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A Review of Dairy Development and School Milk Programme in Thailand

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Contents

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An understanding of the objectives, governance and contribution of the Thai school milk programme (SMP) requires a brief examination of the evolution of the dairy sector in the country because the structure of the sector prior to the introduction of the SMP in 1992 provided the context for introduction of the SMP while the situation after its introduction has been significantly shaped by the SMP.

Milk production and import growth, 1961-2008

Historically, smallholder crop-livestock mixed faming dominated Thai agriculture until very recently. Cattle and buffaloes in these systems were primarily used for draught power and meat (mostly after culling) as milk consumption beyond infancy was not common perhaps because of lactose intolerance among majority of the adult population and beef consumption was low due to its high income elasticity of demand and small share of urban population. In the 1940s and 1950s, Indian and Pakistani settlers in the suburban areas of Bangkok used to raise some dairy cattle because of their tradition of consuming milk and milk products like cheese, yoghurt and sweets (Chantalakhana quoted in FAO, 2002). In the 1950s, under a joint programme of the United Nations and the Thai Government, powder milk was distributed to health clinics and schools to enrich diet of vulnerable people as well as to make the Thai population familiar with milk. In 1956, a Dutch company started producing plain and flavoured liquid milk out of imported powder milk to serve upper class urban consumers. These rudimentary consumer markets perhaps provided the trigger for subsequent development in production, import and consumption of milk in the country.

From a modest level of production and import in 1961, the sector experienced phenomenal growth (Table 1). From 1975, annual production level approximately doubled every five years. Increased domestic production resulted from rapidly increasing number of milk cows as well as increase in productivity. Yield per cow per year increased from about 1000 kg in 1961 to about 3000 kg in 2001- an additional 500 kg yield per animal was achieved every 5 years since 1961. From 1970 onwards, production growth far surpassed import growth so share of domestic production in consumption increased. Per capita consumption increased from 2 litres/year in 1984 to 23 litres/year in 2002. Between 1996-2006, consumption per capita increased by over 6% annually. In 2006, share of domestic production in total consumption (in liquid milk terms) was 30% compared to 20% in 1996 (http://www.aphca.org/reference/dairy/chiangmai_workshop_feb08.html). Due to high consumption growth, during 1996-2008, import level exceeded agreed quota under WTO/TAFTA though the gap decreased in more recent years (Table 2). By 2010, per capita consumption increased to 28.6 litres/year and share of domestic production in total consumption increased to nearly 50%. And 80-100% of raw milk production has been converted into ready to drink milk . There are now 20, 000 dairy farmers raising over 250, 000 milk cows and the industry employs over 250, 000 people throughout the production-processing-marketing chains (Jarialerttsakdi, 2010).

The nature of growth of the sector prior to the introduction of the SMP in 1992 has been influenced by interlinked efforts in the areas of breed development and promotion of dairy farming, organization of farmer cooperatives, promotion of dairy consumption and investment in dairy processing. Since 1950, several steps were taken by different agencies for dairy development in the country. A brief discussion on these aspects follows.

Table 1 Milk production and import in Thailand, selected years

Year	No of milk Cows	Whole milk production (tons)	Import (tons)	
			Skimmed milk powder	Whole milk powder
1961	2000	2000	624	1535
1965	2000	2300	2036	2277
1970	2800	3500	22426	4428
1975	7200	14000	20767	6656
1980	15000	30000	25054	11247
1985	26431	57895	25840	18896
1990	44450	130278	47536	17336
1995	99456	307229	79919	41192
2000	201000	520115	53024	48249
2005	300000	888220	69671	33016
2008	262000	786186	60666	25402

Note : The import levels shown in this table differ from those shown in table 2. Most likely, figures in Table 2 refer to only whole milk powder.

Source: FAOStat.

Table 2 Quantity of milk quota and tax for imported milk powder, 1995-2008

Year	Based on WTO/ TAFTA Agreement (Tons)		Tax)%(			Actual imports)Tons(
	WTO	TAFTA	Within quota	Actual tax	Over quota	
1995	45,000	-	20	5	237.6	55,000
1996	46,111	-	20	5	235.2	88,000
1997	47,222	-	20	5	232.8	88,000
1998	48,333	-	20	5	230.4	88,000
1999	49,444	-	20	5	228	88,000
2000	50,556	-	20	5	225.6	55,600
2001	51,667	-	20	5	223.2	65,000
2002	52,578	-	20	5	220.8	73,000
2003	53,889	-	20	5	218.4	68,348
2004	55,000	-	20	5	216	67,252
2005	55,000	2,200	20	5	216	67,200
2006	55,000	2,200	20	5	216	64,700
2007	55,000	2,200	20	5	216	59465
2008	55,000	2,200	20	5	216	65,431

Source: FAO RAP based on DLD and Bureau of Trade unpublished data

Breed and feed development[1]

Since indigenous cattle and buffaloes were basically not dairy breeds, in 1950, Kasetsart University in Bangkok, then under the Ministry of Agriculture and Cooperatives (MAC), initiated research on dairy cattle breeding at its experimental dairy farm with a herd of imported Swiss Brown cattle. The herd did not perform well in Thai conditions. In 1952, a herd of RedDen (Red Danish) cattle was imported for adaptation but that also did not perform well (FAO, 2002). In 1958, the Department of Livestock Development (DLD) under the MAC imported a herd of Holstein Frisian from Germany and maintained at a Thai-German experimental farm but this also did not perform at a level required for viable commercial dairy farming.

In 1962, following a visit by His Majesty the King of Thailand to Denmark, a Thai-Danish Dairy Farm was established at the Royal initiative at Muak Lek in Saraburi Province (to the north-east of Bangkok) for dairy research. When the cooperation programme finished in 1971, the Dairy Farming Promotion Organization (DFPO) was established and it took over the farm. The Thai-German farm was also handed over to DLD in 1977. Experimentation with RedDen and Frisian and their crosses by DLD and DFPO research centres continued at varying intensity until 1980 but performance at the station and in actual farm conditions turned out to be poor or unsatisfactory.

Given the above, in 1980, a herd of 50-50 Shahiwal:Frisian cross was imported from Pakistan to upgrade the Frisian blood content after adaptation. Research and adaptation of breed also involved development of appropriate feeds and rations, breeding services, disease control and management packages for optimal performance. This strategy appeared to be somewhat satisfactory as average daily milk yield under farm conditions increased from about 8-10 kg in the 1980s and 1990s to about 15 kg at present. The national dairy herd is presently composed of animals with about 87.9% Frisian blood.

