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Matthew Gorton, Mikhail Dumitrashko and John White

For correspondence: John White, Department of International Business, University of Plymouth Business School, Drake Circus, Plymouth, Devon. PL4 8AA. UK.

John.White@pbs.plym.ac.uk

Overcoming supply chain failure: a case study from Moldova of agri-food industry recovery

Matthew Gorton[a*], Mikhail Dumitrashko[b] and John White[c]

[a] School of Agriculture, Food and Rural Development, University of Newcastle, Newcastle upon Tyne, NE1 7RU, UK
[b] Institute of Management and Rural Development, Chisinau, Moldova
[c] Plymouth Business School, University of Plymouth, Drake Circus, Plymouth, Devon. PL4 8AA, UK

ABSTRACT

Successor states of the Soviet Union have witnessed substantial falls in agri-food production since the break-up of the USSR. Supply chain disruption has been a major problem related to this decline. This paper identifies how asymmetric information between farmers and processors led to market failure in Moldova and how one dairy company has overcome such a crisis. The case study company has invested in better quality monitoring to effectively supervise contracts with commercial livestock farms. Small-scale peasant producers, from whom the transaction costs of procuring milk are greater, are being marginalised and the case study highlights the conflicts between development strategies based on bottom-up, pro-poor initiatives and programmes to exploit international competitive advantage.

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1. Introduction

During the 1990s, Central and Eastern European Countries (CEECs) were characterised by significant falls in agri-food production (Lerman, 2001). A number of reasons have been identified for this fall, such as the greater international contestability of CEEC markets, a fall in real protection, a cost-price squeeze and the disruption caused by land reform and privatisation programmes (Macours and Swinnen, 2002; Swinnen and Gow, 1999). In understanding and overcoming disruption it is important to take a supply chain perspective to identify ways in which the new market actors that have resulted from the reform process can develop successful relationships to exploit the inherent competitive advantages that many CEECs possess in the agricultural sector.

This paper identifies how supply chain disruption, with a high level of asymmetric information between farmers and processors led to market failure in Moldova and how one dairy company has overcome such a crisis. The case study details how strategies may be developed to successfully reintegrate agri-food supply chains. The paper is split into five sections, the next section details the disruption to supply chains that occurred with food industry privatisation and land reform and how milk markets were subject to problems of adverse selection. Section 3 presents an overview of the case study company and how it was selected. The evolution of the firm's procurement policy is detailed in Section 4, with relevant conclusions drawn in Section 5.

2. Supply Chain Disruption in the Dairy Sector and Market Failure

During the communist period, the Former Soviet Union (FSU) and most CEECs were characterised by dualistic agri-food chains that encompassed both formal and informal channels. *Formal* supply channels were characterised by a high degree of vertical co-ordination, managed by central planners and linked large state (s*ovkhoz*) and collective (*kolkhoz*) farms with state-owned food processing

plants (*kombinats*) and retail co-operative and distribution systems. Production targets, prices and the mix of products were all controlled through the planning process with the state managing contract enforcement. Given the role of the state in directing resources, there was no effective competition between processors for the available raw materials (Wegren, 1996). These formal channels were supplemented by *informal food production* by households on auxiliary private plots, the output of which was mainly used for self-consumption.

During the 1990s, most CEECs have embarked on the privatisation of formal agri-food channels. In the dairy sector this often resulted in the break-up of large livestock herds managed by the state and collective farms that previously supplied the large, state-owned kombinats. As a result, a large drop in milk production in the region has been witnessed (Table 1). While most FSU states suffered marked declines in milk production in the decade following the break-up of the Soviet Union, Moldova has registered the worst performance: milk output halved between 1992 and 2001.

As part of the Soviet Union, Moldova became an important net exporter of agri-food products to other republics within the USSR *(Institutal Asa Pentru Analiza per Sectoare si elaborari de Poltici*, 1998). Agriculture dominated the Moldovan economy throughout the Soviet era and by 1991, agriculture and the food industries still accounted for 43 per cent of GDP and employed just over 50 per cent of the active labour force (ARA, 1998). During this period, agricultural production was dominated by about 850 collectivised agricultural enterprises, of which 470 were state (*sovkhozi*) farms and the remainder *kolkhozi* (Dumitrashko, 1997). The average size of the *sovkhozi* was approximately 2,000 hectares (ha) while the *kolkhozi* tended to be larger (3,000 ha on average).

