha on farm and the price of wheat is $60 / t, the marginal return is $6 / ha while the marginal cost of the treatment is less than $1 / ha.

In considering agronomic and crop management improvements for low-input farming, careful consideration has to be paid to the costs to farmers of different techniques. Cost-conscious farmers are going to be very reluctant to adopt changes involving major outlays.

More-timely planting has been shown to improve spring wheat yields in northern Kazakhstan (Kaskarbayev 1998). Trials over many years indicate the maximum yield of medium-maturity wheats was obtained with planting between 20-30 May. However, optimal planting dates for a particular season may differ from this because of the variability of rainfall and temperature. For more timely planting of wheat, farmers need the equipment, soil conditions and information about the yield benefits of doing so. Further research could be conducted to quantify the yield relationship with respect to date of planting for wheats of different maturity. Knowledge about that relationship is important for farmers in deciding about timing of operations.

The major cost associated with more timely planting is more-intensive use of the machinery and labor resources to complete field operations on time. Farmers may also spread planting dates in a variable environment to reduce risks in their cropping program. Generally costs of more timely operations are relatively small so long as the better timing can be achieved without purchase of additional machinery. However timeliness can readily be lost without reliable equipment and availability of spare parts and mechanics (see next section). One strategy used by farmers in other countries to improve timeliness of operations is to share equipment and tasks across several farms with different optimal planting and harvest dates.

Better moisture management involves a number of technologies including minimal tillage, blade ploughing, crop residue retention, alternative crop rotations, snow planing and windbreak crops. The relationship between yield and moisture availability is obvious for the spring wheat areas of Kazakhstan. The challenge is to develop low-cost methods of moisture conservation that farmers can employ on a commercial basis. Fallowing generally adds to spring wheat yields, with average gains in yield of the order of 10-30%, depending on timing of rainfall in the growing season (Kaskarbayev 1998). As well as grain yield, important consideration needs to be paid to sustaining levels of soil organic matter and of soil nutrients when choosing and recommending alternatives for farmers.

Poor plant establishment was reported to be a serious problem in recent years. The poor quality of land preparation before planting, cost saving during planting and the poor state of machinery may be important causes. One important method of lowering farmer cost of growing wheat in a low-input environment is to lower seed planting rates. According to research reported by Kaskarbayev (1998), yield is not strongly affected by seed rate and scope may exist to lower this on farm. Further research on saving seed costs and achieving better plant establishment may deliver a low-cost agronomic improvement for farmers. Seed costs at trend yields of 700 kg/ha with a planting rate of 120-150 kg/ha represent about 20% of total output and farmers would be highly likely to adopt technologies saving on this cost of production.

Weed populations have grown considerably during the 1990s with reduced use of herbicides and less cultivation by farmers. Currently, the gains from weed management are probably quite large in farmers' wheat fields. Crop rotation is an obvious way to control weeds at low cost when the opportunity cost of land is low, as it is in Kazakhstan. Herbicides and additional weed cultivation are more expensive and farmers have shown during the 1990s that they are hesitant to pay for these methods. Yield gains from weed management will vary considerably and an average gain is difficult to discern. They are reported to have averaged about 10% for wheat of Western Siberia (Gamzikov and Kholmov 1998). Such a gain at trend yields and prices imply an extra return of $6/ha in Kazakhstan. This would not warrant full herbicide treatment which may cost over $20/ha (Shegebaev 1998). The economics of herbicide application imply that only when weeds are serious and potential yield gains from herbicide application are high (about 30% or more) is it worthwhile for farmers to use herbicides. Other low-cost methods of weed control may warrant research attention.

Use of fertilizer by farmers is likely to be extremely tight in Kazakhstan for the next few years, at least. A 15% yield gain is possible with fertilizers in the steppe zone (Gamzikov and Kholmov 1998). In spring wheat in Kazakhstan this amounts to about 150 kg/ha in a crop with improved varieties on a low-input cropping system. Generally speaking, farmers can purchase 1 ton of artificial fertilizer in exchange for 3-4 tons of wheat. This implies that they are likely to want to see yield gains of at least 8:1 per additional nutrient applied before applying it. Because of weather variability, such a result cannot always be assured. Research on spring wheat that is relevant to farmers should be based on low application rates of fertilizer.