Thus the unique feature of dairy development in Thailand is that it has been pursued not by trying to develop any breed based on indigenous genetic material or by upgrading any indigenous breed using exotic blood but by adapting imported crosses of exotic breeds. Further enhancement of productivity of the current national herd is the present research goal but feed still remains a major constraint for productivity improvement because crop residues and low quality roughage is a major share of the ration used by farmers, and the quality varies widely between farms and regions depending on the type of material available. Also land is scarce so allocation of land for fodder production is problematic for smallholders who are majority though for larger farms it is less problematic. This issue received priority attention in research and DLD has developed a hybrid high yielding Napier grass, which is being multiplied and disseminated at present. It is expected that successful dissemination of this fodder will help resolve major part o the feed constraint and improve productivity significantly.

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[1] Partly based on an interview with Theera Rukkwamsuk and Pipat Arunvipas, Associate Professors, Department of Large Animal and Wildlife Clinical Science, Kasetsart University, Kamphaengsaen Campus, 8 September 2011.

Promotion of dairy farming

Alongside experimental and on-farm adaptive research on breeds, feeds and management, efforts were made to promote adoption of dairy by farmers as a commercial enterprise. Systematic promotion of dairy was started in earnest after the 1962 royal initiative to establish the Thai-Danish Dairy Farm. A package around 5 cows and other technical and financial support services were developed for dissemination by the Farm as well as the DLD. Training, extension, veterinary and artificial insemination services were provided free. Soft loan was provided by the Bank of Agriculture and Agricultural Cooperatives for acquisition of animals, equipment, and for building animal house. After establishment of the DFPO in 1971, it has played an important role in introducing technology to farmers and organizing dairy cooperatives in the central region. In 1978, the DFPO undertook an ambitious 10 year plan to raise fresh milk production to a level required for attaining self-sufficiency, which, along with various supporting policies, accelerated growth though sel-suficiency has not been achieved yet as demand growth outstripped supply.

The central region received main attention for dairy promotion in the beginning because of the existence of Bangkok, the capital, as the market for milk. Central region was the richest among the four regions because of backward and forward linkages with economic activities in Bangkok region. For example, in 1994, average farm size was respectively 4.33, 3.82, 3.72 and 5.26 ha in the northeast, north, south and central regions. But GDP per capita for these regions was respectively Bt 20235, 31064, 39789 and 69589. In Bangkok region it was Bt186167. However, dairy was perceived as having a potential for increasing farm income, reducing poverty and decreasing regional disparity in income. So dairy was promoted in all the regions in varying intensity by providing various forms of incentives and support services. In some regions farmers used to produce cassava, sugarcane or corn, which were not very remunerative due to low yield and low local and world market prices which threatened their livelihood. So DLD and DFPO's promotional messages on dairy attracted them as an alternative livelihood strategy. Local leaders and innovators provided additional impetus for adoption of dairy as a new enterprise. Of the 74 provinces in Thailand, only two had no dairy farms in 1993. Although central region had the highest concentration of dairy animals, growth rate overall was strongest in the north-east region where animal numbers in 1995 was about 14 times more than in 1986 while national average increase was 4.5 times (Table 3). Such widespread diffusion of dairy farming is a feature uncommon in many developing countries where dairy development has been largely promoted in high potential pockets with limited success. Not only dairy expanded geographically, herd size also increased rapidly. In the 1980s few dairy herds had over 50 head of cattle, by 1994-95, in the central and south regions, respectively 25% and 34% of the herds were of this size category (Table 4).

Promotion of dairy cooperatives

Profitability and viability of farms depended on remunerative market access. Urban areas, especially Bangkok, were the main consumption centres. In the absence of tradition of milk consumption in the rural areas, there was little local market for the producers. It was necessary to link farmers with dairy processors who served urban markets with pasteurized and UHT milk. This linkage was not feasible for individual producers because of their small individual volume of output and their dispersed location. Both these factors entailed high transaction costs for farmers to market milk and milk processors for collection. Therefore, farmers were encouraged by the Cooperative Promotion Department of DLD to form dairy cooperatives and establish milk collection and chilling centres from where processors could collect milk for processing.

Table 3 Distribution of dairy cattle population by region, 1986-1995

Year	Region				
	Central	**North east**	**North**	**Southern**	**All regions**
1986	51 708	5 705	4 686	1 506	63 605
1987	55 598	4 163	5 829	2 086	67 676
1988	68 908	14 881	8 563	2 575	94 927
1989	103 041	16 463	10 346	2 926	132 776
1990	118 052	25 234	11 022	3 229	157 537
1991	151 067	25 539	10 618	3 970	191 194
1992	168 213	38 355	11 879	4 052	222 499
1993	166 688	46 121	19 609	4 771	237 189
1994	164 199	47 355	14 861	5 203	231 618
1995	185 370	79 678	16 706	5 493	287 247
Ratio 1995/1986	3.58	13.97	3.57	3.65	4.52

Source : FAO, 2002

Table 4 Percentage of total dairy cattle numbers by herd size and region, 1994-95 average

Herd size	Central	Northeast	North	South	All regions
1 - 2	6.7	4.9	0.6	4.8	3.1
3 - 4	11.5	9.7	2.0	11.1	6.1
5 - 9	20.8	19.4	12.4	21.6	16.1
10 - 19	19.1	22.7	34.8	16.6	27.9
20 - 49	16.2	21.7	34.7	11.8	26.7
50 - 99	5.1	10.2	7.8	6.7	7.3
100 - 499	5.2	11.4	5.4	16.4	6.6
500 and over	15.4	0.01	2.4	11.1	6.2
Total	100.0	100.0	100.0	100.0	100.0

Source: FAO, 2002

Legally, establishment of a cooperative society required a minimum of 60 farming families, with at least 300 cows between them. Farmers had to have passed a training course on dairy farming and have a minimum of 10 rai of land and preferably a minimum of 5 cows. The distance from the milk collection point should be no more than 20 km and there should be an approved market or buyer for the milk. Importantly, the intending cooperative should have access to veterinary and artificial insemination facilities or have these on their own. However, in reality, initially some non-dairy farmers were taken as members by some societies to raise capital and some members having less than 5 cows were also accepted as members. Number of cooperatives increased from 27 in 1988 to 58 in 1993. Average membership of a cooperative was 254 during this period : 274 during 1988-90 and 234 during 1991-93 indicating that the average size of a cooperative became smaller over time. Total number of members increased from 7616 to 13358 between the two years, annual average membership was 11080.