After initial resistance, Moldova embarked on a radical programme of land reform in the late 1990s, which envisaged the complete distribution of the land and physical assets of collective farms to their

members (Gorton, 2001). However, the outcome of the privatisation process was far from uniform. The large former *sovkhoz and kolkhoz* farms located in areas where members were informed about the possibilities and methods of land privatisation were largely disbanded, together with the agricultural enterprises which had financial difficulties and where the farm directors did not resist the privatisation process. However, in some cases these directors did resist the reform process and as a delaying tactic they created other enterprises based on their *kolkhoz* or *sovkhoz* such as joint stock companies, production co-operatives and associations of peasant farms. In the latter event, the privatisation process often did not see a large transfer of property to members and in some cases only the name of the enterprise effectively changed. The managers of these enterprises are the ex-directors of the *kolkhozi* or *sovkhozi* and many have kept their animal breeding activities. There were also some cases of former collective farm directors, veterinarians and zoo-technicians (or a team of some of these specialists) being able to convince the farm's members to keep their shares together. In these instances the large farm was not disbanded or a new, smaller joint-stock company specialising in livestock farming was created. The new private farms that appeared where the *kolkhozi* and *sovkhozi* were fully disbanded own typically only 1 or 2 cows, which the owners possessed before privatisation or which they received as a share from the privatised farms.

These reforms have meant that in Moldova there are currently two main types of milk producer: (a) agricultural companies and (b) peasant producers with typically one or two cows who produce mainly for self-consumption. The agricultural companies have their origin in the former collectivised farms that were not fully disbanded. They are operating on a smaller scale than in the late Soviet period and typically currently have 50 to 100 cows. The peasant producers market only a fraction of their output but may sell surplus milk to the dairies via milk collecting stations, with typically around 100 people supplying each collecting station (Figure 1).

At the food processing level, the large state-owned kombinats have also been subject to privatisation and they face new forms of competition from emerging small-scale producers, domestic traders and, in some cases, foreign investors (Gorton *et al.* 2003). Moreover, food processors which have survived privatisation have to manage their own supply channels and contracting in an environment of new small entrants, declining supplies and a much changed agricultural base (Zaharieva *et al.* 2002).

Milk procured via collecting stations tends to have high total bacterial counts caused by contamination (dirty equipment, lack of mastitis control measures) and the absence of adequate cooling and cold storage facilities (Bjelica *et al.* 1996). While pasteurisation at the dairies aims to ensure bacterial destruction, the effectiveness of this control is lost if the initial raw milk is heavily contaminated (Hubble, 1997). The procurement of milk from peasant producers is also characterised by high transaction costs and many collecting stations in the FSU are largely poorly equipped to monitor the quality of milk purchased. This presents a situation of asymmetric information regarding product quality between buyers and sellers, as presented in Akerlof's (1970) market for 'lemons'. Akerlof famously demonstrated that when agents on one side of a transaction are better informed, some markets may entirely fail to emerge as bad quality goods drive out good ones. Drawing on this, Levin (2001) theoretically establishes that improving the buyer's stock of relevant information in such an adverse-selection market, i.e. making private information public, unambiguously improves trade so long as market demand is downward sloping.

3. Overview of the Case Study

The Moldovan dairy processor Molmilk[1] is located in the Central belt of Moldova and is the focus of this paper. Molmilk was chosen because it is a domestically owned enterprise that has recovered from a crisis situation by restructuring its procurement procedures and grown despite a difficult

operating environment and offers lessons for managing restructuring in other enterprises and transitional states.

Phase 1: Establishment

The Molmilk factory was created as a state unit in 1992 and in 1996 the plant was privatised as a joint stock company with the state retaining no stake in the enterprise. The capacity of the dairy is fairly small (50 tonnes of milk can be processed per day). During the period between 1993 and 1996, when the factory commenced production, it processed between 20 and 25 tonnes of milk daily, i.e. operating at half its full capacity. The plant pasteurised milk and produced *kefir* and cottage cheese using raw materials from *kolkhoz* and *sovkhoz* farms.

Phase 2: Privatisation, Collapse and Crisis

Simultaneous with the privatisation of Molmilk, most *sovkhozi* and *kolkhozi* were disbanded as part of the land reform process. Livestock on such farms were distributed to members or, more commonly, slaughtered without being replaced. Members who received livestock were not prepared for commercial production nor possessed sufficient equipment to maintain milk quality. As a result both yields and quality diminished alarmingly so that by the end of 1996, only 5 to 6 tonnes of milk per day was processed. Milk yields fell throughout Moldova[2] and the lowest level of output for Molmilk came between 1997 and 1998, when just 500 kg of milk was processed per day.