Research has been conducted on alternative crop rotations in Kazakhstan and knowledge of alternatives amongst farmers and scientists seems high (Kaskarbayev 1998). Further research in this area might be directed at low-input rotations as alternatives, especially with livestock and agroforestry being better integrated with cropping. During the Soviet era specialist monocropping technologies occupied a large area of the steppes (even though a small proportion of total area). With the move to a less-intensive form of agriculture, marginal cropping areas may be more profitably devoted to livestock and agroforestry. Cropping could thus be concentrated in the more favored cropping areas and undertaken in rotations with technologies that are more sustainable.

Machinery and Productivity Improvements

The aging of machinery and its run-down state is likely to be affecting seriously the on-farm productivity of wheat in Kazakhstan. With the large areas cropped, tractors, harvesters and tillage-, planting-, spraying- and grain handling- equipment are all needed for efficient wheat production. Satybaldin (1998) has highlighted the importance of mechanization and mechanization policy for Kazakhstan's farming. He emphasizes the need to upgrade the stock of machinery, both on farm and for grain processing and recommends that joint ventures with foreign companies be employed to facilitate this. He also encourages the development of local manufacturing of certain farm equipment and the amount of equipment to be replaced in the future would suggest that such a strategy is viable.

The low rates of investment in machinery are closely related to the overall financial position of farmers. Thus ability to borrow against farm assets becomes an important consideration in machinery investment. Farm investment has suffered during the 1990s because farmers have had extremely limited access to credit at reasonable rates of interest. Policies which provide greater certainty in the economy generally, including stable prices, low real interest rates and a general climate of growth and stability will assist farmers to be able to invest in their enterprises. Policies which provide sufficient assurance in title to land that banks will lend money against the title will also assist farmers in financing machinery and operations.

Improving Marketing and Transport Efficiencies

Considerable scope exists for improving the marketing and, to a lesser extent, transport efficiencies for wheat in Kazakhstan. This is documented in Satybaldin (1998), Kolobaev and Nikitina (1998) and Sigarev (1998). The concerns expressed by farmers and farm leaders of Kazakhstan about the efficiency and fairness of the marketing system during meetings with them suggest that scope exists for improvement.

As an example of marketing inefficiency, the collapse of farm prices of wheat during 1998 occurred with wheat traders widening their marketing margins considerably. The limited evidence available to this study suggests that margins widened relative to international prices by probably US$20/ton from 1997 to 1998. Such a widening would suggest that considerable inefficiency exists in the market. [18]

Where are the sources of inefficiency in marketing and what can be done to improve it? To establish that requires more substantial research on the behavior of the market, especially on price relationships across different types of wheat, locations, different levels of the market and times of the marketing season. One source of inefficiency in the wheat market is a general lack of knowledge and experience in Kazakhstan of the working of modern international grain markets. Another is a lack of marketing infrastructure and institutions that would provide the facilities for efficient pricing and marketing activities. Grading of grain and price premiums for higher quality are an essential part of an efficient wheat marketing system and should be further developed.

The extent to which the marketing system is concentrated amongst major traders may be a source of collusion. Does Kazakhstan's law facilitate the efficient and fair marketing of grain? Would antitrust law make the market behave more fairly and efficiently? There are a number of institutional and legal questions that should be addressed to improve the efficiency and fairness of agricultural marketing in Kazakhstan.

Whether Kazakhstan should undertake large-scale strategic storage of wheat to offer a more reliable supply to customers is worthy of further economic and marketing research. While storage offers greater certainty of supply to customers, it costs money and/or resources. At issue is the size of the strategic carryover.

[18] Care needs to be taken in drawing too wide a conclusion from this event however. Another explanation of this widening is that the events in the Russian economy during 1998 created uncertainty and thus broke the link between international wheat prices and those of Kazakhstan.