Initially, the cooperatives often lacked the financial resources to invest in milk collection facilities and in transport and processing facilities. There were limited number of people in the dairy cooperatives with an adequate knowledge of management, accounting and extension. Even in the early 1990s, for many cooperatives, the scarcity of trained personnel resulted in them being run by government officers. Cooperative members had little, if any, say in the operation of the cooperatives (Thirasuttakorn quoted in FAO, 2002). So in order to help cooperatives run their own organization effectively, government assistance to cooperative societies included the following :

- Grants to cooperatives for investment in cattle and equipment;
- The provision of loans to farmers for purchase of animals and animal feed.
- Training of farmers through extension programmes in dairy cattle management and dairy cattle health;
- Training and education of members in organizational and financial management.

On the other hand, the cooperatives were involved in the following activities:

- The operation of milk collection centres where the farmers could deliver milk. This milk was purchased at a base price adjusted for butterfat content, protein content, bacterial count, sediment, water content and farm hygiene.[2]
- The processing of milk if there was own processing plant or the sale of the milk to other processors.
- Operating feed mills, if established, to produce feed concentrate and feed rations for members.
- The bulk purchase of equipment used by member dairy farmers on their farms.
- Providing extension services to farmers to improve farm management.
- Facilitating loans from the Bank for Agriculture and Agricultural Cooperatives.
- Running seminars to improve management practices.

Since the early 1980s, the Thai government pursued a policy of promotion of decentralization of investment for development and to that end the country was divided into several investment zones, and various forms of incentives like reduced duties, tax breaks, credit on easy terms were provided to encourage investment in zones away from Bangkok. Agriculture in general and dairy processors and dairy cooperatives in particular took advantage of these facilities to increase herd size, establish chilling and processing facilities and feed mills. By 1990, 12 private dairy processing companies invested 631 million Bhat of which 48% was Thai capital, the rest was foreign. Companies under exclusive Thai ownership invested 27% of the value, joint ventures invested 57% of the value and exclusive foreign subsidiaries invested 16% of the capital. Similarly, large investment was made in

[2] After the 'melamine in milk' scandal in China, protein content has been dropped as a criteria for assessing quality in Thailand because of the possibility of melamine use to enhance protein content (Interview with Baan Bueng Dairy Cooperative, 10 September, 2010)

dairy feed mills along with feeds for poultry and pig industries. Some cooperatives also established their own processing plants and feed mills taking advantage of the incentive policies (Table 5). At present there are 117 dairy cooperatives of which 60 have processing facilities. In addition, there are 5 processing plants owned by the DFPO and about 30 private processors of varying sizes of which Nestle, Foremost, Melji and Dutch Milk are the largest.

Milk market and price prior to introduction of the school milk programme

Initially dairy producers had very limited local market for raw milk, so they formed cooperatives to facilitate bulk selling to private processors who serve urban markets. One or more processors usually signed a contract or MOU with a cooperative for purchase of milk at an agreed price. The farm gate price of milk was determined by the DFPO and DLD on the basis of estimated cost of production and a margin to match the open market retail price of pasteurized milk. Cooperatives usually received payments twice or thrice a month as agreed and members in turn received at the same frequency. Processors were also subjected to import quota as mentioned earlier. Thus subsidies and organizational support in the production sector and protection in the market provided an environment for rapid growth in output in the 1980s. However, retail price was determined by processors based on world market price as well as local market conditions without government interference. So, when world price for powder milk fell and/or milk exporting countries pursued subsidized exporting policy, domestic dairy producers and cooperatives faced problems in selling milk because large processors found import more economic than buying milk from dispersed domestic market. Transaction contracts were often ignored and enforcement of those contracts became difficult. In 1984, dairy farmers and cooperatives agitated over unsold milk and demanded assured market for milk to continue dairy farming, which led to the adoption of a number of measures including introduction of school milk programme for promotion of consumption and market expansion.

School milk programme as a new market outlet

Background and evolution

Partly in response to the farmers' complaint about unsold milk, The National Milk Drinking Campaign Board was established in 1985 in order to publicize milk as a nutritious food and promote its consumption. This organization and the National Youth Bureau conducted a campaign with private sector funding to publicize the dietary value of milk under a slogan : "Have you had your milk today?" (Itsaranuwat and Robinson 2003). The campaign also initiated a pilot programme in 1985 in selected areas of Bangkok and Chiangmai in which the parents of primary school and kindergarten children purchased milk at 25 percent less than the normal price through monthly coupons in order to create a taste for milk among small children and prepare them as potential future consumers of milk.

Malnutrition (especially protein-energy malnutrition) among pregnant and lactating women and preschool and school-age children continued to be a principal nutritional problem in Thailand even though the nation has enjoyed rapid economic growth in the past several decades. It recorded an average annual Gross National Product (GNP) growth rate of 6.7 percent from 1968 to 1986 (Warr, 2007). Previously malnutrition was regarded as a health

Table 5 The status of three dairy cooperatives

	Wangnamayen Dairy Cooperative Ltd Sa Keow Province	Nakhon Pathom Dairy Cooperative, Nakhon Pathom Province	Baan Bueng Dairy Coopearive Chonburi Province
Year established	1987	1974	1985
Membership at inception	200	10	25
Membership at present	1300	281	158
% members dairy farmers			
- inception	100	100	60
- Present	100	28	40
Number of cows at inception	1000	Few	150
Number of cows at present	42000	5000	3200
Raw milk production per day - tons	150	22	8
Collection centres	5	na	na
Year processing factory established	1998-2000	1985	1992
Processing - pasteurized milk	70 t/day	20t/day	10t/day
-UHT milk	60-70 t/day	None	None
% Sales to school programme	80	95	95
Other enterprises established	Feed mill, rice mill, coffee shop, minimart, gas station	Gas station, mini mart, coffee shop	200 cow dairy farm
Enterprises in pipeline/under Construction	Powder milk factory, drinking water factory, 1000 head dairy farm	None	None