Alongside the drop in output, the number of employees at Molmilk fell from 58 in the early 1990s to just 11 people by 1998. The future of the plant was in severe jeopardy and Molmilk was not alone in this problem. In comparison with the period between 1985 and 1990, when 10 milk factories operated in Moldova, by 1999-2000, 5 had ceased production completely and the remaining 5 plants

[1] The fictitious name of Molmilk has been chosen to protect the anonymity of respondents.
[2] The average milk yield in 2001 was approximately 2,000 kg compared against 4,022 kg in 1989.

operated at a fraction of their true capacity (10-15 per cent). By 2002, the five plants that had ceased production had not restarted processing and the other five plants still operate significantly below true capacity.

Phase 3: Recovery

After the crisis years of 1997 and 1998, Molmilk has steadily rebuilt. Between 1999 and 2000, the plant processed up to 2 tonnes of milk per day and in 2001 this quantity went up to a daily rate of approximately 12 to 15 tonnes. The latest complete figures that are available (August 2002), indicate that the factory processes 17-18 tonnes of milk per day and it expects this to rise to 30 tonnes by the end of 2003. This is still below the initial capacity level planned for the factory but represents a major turnaround in the company's fortunes. Table 2 details the growth in milk processed, employment and value of output between 1999 and 2001 (due to the disruptions in production for 1997 and 1998, there is a lack of data). The next section details the role of changes in procurement policy in underpinning the recovery of Molmilk.

4. Procurement Policy

During the Soviet era, milk was collected from the *kolkhozi* and *sovkhozi* according to the state plan and in conformity with contracts formulated at the beginning of each calendar year. Molmilk in its early years was supplied by such collective farms drawn from different *judets* (districts) of the Republic of Moldova.

When the majority of collective farms were disbanded, Molmilk was forced to rely on peasant producers that supplied milk to Molmilk via collecting stations located in villages around its plant. At collecting stations the milk is currently tested for its fat content, acidity and density. After testing, the milk is poured into 49 litre tanks and sent to the factory. However, milk procured in this manner presents four major problems. First, the milk tends to be of low quality, sometimes diluted with

water, mixed with goats' milk or contaminated. The greater the level of asymmetric information between buyers and sellers concerning product quality (i.e. poor quality testing at village collecting stations), the greater the scope for cheating. In Moldova, five specific cheats perpetrated either by sellers or buyers of milk can be identified:

(a). Passing off contaminated milk as fresh,
(b). Adding water to milk where payment is based on volume,
(c). Adding lard to milk where payment is based on fat content,
(d). Adding sheep's milk to cows' milk,
(e). Defecting on paying farmers for milk (late or non-payment).

Given this problem of cheating, dairies have had to improve their ability to test milk at the collecting station so that it can be checked for its density, acidity, fat and ammonia content. Second, animals in the subsistence sector tend to be kept in poor hygiene conditions and this has a negative impact on milk yield and quality. Third, given that each subsistence producer generates only a very small marketable surplus but expects to be paid individually at collecting stations, the transaction costs of collecting milk from such a fragmented production base are high. Finally regarding problems of milk supplied from small-scale producers, output is highly seasonal as the majority of births are in the months of December to February, so, if the factory collected milk only from them its activity would be highly erratic.

Given the difficulties of procuring milk from the subsistence sector, after the collective farms that were close to the factory were disbanded, Molmilk was obliged to search for other commercial suppliers from different *judets*, where such collective farms or successor agricultural companies still existed. The most attractive source of raw milk are the joint-stock companies that hold larger herds of cows because they follow and use a higher level of technology in feeding (a factor that influences the quality of curds) as well as mechanised milking, which ensures better hygiene standards. These companies also possess milk coolers that act directly to maintain milk quality. In some villages

where there are large farms milk is also collected from the private peasant producers with the milk cooled in local refrigerators. However where no such functioning farm exists, facilities to maintain milk quality are scarce. The collected milk is transported in factory owned trucks.

During the land reform process the former collective farm directors were often seen as an impediment to creating an efficient agribusiness sector (Csaki and Lerman, 2002). However for Molmilk the existence of joint stock companies that engage in dairy farming, which were created where the collective farms were not fully disbanded, has been vital to its survival. Procurement based solely on peasant producers, each with 1 or 2 cows, was not commercially viable. A key strategy for the factory has thus been to increase the number of agricultural enterprises that supply them with milk and it has had to try to formulate robust contracts with such actors. Molmilk has been successful in this: in the five years to 2002 the number of commercial milk enterprises that supply Molmilk increased from 2 to 18. At present there are 12 basic suppliers which, even if they are located some distance from the factory, are reliable and each possess between 50 and 150 milking cows. As a result of these efforts to build ties with joint-stock agricultural enterprises, only a small proportion of procured milk (about 4 per cent) is currently collected from local peasant producers (Figure 2).