Kazakhstan's farmers and farm leaders were interested to know more about grain marketing boards and their evolution in other wheat exporting countries during meetings with them in 1998. Considerable scope exists for Kazakhstan's grain production and marketing leaders to be introduced to marketing systems of other countries. Ideas generated from such interchanges may be very beneficial in improving the grain marketing system of Kazakhstan. Well-functioning grain marketing boards similar to those working in Canada and Australia offer some security and fairness to individual farmers in pricing of wheat. However, generally they will be less efficient than a private marketing system. The tradeoff between efficiency and fairness thus becomes an important issue in the future direction of wheat marketing in Kazakhstan.

In the way that Kazakhstan's farm machinery has aged and not been well-maintained during the 1990s, the same has occurred for grain storage and processing facilities and for grain transport equipment, both road and rail. This has probably caused a loss of productivity of marketing, storage and transport of grain. With the decline in grain output during the 1990s, the grain transport and storage system has had excess capacity. Presumably investment in transport and storage equipment will resume when economic activity strengthens and when the rail and road transport managers see useful returns from such investment. A perceived recovery in grain production may be necessary before a solid upturn in investment occurs in this sector, however.

Implications for Research, Extension, Training and Education

Need for a Cultural Change

Kazakhstan's wheat sector in the late 1990s is reflecting the fundamental change in incentives and in values that were adopted when the nation became independent in 1991. The ending of the Soviet system and the adoption of a more market-oriented economy called for many adjustments to be made and for the formation of new institutions and ways of doing business in the economy and in agriculture. Through sheer necessity, farmers have been relatively quick to adapt to the new system. The research, extension, training and education sectors have faced strong pressures to change also and have done so under tight budget constraints.

Farmers have cut back the intensity of agricultural production dramatically during the 1990s. In doing so they have positioned agriculture to use farm inputs and resources much-less intensively and much-more competitively than a decade ago. The land is less heavily stocked, less ploughing and monocropping of land is occurring now and the energy-intensive agro-industrial complexes of the Soviet era have been trimmed considerably. These changes have not been without hardship and uncertainty for Kazakhstan's farmers nor for those supporting the agricultural sector through research, education and other contributions.

The analysis in this study suggests that the input-intensive method of farming in Kazakhstan that was developed during the Soviet era is not competitive under the market-based system now prevailing. If this is correct and applicable across other agricultural crops and livestock, there are major implications for future strategies towards agricultural

research, extension, training and education in Kazakhstan. A fundamental change in attitudes is suggested for agriculture as a consequence. Since most of the research and education that has accumulated in Kazakhstan over many years was undertaken within a more-intensive Soviet agricultural system, the knowledge and thinking now has to be recast and adapted to be relevant to conditions of farming today and in the future.

During meetings with various agricultural agencies, farmers and farm leaders in late 1998, two important attitudes were observed. First, there was a negative mood about agriculture. The contraction of agriculture, lack of investment, decline in agricultural research funding and so on were looked upon with considerable concern. Second, there was a strong longing for the past. Many people expressed sadness about the changes of the 1990s and stated concerns about the future of agriculture in Kazakhstan. Some clearly stated that farming in the Soviet era was better. The 1998 drought and low grain prices of the time undoubtedly colored the mood of the meetings. However, the attitudes revealed have a strong message for future strategies for research, extension, education and training.

For the future, Kazakhstan's agricultural sector needs a major change of attitudes amongst farmers, researchers and others supporting and doing business within the sector. A major cultural change is needed. As well, a major improvement in morale is needed. Leaders of agriculture need to develop strategies that will alter attitudes and develop a positive and forward-looking approach to Kazakhstan's agriculture. This needs to occur with education as well as research so that the future leaders of Kazakhstan's agriculture are forward-looking, positive and well-trained to address the needs of farming in the 21st Century.