Notes:

a) All the cooperatives had started with few members, sometimes as an informal group, e.g. Baan Bueng Dairy Cooperative started as an informal dairy group in 1985 with 25 members and 150 cows primarily to pool milk for selling to a processor. Membership kept growing so in 1988, it registered as a cooperative with 122 members having about 3000 cows. Initially all of them received grants from one or more sources e.g. the central and provincial governments, cooperatives and in some cases, external donor.

b) Growth of membership and size of business of a coop depended on success of the initial effort, adoption of dairy by farmers in the area as well as leadership and management. Leadership quality made a lot of difference, e.g. strong leadership of the Wangnamayen Dairy has transformed it into a large multi-enterprise business group in a relatively backward area and it has plans to expand further.

c) Members are generally promise bound to sell milk to its collection/processing unit at prices determined by the government or by themselves. They also have obligations to supply school milk – either pasteurized or both pasteurized and UHT. But recently some cooperatives are facing the problem of default from members, e.g. some members even directors of Baan Bueng Coop sell a significant portion of their milk to outside buyers at higher prices rather than selling to its own processing plant, so the coop has to buy milk from outside to fulfill school milk obligation. The result is less profit and bonus for members for now but such behaviour of membership may eventually make the coop suffer losses and eventual collapse.

d) All the cooperatives have various packages to serve members, e.g. credit, AI and vet services, feeds for cash or credit etc, to improve production. Recently they have been facing the problem of membership drop out because older generation is retiring and younger ones after having higher education are less interested in dairy or agriculture. So some cooperatives have both dairy and non-dairy farmers and others have only dairy farmers as members. Average dairy herd size is increasing in varying degrees which may compensate loss of member.

Source: Field visit and interviews

problem and was addressed under the health programme but since 1982, the problem was linked with poverty alleviation and community development programmers. Experiences of two previous pilot school lunch programmes (SLP) provided a basis for approaching the nutrition problems of children through school lunch programme. One was initiated by the Bangkok Metropolitan Administration in 1977 targeting the city's lower income households with funding from the government as well as the private sector and some individuals. Another initiative was taken in 1987 by the then National Primary Education Authority under the Ministry of Education, which directed every school to implement a free school lunch programme for all students and some financial assistance was provided to schools in deprived rural communities where agricultural production was low or not feasible and students were unable to afford to buy lunch (Kachondham et al. 1992). Although insufficient funding impeded full coverage of all schools and all students, these initiatives promoted public recognition of the importance of school feeding which eventually led to the adoption of The Fund for School Lunch of Primary School Act B.E. 2535 in 1992, under which central government fund was allocated to all primary schools to provide lunch to all KG-Grade 6 students suffering from malnutrition and to a lesser extent, to students living in poverty in remote rural areas. The objectives were to enhance food security, promote desirable/healthy eating habits and promote full growth and development of children. The mode of implementation of the programme (food menu, procurement and delivery, supervision and management) and student coverage varied widely across schools and regions and between rural and urban areas.

The pilot school lunch programme implemented since 1987 suffered from some deficiencies e.g. the food menus provided were often small and low quality in terms of nutritive value, which highlighted the need for improving the size and quality of the lunch menu. About the same time, FAO drew attention of the Thai government to experiences with school milk programmes implemented since the second world war in Europe and the USA and more recently in many developing countries, as a vehicle to provide nutritious food to children suffering from malnutrition. The message was that milk contained protein, fat and over 12 essential micronutrients required for healthy growth of children. If these are missed in infancy and early childhood, the resulting deficiency in physical and mental growth can't be recovered or compensated fully even with better nutrition in later years. So in 1992, in addition to the school lunch act, School Dietary Supplement (Milk) Project was introduced to solve the problems of child malnutrition as well as to create market for Thai dairy farmers. In 1992, 1993 and 1994, central government funding was allocated to provide 200 ml milk to kindergarten students throughout the country for 120 days. Subsequently all grades in primary schools were gradually covered and duration of milk supply was also increased to 200, then 230 then 260 days (Table 6).

After the introduction of the school milk programmer in 1992, both producer price and factory gate (processor) price for delivery of school milk were determined by DFPO and DLD, so a delicate balance had to be maintained to give both producers and processors adequate incentive to make the system work. Given the fact that the entire budget for school milk came from the government, budgetary implication also became a factor in the determination of prices at different points because over time the school milk programme became larger due to addition of grades and increased enrollment of students. In the early stage of the school milk programme, farm gate price was 38-40% of the factory gate price of school milk, but this ratio gradually increased to over 50% in recent years (Table 7). The producer share of retail price of milk in the open market has been much less as the open market price was unregulated and higher than factory gate price for school milk. The implication of increased producer share of the factory gate price depended on who supplied school milk. Initially school milk was mainly supplied by private dairy processors, so they benefitted from a smaller producer share of retail price of processed milk. Over time, taking advantage of various policy support, as explained earlier, a large number of cooperatives also created processing facilities and they became suppliers of school milk. A significant proportion of cooperatives sell over 80% of their raw milk output to the school milk programme, so members receive income from selling raw milk and bonus on shares in the processing enterprise and other businesses as discussed earlier. An increased producer share of retail price or school milk price, therefore may mean lower bonus income from processing enterprises. However, most cooperatives have been reportedly paying good rates of bonus on members' shares, which indicates that both farm and factory gate prices have been reasonably in favour of the cooperatives as producers and processors.