Contracting

The factory formulates and agrees contracts with all its commercial customers on an annual basis and thereafter at the end of every year. Contracts are prolonged if the both sides concur. The contracts between the factory and its larger suppliers specify the quantities of milk for sale, the price (based on a fat content of about 3.5 per cent) and payment terms. In the case of unforeseen changes in market conditions an additional annex for each contract is drawn up. For example in the summer of 2002 the farm-gate price of 1 litre of milk was 1.75 *lei* (approximately € 0.15), however by the beginning of

September it had risen to 2.0 *lei* (€ 0.17).[3] An additional annex was attached to the contracts to specify the change in prices. Thus although contracts specify a price this is not binding when market conditions change. Due to macroeconomic instability and relatively high inflation farmers have been very unwilling to sign contracts that lock them into selling at a predetermined future nominal price. Moreover, farmers will often cancel contracts when they receive a higher offer price. In 2002, Molmilk suffered from one such case but lately the contract has been re-established as the new processor that the producer switched to failed to pay on time. In general Molmilk pays its commercial suppliers weekly and private peasant suppliers are paid on the spot at collecting stations. Paying on time is considered to be essential for maintaining relationships with core suppliers.

Bonuses and Penalties

There are no bonuses for higher quality milk but, instead, penalties relating to substandard milk. Contracts stipulate that milk density cannot be less than 1.027kg/m^3 and this is used as a measure of water content. If the density is lower, i.e. high water content as the density of milk is higher than water, the price paid by Molmilk is reduced by 2 per cent. If the acidity is above 18^{o}T (degrees Thorner), the price is reduced by 50 percent or the milk is returned to the producer. Where producers try to cheat by selling counterfeit milk the offending material is returned to the producer rather than contract abrogation.[4] Each batch of milk from every commercial enterprise is tested regarding its quality at the farm and on arrival at the dairy, prior to payment. In this way asymmetric information, between sellers and buyers, regarding quality is avoided. The factory also now supplies its collecting stations with chemical reactives to analyse milk quality (sulphuric acid, alcohol and sodium hydroxide)[5] and the quality of milk is determined for each batch from every livestock holder. In this way, peasant farmers that try to sell counterfeit / substandard milk can be identified.

[3] In 2002 the average exchange rate was 1 euro (€) = 11.53 Moldovan *lei*.
[4] Penalties are foreseen in the contracts, at the figure of 0.02 per cent of the market price but the factory does not apply them. The costs of legal enforcement are seen to be prohibitive.
[5] Sulphuric acid is used in combination with alcohol to determine the butterfat content of milk (the Gerber test). Sodium hydroxide is used in the test for acidity and is a measure of freshness.

There are currently no 'lock-in' exclusive supply clauses in contracts between the agricultural joint stock companies and Molmilk but a belief that reciprocal and credible growth encourages long-term relationships. For this to be sustainable Molmilk sees a need to respect contract conditions, especially concerning the mode and terms of payment. Contracts stipulate that if Molmilk fails to pay on time it has to pay a penalty based on the market price of the milk to the commercial supplier.

Quality Monitoring

The factory uses the established norms that are approved for Moldova as a whole by the state agency 'Moldova-standard'. These standards have their origin in former Soviet norms and there are discrepancies with typical international standards on quality and there is a need to develop a new national system of quality measurement. In future Molmilk would like to have greater control over the way livestock is managed on the farms that supply it with milk. The company has considered backward integration into diary farming to secure a more stable supply base and may use profits from processing to establish its own farm. The restoration of a livestock farm could produce 8 tonnes of milk per day and allow for a more direct control on product quality and provide a model for integration with other farms. As Molmilk is specialised in the production of cottage cheese, milk protein content is critical and it would like to stimulate livestock selection in this direction.

5. Conclusions and Lessons for Development Strategies

Molmilk's short but turbulent history illustrates a number of dilemmas that have been confronted in rebuilding post-Soviet agri-food industries and a set of conclusions can be drawn. First, land reform programmes should take a supply chain perspective. However, land reform is often treated solely within an agricultural context and the debate on transitional countries has been principally concerned with the benefits that might accrue from decollectivisation and the distribution of private property

rights (Berman, 1996). Yet changes in agricultural structures can have a profound effect on the operational viability of food processors and this is clearly illustrated with the case of Molmilk. In other words, there is a danger that too much attention is paid to the benefits that may accrue from changes in ownership and too little attention to how these new actors may successfully interact to develop competitive final products (Zaharieva, *et al.* 2002). In Moldova, land reform led to the creation of a mass of small-scale plots and herds of 1 to 2 cows are inimical to commercial dairy processing.