Implications for Wheat Research

The most important implication for future wheat research is Kazakhstan's farmers are likely to be very reluctant to spend money and resources on farm inputs. Generally, they will be employing low-input technologies. As a consequence, the priorities for research should be to develop technologies that are low-cost to farmers and that will deliver high rates of return for small investments by farmers. Wherever possible, technologies that can save on inputs in a sustainable manner, such as reducing the planting density of seed for wheat, will be preferred to the high-input technologies that prevailed during the Soviet era. Crop protection technologies, for example, which deliver solutions at low cost to farmers are likely to be more readily adopted than high-cost options. Calling for farmers to move to a more-intensive form of agriculture in the near future is likely to be futile. The reality is that farmers now have to pay market prices for inputs and they are simply doing their best to pursue their objectives under the risky and market-driven situation now faced (and likely in the future).

Past research in Kazakhstan will offer considerable information of value for low-input agriculture. The challenge for scientists will be to infer as much as possible from the information that is relevant to the new conditions of agriculture. In designing strategic research programs, careful consideration should be given to building knowledge in areas that are relevant to low-input farming. Use should be made of joint research with CIMMYT and other international centers to develop and promote the low-cost technologies for wheat in Kazakhstan. Kazakhstan's wheat scientists may profitably learn a lot from other low-

input wheat production sectors, especially Canada, Australia, and the drier wheat lands of the USA, Argentina, and relevant areas of Asia and Europe. The large body of knowledge from these sources will prove very useful in shaping future directions for wheat research in Kazakhstan and should be reviewed extensively, perhaps in collaboration with scientists from the different countries.

A program of collaborative research has already been mapped involving Kazakhstan's wheat programs, CIMMYT, ICARDA and selected American universities (Morgounov *et al*. 1998, Appendix 1). This program reflects the differences between the spring wheat research needs and the winter wheat ones. For both areas, farmers are likely to be tight in use of inputs, although this will vary according to moisture availability, soil type, and other farming circumstances. When farmers are likely to be able to resume investing in equipment and new technologies will depend on general economic conditions, seasonal conditions, prices of wheat, and credit conditions for farmers. Wheat researchers would be prudent to assume that investment is likely to pick up only very slowly in the next few years. Beyond that some improvement in investment is likely.

This study suggests that high priority for wheat research should be varietal improvement and work on other technologies that are likely to be adopted at low cost. Any cost-saving techniques such as reducing planting rates and employing rotations to minimize weed and disease problems are likely to be looked on favorably by farmers. In contrast, technologies involving intensive use of inputs are likely to be adopted only in those areas where moisture levels and related yields assure farmers of a reasonable return on their investment. Research on intensifying wheat growing in the spring wheat areas should be a very low priority and re-oriented to other more relevant opportunities.

Wheat research needs to address the issue of sustaining the use of soils and other natural resources in Kazakhstan. This calls for a longer-term research program which should be integrated with other crops and livestock programs, as well as those for agroforestry and natural resources more generally. These programs should be also based on the assumption of that Kazakhstan's land resources will be used less-intensively in the future than under the Soviet era. All wheat researchers need to be conscious of the underlying principles of sustaining the soils and other natural resources.

Related to this is the need for a much-more commercially-oriented analysis of weather developments for researchers, farmers and grain exporters in Kazakhstan and neighboring regions. Meteorological data are difficult to obtain in Kazakhstan currently and a much more-accessible and commercially-oriented service is needed for agriculture. The methods of climatological research employed in low-rainfall and risky climates in other parts of the world could usefully be adopted and employed in Kazakhstan.

Implications for Wheat Marketing and Economic Research

Considerable technical research on wheat marketing and processing has been undertaken in Kazakhstan. However, there is a strong need for this to be matched by commercial research on wheat marketing. This research should have a Central Asian focus. The marketing research suggested includes the following:

- analysis of flows of grain geographically and via alternative transport routes
- analysis of costs of different marketing, storage and transport activities and comparisons with international best-practice
- analysis of price behavior within markets spatially, between qualities and over time
- assessing the efficiency of the wheat market of Kazakhstan and Central Asian countries
- assessing the degree of concentration in grain marketing and ways of minimizing anti-competitive behavior, including legal and institutional changes
- analysis of potential for an improved set of grades of wheat and related price premiums
- reviewing and improving collection and dissemination of market information
- improving crop forecasting methods
- analysis of the potential for a modern fully-private grain marketing board to provide farmers with an alternative market outlet.