Table 6 Budget, coverage and number of students involved in the school lunch and school milk programmes, 1992-2010

Year	Budget (mill Bhat)		Coverage (grades)		N of students (Mill head)		N of days provided	
	SLP	SMP	SLP	SMP	SLP	SMP	SLP	SMP
1992	30	279	K-P6	K	na	0.69	na	120
1993	220	424	K-P6	K	na	1.26	na	120
1994	1333	1208	K-P6	K	na	1.62	na	200
1995	2147	1715	K-P6	K-P1	na	2.8	na	200
1996	2286	2213	K-P6	K-P2	na	3.52	na	200
1997	2412	4335	K-P6	K-P3	na	5.01	na	200
1998	2525	5324	K-P6	K-P4	na	5.39	na	200
1999	2966	5356	K-P6	K-P4	na	5.84	na	200
2000	3213	5981	K-P6	K-P4	na	5.9	na	200
2001	3272	6070	K-P6	K-P4	na	6.22[a]	na	200
2002	3079	6752	K-P6	K-P4	na	5.84	na	230
2003	2556	6819	K-P6	K-P4	na	5.96	na	230
2004	3394	6853	K-P6	K-P4	na	5.99	na	230
2005	5005	7000	K-P6	K-P4	na	6.09	na	230
2006	5279	6989	K-P6	K-P4	na	6.07	na	230
2007	5144	6570	K-P6	K-P4	na	5.37	na	230
2008	na	6520	K-P6	K-P4	na	5.33	na	230
2009	na	10010	K-P6	K-P6	na	7.11	na	260
2010	na	14000		K-P6	na	8.4	na	260

a. K means kindergarten. In 2001, students of grades 5 and 6 with malnutrition problems were included, hence this enhanced number of students served.

Source: Department of Livestock Development (DLD), unpublished data; Kanemasu, 2007

Governance of the programme

Although the programme significantly contributed to increased production and consumption of milk in the early stages, its governance raised new issues, which were resolved through policy changes. From inception in 1992 until 2000, the Office of the National Primary

Education (ONPE) purchased the milk for the schools it supervised. The purchase was on a competitive bidding basis. Potential bidders could bid for supplying one or more schools depending on their capacity and interest as some did not want to sell entire output to school

Table 7 Farm gate, factory gate for delivery to school and retail prices of milk, 1986-2011

Year	Farm gate price, Bt/kg raw milk* (a)	Retail price, UHT milk Bt/kg** (b)	School milk price, Bt per/lit pasteurized milk (c)	School milk price, Bt per/lit UHT milk (d)	Farm gate price as share of retail UHT price (e) = a/b	Farm gate price as share of pasteurized school milk price (f) = a/c
1986	6.55					
1987	6.59					
1988	6.62					
1989	6.65					
1990	7.01					
1991	7.12					
1992	7.51		20.00			0.38
1993	7.98		20.00			0.40
1994	7.96		20.00			0.40
1995	7.96		20.00			0.40
1996	9.07		20.00			0.45
1997	9.39		20.00			0.47
1998	10.66		22,20			0.48
1999	11.25		22.20			0.51
2000	11.17		22.20			0.50
2001	11.33		22.20			0.51
2002	11.34	31.69	22.20		0.36	0.51
2003	11.35	32.28	22.20		0.35	0.51
2004	11.38	32.16	22.20		0.35	0.51
2005	11.48	32.35	22.20		0.35	0.52
2006	11.50	32.86	22.20	23.45	0.35	0.52
2007	12.91	34.01	23.45	29.70	0.38	0.55
2008	14.56	36.10	25.70	32.60	0.40	0.57
2009	16.50	41.73	31.30	39.30	0.40	0.53
2010	17.00	42.10	31.30	37.75	0.40	0.54
2011	18.00	43.20	31.85	38.05	0.42	0.57

Note: Retail price of pasteurized milk could not be collected, so only retail UHT price is shown. Usually price of UHT milk is higher than that for pasteurized milk. National school milk programme started in 1992, so prices are shown since then. UHT milk distribution in school milk started much later. School milk is served in 200 ml packets and priced as such but price is shown per litre for easy comparison with farm gate price

Source: *Office of Agricultural Economics, Ministry of Agriculture and Cooperatives
**Bureau of Trade and Economic Indices, Ministry of Commerce

programme. The lowest bidder usually would be awarded the contract but sometimes the distance between the supplier's processing facility and the school could be prohibitive for timely and efficient delivery. During this period, only condition about the form of the product was that 200 ml packets of pasteurized milk should be supplied. There was no restriction or specification on the source of raw material to be used so raw milk or powder milk or a mixture could be used as raw material. Also there was no restriction or specification on the type of packing and labeling to be used so pouch or sachets or paper cartoons could be used for packing, and any kind of labeling the company or cooperative preferred could be used. Therefore, school milk could not be separated from commercial milk which might require a different quality standard. As the coverage of the programme increased, demand for milk increased rapidly, and since lowest bidder was awarded the supply contract, various kinds of quality problems arose as suppliers tended to use more powder milk of questionable quality when world prices were low, and adulteration with water to increase volume was also rampant. Together these problems led to deterioration of the quality of milk in some cases.

In order to address these problems, several policy measures were taken. In 2000, it was proclaimed that only raw milk could be used to prepare packets to supply school milk, the objective being elimination of dilution with powder milk. In 2001, a common design for school milk packets was provided which every supplier of school milk had to follow. As a result, school milk was given a separate identity or brand like presentation different from commercial milk even though the labeling included the name and logo of the supplier. A system of zoning at the provincial level was introduced so that only specific suppliers satisfying specified criteria could supply a particular zone. This arrangement would also ensure supply of local milk to local schools and create a sense of ownership of the programme among all stakeholders involved. However, later the province level zoning was found to be very restrictive, so it was redefined at the regional level, which means that processors in a given region could participate in a bidding process to supply milk to one or more schools in the region depending on processing capacity of the processor. As a result some processors might be left out of the school milk programme if they failed to win any bid. In 2003, there was a proposal to define zone by fixing the distance between school and processing plant at a maximum of 100 km but this was not implemented due to the small number of dairy processors in the country and their concentration in a few locations.

In 1999 the central government adopted a policy of decentralization of civil administration by giving more authorities to Local Administrative Organizations (LAO). So the administration and governance of schools became the responsibility of LAOs, and rather than sending central government funds directly to schools from the Education Ministry, the fund was channeled through the Interior Ministry to the LOAs for further distribution to individual schools. Since 2001, in line with the general school fund allocation, central government fund for school milk has been sent to the LOAs. However, the regional zoning for supply of milk to schools by processors had to be synchronized with the LOA boundaries. More than one LOA might fall within the boundary of a zone. So based on decisions of the National School Milk Committee and directives of the Dairy Farming Promotion Organization (which serves as the secretariat of the committee), a tri-partite agreement used to be signed between the LOA, the schools within the LOA and the milk processors that are allocated quota to supply milk to schools within the LOA. Under the agreement, the processor was obliged to supply agreed and required quantity of milk directly to the school but would receive payment twice or thrice a month from the LAO on the basis of certified invoice submitted by the school. The LOA in turn would receive reimbursement from the Interior Ministry every quarter or on a half yearly basis. This means that the LOA had to use its own cash to pay the processors more frequently than it received reimbursement from the central government.