Successful supply chains also require an ability for both suppliers and buyers to evaluate quality in order to avoid adverse selection problems. Where asymmetrical information persists between buyers and sellers, as at most Moldovan milk collecting stations during the late 1990s, opportunities for cheating will emerge. This problem is often overlooked in the development literature and was not discussed in Moldova at the time of land reform. Nevertheless it led to market failure and put the viability of the whole supply chain in doubt.

Restructuring also requires the development of successful contracting, which allows for stable relationships between processors and suppliers. In an environment where the public enforcement of business contracts has broken down, the ability to form and maintain private, self-enforcing contracts becomes paramount (Gow and Swinnen, 1998; Gow and Swinnen, 2001). Where producers attempt to improve the value-added of their production, as Molmilk is attempting by specialising in cottage cheese production, contracting also becomes a vital tool in improving the ability of the processor to influence the quality and specification of the raw material available for sale.

Finally in Moldova, as elsewhere in the FSU and illustrated in the Molmilk case, there is a trend for processors to concentrate on their linkages with commercial farming enterprises and diminish or completely cease procurement from peasant producers. This highlights a dilemma for development

agencies. Pro-poor development strategies will typically seek to aid the poorest, small-scale producers and encourage an inclusive agenda that maximises participation (Dudwick and Youssef, 1998). However, for strategies linked to export led development and exploiting the cost advantage that many CEECs possess in agri-food production, developing supply chains that concentrate on larger commercial producers is appropriate. However, the latter course would likely further marginalise peasant producers who are amongst Europe's poorest.

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Table 1: Index of Cow Milk Production for Selected Former Soviet States (1992=100)

	1994	**1996**	**1998**	**2000**	**2001**
Armenia	105	109	115	120	117
Azerbaijan	92	99	111	121	126
Belarus	94	83	89	76	82
Estonia	84	73	79	68	74
Georgia	113	137	167	163	182
Latvia	68	62	64	56	57
Lithuania	78	76	80	71	74
Moldova	80	65	52	49	50
Russia	89	76	70	68	69
Ukraine	95	82	71	66	69
FSU Aggregate	91	78	74	71	74

Source: own calculations based on data from FAOSTAT (2002)

Table 2: Analysis of Production at Molmilk (1999-2001)

	Measure / units	1999	2000	2001
Number of employees	People	14	15	28
Average salary	Euros per month	31.44	41.23	78.43
Collected milk quantity (fat content of 3.5%), total	Tonnes	98	874	1905
Of which from small-scale, private holders	Tonnes	-	51.4	670
Products produced, of which				
Milk	Tonnes	15	6	178
Butter	Tonnes	0	4	0
Sour cream	Tonnes	0	0	40
Cottage cheese	Tonnes	76	129	259
Value of Total Output	Euros	17,499	207,119	446,835

Figure 1: The Structure of Dairy Supply Chains in Moldova

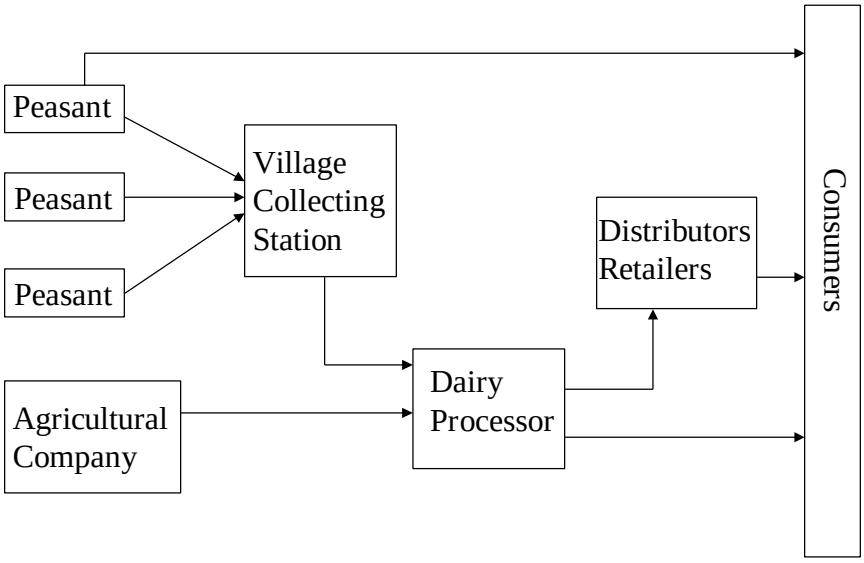

Figure 2: Sources of Milk Supply for Molmilk (2002), in percentages