Such work should be given high priority and undertaken in parallel with the agricultural research. Without the development of agricultural marketing in Kazakhstan, attempts to encourage farmers to grow more wheat could prove hollow.

Economic research is also needed. This study should be followed up with more extensive study of policies and their impact on wheat production and on other crops and livestock. This could be conducted as providing estimates of producer subsidy equivalents and policy effects in Kazakhstan and other Central Asian agriculture.

A number of other important economic studies could be pursued, including:

- diagnostic study and baseline study of wheat production in selected locations of Kazakhstan
- assessing impact of new wheat technologies and returns to wheat research in Kazakhstan
- improving the title to land to provide assurance to the credit market for Kazakhstan's agriculture
- economics of alternative technologies for sustaining agricultural production in Kazakhstan
- medium-term prospects for grain and livestock production in Central Asia
- implications of growth of the energy resources sector and inter-sectoral competition for the agricultural sector of Kazakhstan
- implications of uncertainties and developments in Russia for Kazakhstan's agriculture
- potential export market developments and related economics of exporting to different markets
- potential for strategic storage of wheat in Kazakhstan and Central Asia.

Implications for Education, Training and Extension

Education, training and extension needs also to be reshaped and better-oriented to the reality of farming in Kazakhstan today and for the future. The principles and ideas taught at university need to be re-shaped to be relevant to the market-oriented system of agriculture. Of particular importance in higher education is the teaching of agricultural business and finance, marketing, economics and policy to students so that they appreciate the changes in the commercial conditions facing farmers and the needs of a commercial agricultural sector.

Technical courses undertaken by university students should be re-focused so that they learn about research and development methods that are relevant to a low-input commercial agriculture. The technical students need to be taught actively on how to assess research opportunities and to work with farmers and businesses in R&D for agriculture. Training in aspects of sustaining the soils and natural resource base of Kazakhstan is also high priority.

Training and extension for farmers and technicians needs to be re-focused to be very practical and relevant to farmer conditions faced today and for the future. Considerable commercial training is required and should be given high priority in training about new technologies. It is especially important that those providing training offer forward-looking perspectives on Kazakhstan's agriculture. They must encourage farmers to continue to adopt new and innovative low-cost ways of growing and marketing wheat in the country. Old ways of calculating cost of production should be abandoned and farmer budgeting and other decision making tools to help farmers implemented. A useful starting would be a "Farm Management Handbook" following the models of Nix (1989), Chadwick (1989) and Ahmad, Hussain and Longmire (1989).

Because Kazakhstan needs to build the institutions for a more market-oriented and low-input wheat industry, those involved in education, training and extension should be exposed much more to what is done in other parts of the world. Thus they should be supported to interchange actively with wheat industries in Canada, Australia, parts of the USA and other parts of the world where the wheat industry is market-oriented and employs low-input technologies. This interchange should include visits, conferences and seminar attendance as well as focused study tours and study leave.

To facilitate such interchange, English language training should be offered to young scientists and educators and email and internet links provided at key locations for the educational and training community. Scientists, economists and educators from other parts of the world should be encouraged to undertake study visits to Kazakhstan to assist in building capacity in agriculture.

Policy Implications and Recommendations

Policy makers have set Kazakhstan on a path of commercialization in expectation that future efficiency gains and improvements in the use of the nation's resources along with more freedom for individuals and the nation will more than compensate the adjustment costs involved. This is a long-term process and may take at least twenty years (Fischer, Sahay and Vegh 1998). The Kazakhstan economy returned to growth in 1996 after almost contracting to half the reported GDP prior to independence. Agriculture declined after

independence but there are signs that this phase has ended, although the 1998 drought and Russia's economic uncertainty may cause some further contraction in 1999.