Initially milk was supplied only on school days but later school holidays were also included in the programme. Pasteurized milk was the product supplied for daily instant consumption at the school, but inclusion of holidays in the programme created problems for the schools as either students had to come to school during holidays to drink milk if supplier delivery was daily as before, or if supplier delivery was periodic, students could take periodic delivery of packets, if they had refrigerator at home, to consume at home. But it could not be ascertained if they consumed themselves at the prescribed time and manner or shared with other members of the family. After a while the problem created by pasteurized form was solved by procuring UHT packets for the holiday periods (the MOUs for purchase specified the delivery schedules for pasteurized and UHT milk packets)[3] and by making periodic delivery to students to take home as no refrigeration was required. However, the other problem of ascertaining regular and timely consumption by the students themselves instead of sharing within the family remained unresolved. Perhaps this need not be emphasized in the Thai context today as the primary objective is to promote milk consumption among children and no nutritional impact data (e.g. height and weight) are recorded during the holidays.

In spite of the above measures, marketing problems of producers did not disappear altogether. Farmers sometimes faced the problem of unsold milk as some processors, contrary to rules, mixed some powder milk with raw milk whenever it was economic. This was prompted by two factors. First, raw milk had to be purchased at prices fixed by the Ministry of Agriculture and Cooperatives and the price was high in relation to the world market price. On the other hand competitive bidding to get school milk supply quota required that the offer had to be at lower prices. There was thus the possibility of a mismatch between these two market prices. Moreover, due to lack of local demand and competition among suppliers, retail price of commercial pasteurized milk market was also very low in many areas, so processors might incur losses in the commercial milk market sector. This situation made room for adulteration with powder milk or water to reduce cost in order to compete at lower price to supply school milk, which then might be of lower or poorer quality.

In order to address such problems, in 2005 the government intervened by making a rule that in order get a right to supply milk to school, a processor had to buy a portion of raw milk from domestic producers to get import permit for another portion, and that a processor could supply to the school programme only up to the amount of raw milk it purchased. However, the problems created by mis-matched prices at producer, retail consumer market and school levels continued to disrupt smooth running of the dairy sector in general and management of the school milk programme in particular. For example, there was unsold milk (in 2009, out of 2559 tons of milk produced per day, MOUs were signed with producer cooperatives for 1088 tons to supply school milk and for 1354 tons for commercial marketing, leaving 107 tons unsold) and there was occasional news about corruption in milk auction in some places, which was also a manifestation of the underlying problem. In order to address these problems, the governance mechanism of the school milk programme was changed a couple of times between 2005 and 2009, e.g. the zoning system for allocation of milk to schools was rescinded and reintroduced with some modification; the roles of the Ministry of Agriculture and Cooperatives, the DFPO, the DLD, the School Dietary Supplement (Milk) Sub-

[3] If a supplier processor does not have its own UHT processing capacity to fulfill the holiday delivery requirements, it usually gets into contract with a bigger processor having UHT facility and gets its raw milk processed into UHT form or sells its raw milk to the processor and buys UHT milk from that processor.

Committee, the Dairy Cow and Product Committee were defined and redefined. At the end, between 15 December 2009 and 16 February 2010, several deliberations by the Cabinet and other relevant bodies and committees led to the adoption of a series of decisions to address the problems of the sector in a comprehensive manner. Some key elements of those decisions are as follows:

a) The system should ensure that dairy farmers can sell all their milk at reasonable/remunerative price, school children can get quality milk processed in the country without adulteration with powder milk or other substance; producers can sell and processors can purchase, process and sell milk at minimum logistics and transactions costs; flow of funds is adequate and timely so that all payments between parties are made in a timely manner.

b) The School Dietary Supplement (Milk) Sub-Committee will act as the Central Committee for management of the School Milk Programme and the DFPO will act as the Secretariat of the Committee. The DFPO is authorized to sign MOU with all processors who will sell school milk to the LOAs and distributors. Thus the DFPO has two roles. It is a regulator and monitor assessing the amount of raw milk available, the amount of milk to be distributed to schools, designate areas where processors will distribute milk, and monitor and certify the quality of raw milk and processed milk. And it is also a supplier of milk from its processing units to the school milk programme.

c) Based on the accumulated experiences in running the programme since 1992, the School Dietary Management (Milk) Sub-Committee developed a set of mandatory criteria and guidelines for various stakeholders involved in the system for proper running of the programme. The criteria and guidelines include the following (details are in Appendix B):

- Criteria for selecting entrepreneurs to join the project
- Criteria for granting rights and designating school milk distribution areas to entrepreneurs in the project
- Guidelines for purchase of school milk by LOAs and private schools
- Guidelines on school milk transportation and storage
- Measures to monitor and control the distribution of school milk in school milk dietary supplement (milk) project
- Guidelines on prices for pasteurized and UHT milk

d) The entire programme will be financed by the central government and several ministries will have specific roles. The Ministry of Interior will be the buyer for government schools administered through LOAs, Ministry of Education will be the buyer for private schools; the Ministry of Agriculture and Cooperatives will administer quota allocation for raw milk sales; the Ministry of Public Health will be responsible for product approval and quality control, and the Ministry of Industry will be responsible for issuance of production license for processors.

Outcome of the programme

The contribution of the school milk programme to the growth of the dairy sector can't be measured precisely based on any single criteria. However several indicators may be presented to highlight its contribution to the dairy sector.

The main pathway of impact of the school milk programme on the dairy sector has been through enhancing consumption and reducing malnutrition among children. Due to the school milk programme, per capita consumption of milk increased rapidly, For example, currently, school milk consumption constitutes 37% of domestic raw milk production, and 16% of overall national consumption (Table 8). Overall per capita consumption is about 29 l/capita/year but school students alone consume about 52 l/capita in 260 days, thus overall increase in per capita consumption has resulted from school milk programe but school leavers perhaps continued their milk drinking habit, as originally envisaged in launching the k programme, hence overall average consumption also increased rapidly.

Table 8 Some impact indicators of the school milk programme, 1992 and 2009

	Base year	Base year value	2009 value
Number of dairy cows	1992	43940	280,000
Raw milk production, t/year	1992	134,011	840,691
Milk used for school milk prog, t/year	1992	16,560	312,000
Overall liquid milk market, t/year	1992	552500	1,900,000
School milk as % of raw milk production	1992	12	37
School milk as % of milk consumption	1992	3	16
Domestic raw milk as % of overall consumption	1992	24	44
Milk consumption per capita, l/year	1992	na	29
Milk consumption per capita by school student, l/year	1992	24	52
Number students served by school milk, million	1992	0.69	7.1
Annual budget million Bhat	1992	278.6	10010
Number of dairy cooperatives	1996	62	117
Number of dairy cooperative members	1996	15525	20000
Number of dairy processors -Total	1992	70	91
of which cooperatives		na	61
Number of processors selling milk to schools -Total	2003	69	68
of which cooperatives		na	na
Number of processors making pasteurized milk	2003	69	72
Number of processors making UHT milk	2003	11	11

Source: FAOstat ; Department of Livestock Development; other unpublished sources

In the beginning some systematic records were kept in the schools on height and weight of children under the school milk programme as well as on their school attendance. A study by Mahidol University conducted in 1995 acknowledged the importance of school milk as a supplementary drink in meeting the nutritional requirements of school feeding but no precise impact parameters were reported (Chittchang 2005). No systematic analysis of the school records have been done to assess the nutritional and other impacts of the programme.

However, nationally child malnutrition dropped to less than 5% in 2006 from 18% in 1992, the year of inception of the school milk programme (Chittchang 2005; Kanemasu, 2007; Jarialerttsakdi, 2010). Jarialerttsakdi (2010) also reported that in 2004 children height grew 5 cm a year compared to 2-3 cm in 1992. It can be reasonably argued that school milk consumption has contributed a significant share of these changes along with general economic growth, school lunch programme and other interventions occurring simultaneously in the economy.

Increased consumption and demand, even if artificially created in the beginning as a public sector demand, induced changes in different fronts. An expanding market induced existing producers to increase herd size and volume of production and new producers to enter the sector. Between 1990 and 2000, number of dairy cows doubled and milk production more than doubled every five years (Table 1). Currently share of domestic raw milk constitute 44% of overall milk consumption in the country (Table 8).

Major expansion took place in the producer cooperative sector. Number of societies increased from 62 in 1996 to 117 in 2009 and average membership of cooperatives increased from about 15000 to about 20000 between the two years (Table 8). Seventy two percent of the members were dairy farmers and they owned 82% of the total number of dairy animals in the country.

The size and capacity of the processing industry also increased rapidly. Number of dairy processors increased from 70 in 1992 to 91 in 2009. Number of private processors increased to 30 by 2010 though Nestle, Foremost, Dutch Milk and Melji control perhaps over three quarters of the private sector market. During 1995-2000, cooperative processing plants processed 78% of national milk output, the rest was processed by private processors who also processed imported powder milk. Since then many more cooperative societies established their own processing plants rather than just selling chilled milk to private processors. Sixty eight out of 117 cooperative societies now have processing units, others sell chilled milk to private and cooperative processors (Table 7).

Thus, school milk and cooperatives played a major role in the growth of the dairy sector because in the absence of the guaranteed market provided by the school milk programme and group efforts to create collection centres and processing facilities to compete with private processors, who otherwise could control the raw milk and retail markets, there would have been serious market constraints for the growth of the dairy farming sector.

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Appendix 1: Criteria and Guidelines for the Thai School Dietary Supplement (Milk) Project

According to the Resolution passed by School Dietary Supplement (Milk) Management Sub-Committee at Meeting No.1/2010 on 29 January 2010

The criteria for selecting entrepreneurs to join the project

1.1 The entrepreneurs have been granted Permit for Factory Operation.
1.2 The entrepreneurs have been granted Food Production Permit.
1.3 The entrepreneurs have been granted Certificate of Food Recipe.
1.4 The entrepreneurs have been granted Certificate of Good Manufacturing Practice Procedures by Food and Drug Administration and have passed the inspection of a place of production in the last 12 months and can present the formal Inspection Report.
1.5 The entrepreneurs have signed MOU to purchase milk from raw milk sources and the entrepreneurs must ensure that they will purchase the raw milk throughout 365 days according to the price and standard of raw milk purchase set by Dairy Cow and Product Committee.
1.6 The entrepreneurs do not have any overdue bill to pay any farmer or agricultural institute.
1.7 The entrepreneurs are the producers. They cannot hire other entrepreneurs to process milk or administer for them. Except for UHT milk, the entrepreneurs who have the contract to sell mainly pasteurized milk can hire others in case the amount of raw milk is higher than the amount of pasteurized milk distribution and during school breaks.

Criteria for granting rights and designating school milk distribution areas to entrepreneurs in the project

1.8 The entrepreneurs are granted the rights in accordance with the amount of raw milk specified in MOU that they have signed with The Cooperative Promotion Department (only MOUs in School Milk Project) and this amount has to accord with the real amount of raw milk being purchased.
1.9 In the budget year for 2010, the rights and school milk distribution areas will be granted and designated according to the MOUs signed in 2009-2010 (1 October 2009–30 September 2010) since MOUs were already signed. However, in the budget year for next year, the potentials of entrepreneurs, their past conduct, and other criteria set by the Committee, will be taken into consideration before specifying the amount and designating the distribution areas in the new MOUs.
1.10 The amount of 1 ton/day of raw milk, being produced and purchased 7 days a week, will become 4,800 bags or cartons of milk per day (calculate the volume by subtracting specific gravity and 1% loss). The entrepreneurs will be granted distribution rights or deliver 6,720 bags or cartons of milk to schoolchildren 5 days a week. In another word, 6,720 students per day get to drink milk.

The amount of raw milk according to MOUs signed in 2009–2010 totals 1,211 tons per day. The milk will be distributed to 8,137,920 students. This number is close to the number of pre-school children and schoolchildren in 1st to 6th grades in primary schools nationwide in 2010.

1.11 After each entrepreneur is granted the rights to distribute certain amount of milk, the distribution areas or the delivery areas of school milk to schoolchildren will be designated. The allocation criterion in each province specifies that there should be at least 2 entrepreneurs and distance will be taken into consideration to ensure fairness.