Several policy implications flow from this study. The first and most important is that Kazakhstan's agriculture has changed fundamentally during the 1990s, because farmers have faced a market-oriented and commercial situation. The scaling back of agriculture to a much-less intensive form of production, for both grains and livestock, has been dramatic. Commercial pressures have encouraged farmers to move away from the energy and input-intensive methods of farming of the Soviet era. These methods are no longer competitive and are unlikely to become competitive again.

The collapse of investment in farming during the 1990s has caused wheat productivity to fall in Kazakhstan.[19] This suggests considerable potential exists for improving wheat productivity now. Investment in farming is likely to pick up only slowly in the next few years but the medium-run outlook for investment is better. Thus short-term productivity improvements must be low-cost or cost-saving for farmers and the marketing system.

With regard to the wheat sector, several policy recommendations flow from this study. First, the research, extension, training and education sectors servicing agriculture have faced extremely tight funding in recent years. There is a need for these important sectors to be better funded, through government revenue and through other means. Ways should be found to fund part of the activities of these sectors from research levies applied to sales of grain or food products within Kazakhstan. With an efficient marketing system, the benefits of research will flow primarily to farmers of Kazakhstan (Edwards and Freebairn 1981). Thus a levy at the wholesale level (of say 1% of all grain sold) could be collected to partially fund research and related activities that will benefit farmers through increased productivity.

Kazakhstan has witnessed considerable decline in productivity in the wheat sector during the 1990s, indicated by the sharp decline in yields. There is a strong need to reverse this decline. Government needs to play an important role in offering leadership to the research, extension, training, seed, farming, marketing and processing sectors to improve products, technologies and productivity. People need to be encouraged to think strategically towards the future of their businesses and research and support activities. Such strategic thinking should not involve bureaucratic strategic planning exercises. It should involve developing strategies which are relevant to the new low-input agriculture which is evolving in Kazakhstan.

A special program of re-invigorating the farm sector is needed. Every means possible should be devoted to supporting farmers and others to develop the low-cost and low-input technologies that will be needed to regenerate production. This should be done at the same time that changes are made to policy to improve the commercial conditions of farming. No attempt should be made to take Kazakhstan's agriculture back to the energy and input-intensive systems of the Soviet era.

[19] Overall productivity may be 20-30% below what could be achieved with adoption of improved varieties, lower planting rates, seed treatment and other cost-saving or low-cost improvements to wheat production and marketing.

Title to land remains uncertain in Kazakhstan. For this reason the credit market is not working satisfactorily for farmers. They use barter and probably pay high implicit interest rates as a consequence. Further investigation and improvement of the land title system is needed to ensure that the farm sector is able to function efficiently and with greater certainty in the future. Improvements in the land title arrangements will encourage more investment by farmers which will flow on to regenerate the rural economy and make it more productive.

Considerable development is needed in the agricultural marketing systems of Kazakhstan. Marketing research and development should be undertaken so that Kazakhstan can progress towards an efficient and fairer system of agricultural marketing. Currently, farmers believe that the system is unfair and dominated by a small number of traders who may be colluding. Government has an important responsibility to ensure that markets work competitively and should penalize heavily those who practice anti-competitive behavior. Trade practices legislation, anti-trust legislation or national competition policy should be enacted and implemented to ensure that severe penalties apply to those practicing anti-competitive behavior.

Kazakhstan's government and farmer bodies might investigate a role for a modern fully-private grain marketing board and for the further development of commercial arms to farmer associations to provide more balanced market power in the grain and input markets. However, there is unlikely to be a case for intervention in the wheat market by government. Those growing wheat and others involved with the industry need to know that they will be operating in a commercial environment which is stable, consistent, efficient and fair within the law. That way farmers and others involved with agriculture in Kazakhstan will best be able to cope with the inevitable changes ahead. The future for wheat in Kazakhstan over the medium term is promising. However, many changes are needed, especially change in the mindsets, culture, and approaches of those working in and supporting the wheat industry and conducting research, training, and education for its future.

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