Regarding the distribution rights or the delivery areas of school milk to schoolchildren in the 2nd semester in 2009, the organizations which have not purchased any milk, especially private schools, which receive the budgets for the first time this year, first the rights will be granted to Dairy Farming Promotion Organization of Thailand which will purchase surplus raw milk according to resolutions No. 8/2009 and No. 9/2009 passed by Dairy Cow and Product Committee and then the rights will be granted to the entrepreneurs who produce UHT milk from raw milk that they cannot distribute in the 2nd semester in 2009. Concerning the criteria of distribution rights, Dairy Farming Promotion Organization of Thailand, the entrepreneurs, and the distributors can discuss and come to a conclusion together.

1.12 After the rights are granted, the distribution areas are designated, or the milk is delivered to all schoolchildren nationwide, the list of entrepreneurs and delivery areas will be made and sent to Local Administrative Organizations, private schools all over the country, and the entrepreneurs. The purchasing contracts between Local Administrative Organizations or distributors and Dairy Farming Promotion Organization of Thailand or the entrepreneurs to whom powers of attorney are given by Dairy Farming Promotion Organization of Thailand, then will be signed.

The entrepreneurs will receive powers of attorney from Dairy Farming Promotion Organization of Thailand. They will sign guarantee agreements with Dairy Farming Promotion Organization of Thailand. Each entrepreneur should also present Letter of Guarantee issued by a bank, collateral or guarantor to Dairy Farming Promotion Organization of Thailand. The collateral cannot be worth less than 5% of the value specified in the MOU. All entrepreneurs have to comply with conditions set by Dairy Farming Promotion Organization of Thailand and School Dietary Supplement (Milk) Management Sub-Committee.

Guidelines on the Purchase of School Milk by Local Administrative Organizations (LAOs) and Private Schools

1.13 Dairy Farming Promotion Organization of Thailand sends the LAOs and private schools nationwide the list of entrepreneurs.

1.14 Dairy Farming Promotion Organization of Thailand gives powers of attorney to the entrepreneurs in the list so that the LAOs and private schools can sign purchasing contracts with these entrepreneurs in their areas.

1.15 The LAOs and private schools sign purchasing contracts with Dairy Farming Promotion Organization of Thailand or the entrepreneurs to whom powers of attorney are given by Dairy Farming Promotion Organization of Thailand. The special purchase procedure is adopted when signing contracts with the LAOs as specified in the Cabinet's Resolution on 15 December 2009 and the Resolution passed by Committee on Granting Privileges to Organizations and State Enterprises (The Comptroller General's Department) on 14 January 2010.

1.16 The entrepreneurs deliver school milk to the LAOs and private schools as specified in the purchasing contracts. The purchasing contracts shall state that the LAOs and private schools pay the entrepreneurs monthly after the entrepreneurs deliver due amount each month. The entrepreneurs shall receive the power of attorney from Dairy Farming Promotion Organization of Thailand to ask for payment from the LAOs and private schools.

Guidelines on School Milk Transportation and Storage

1.17 The Transportation of School Milk by Entrepreneurs

- Pasteurized milk must be transported in a truck equipped with cooling system. The temperature shouldn't be higher than 4 degrees Celsius. The cold temperature has to be maintained at all time while transporting the milk. In the 2nd semester in 2010, all school milk has to be transported by a truck equipped with cooling system.
- UHT milk must be transported by a container truck or a truck which has roof or is covered with canvas. The school milk packed in paper boxes can be laid on top of each other but not higher than 10 boxes in a row.

1.18 The Storage of School Milk by the LAOs or Distributors

- Pasteurized milk has to be stored in the refrigerators. If it will be kept in a container, the container has to be clean and the ice used has to be clean. The temperature has to be maintained at not higher than 8 degrees Celsius.
- UHT milk has to be stored in a clean area where animals which carry diseases cannot gain access to. The UHT milk has to be packed in the paper boxes and these boxes can be laid on top of each other, but not higher than 8 boxes in a row. The paper box which is covered with plastic film can be laid on top of each other, but not higher than 5 boxes in a row. The UHT milk has to be kept in a raised area, at least 10 centimeters higher from the ground. The temperature should not be higher than 45 degrees Celsius. The area shouldn't be wet nor directly exposed to the sun.

Measures to Monitor and Control the Distribution of School Milk in School Milk Dietary Supplement (Milk) Project

1.19 A Committee on Monitoring and Controlling School Milk Quality will be established. This committee is a sub-committee appointed by Dairy Cow and Product Committee.

1.20 A Provincial Committee on School Dietary Supplement (Milk) Project will be established to monitor and control School Dietary Supplement (Milk) Project in the areas. The governors appointed the deputy governors to be a chair of the former School Dietary Supplement (Milk) Project. There were representatives of the LAOs and relevant individuals serving in the committee. Animal Husbandry Official served as a secretary and Cooperative Official served as an assistant secretary in the committee. All former members of the committee still serve in the present Provincial Committee on School Dietary Supplement (Milk) Project. The chair of Dairy Cow and Product Committee appointed the Deputy Director

General of Department of Livestock Development to be a chair, Bangkok Animal Husbandry Official to be a secretary, and Director of Office of Cooperative Promotion in Area 1 and 2 (Bangkok) to be an assistant secretary of the former Bangkok Committee on School Dietary Supplement (Milk) Project. All former members of the committee still serve in the present Bangkok Committee on School Dietary Supplement (Milk) Project.

1.21 The entrepreneurs, who do not comply with the criteria and guidelines on School Dietary Supplement (Milk) Project, who give false information to the relevant committees, and whose products don't meet the standards required, the contracts will be terminated.

The Distribution Prices

The LAOs and private schools purchase the school milk at the prices set by School Dietary Supplement (Milk) Management Sub-Committee (the prices cannot be higher than standard prices set by Dairy Cow and Product Committee or the Cabinet) from the 1st semester in 2010 onwards. The prices are as follows:

Pasteurized milk	6.06	baht	per bag
UHT milk	7.30	baht	per carton
	7.20	baht	per bag

In the 2nd semester in 2009, School Dietary Supplement (Milk) Management Sub-Committee passed a resolution asking the private schools to buy all UHT milk to solve the problem of UHT milk processed by the entrepreneurs who purchased surplus raw milk. In the 2nd semester in 2009, the entrepreneurs agreed to sell UHT milk at 7.00 baht per bag.