

## Additional costs to Finnish dairy farms due to occupational safety and health

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**Abstract.** The additional costs incurred by work safety measures to dairy farms were estimated by interviewing 95 dairy farmers and inspecting with them production buildings, machines and the need for personal protective devices at a commune.

The present value of the implemented safety and health improvements rose to FIM 22 000 per farm in 1983. About FIM 17 000 were due to the tractors, FIM 3 000 to the cow houses and FIM 2 000 to other machines and tools than tractors. The protective equipment of tractors caused the annual maintenance cost of FIM 4 350 and cow house FIM 650, if the interest rate were 10 %. The annual total cost was over FIM 6 000. The replacement value would have been about FIM 31 000 in 1983.

If all deficiencies still remaining in 1983 had been corrected at once, the total cost would have been about FIM 12 000 per farm, which leads to an annual cost of FIM 3 100. As for still remaining deficiencies, the study suggested need for an annual cost of about FIM 1 500 due to personal protectors. Half of this sum was due to need for the acquisition of personal safety equipment for forest work. Correcting the safety and health deficiencies of the cowshed and agricultural machines would produce each an annual cost of about FIM 800 per farm.

The present value of the labor protection investments in 1983 was FIM 22 000 per farm, and there still remained need to invest an additional FIM 12 000 in order to eliminate the remaining deficiencies. So, the theoretical total of the annual maintenance cost would have been FIM 6 600—9 200 per farm depending on the interest rate. Because the study concerned only one commune, the results cannot be generalized to the whole country.

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Index words: costs of labor protection, safety on farms

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### Introduction

#### *Background and aim*

The expenses due to occupational safety and health form a part of the total production costs that are in principle included in the prices of farming products. Investments in

labor protection are often difficult to separate from the other monetary input for production. Even the costs of safety devices of farming machines are difficult to estimate, because the price of spare parts is normally much higher than of the original part mounted in the manufacturing phase. The labor protec-

tion costs of farm buildings are even more difficult to estimate than those of machines.

Various costs are caused by public administration, to employers and sometimes to the accident victim due to occupational accidents (ANDREONI 1986). Investment in labor protection is often also economically profitable, in other words the marginal revenue is higher than the marginal cost. When protection costs are increased the »law of diminishing returns» will start to lessen profitability. On the other hand, it is important to keep in mind that the ultimate goal of labor protection is not merely to lower accident costs and hence production costs profitably, but to alleviate or prevent human suffering.

The aim of this study is not to estimate the cost-benefit or cost-effectiveness relationship of labor protection costs, but only roughly to describe the size class of labor protection costs on typical Finnish dairy farms according to prevailing safety norms and general requirements in Finland. When we tighten labor protection norms and recommendations, the cost calculations will show an upward trend.

The costs for alleviation of the psychosocial and mental load, safety education and dissemination of safety education were not taken into account in this study because of the difficulties in estimation methods.

An example of the cost — effectiveness or cost — benefit approach would be the equipping of old farm tractors with safety cabins, which in Finland would cost about FIM 350 million. According to follow-up studies on occupational deaths in Finland, we know that doing this would evidently prevent ten accidental fatalities yearly. If we presume that the effective time of this safety cabin investment were 10 years, the »value» of saved life would be about FIM 3.5 million without taking the rate of interest into account.

In any case, it is impossible to predict with certainty how the costs demanded by modern norms could lower the number of accidents and their costs, as well as other health risks. Only an intervention study with a control group can give an answer to such a question.

The Research Institute for Social Security of the Social Insurance Institution, the National Board of Health and the Kuopio Regional Institute of Occupational Health have been doing research work aiming to develop and support the occupational health care system for the Finnish farming population. In 1983 the Kuopio Regional Institute of Occupational Health launched a study to estimate the costs incurred by occupational safety and health to dairy farms.

### *Definition of central concepts*

»Replacement value» equals the sum of money that is needed when a certain piece of property is replaced with a new product of the same kind (RIISTAMA & JYRKKIÖ 1982).

The present value of the property is the replacement value minus the reduction of value due to aging and use (RYYNÄNEN & PÖLKKI 1983).

»Written down value» is the value of a device, etc. when it is removed from use, because of wearing out (RYYNÄNEN & PÖLKKI 1983).

Cost (production cost) is the use of a production commodity converted into money (RYYNÄNEN & PÖLKKI 1983).

The present value (discount value) of capital (or cost) is the value of capital or cost received after  $n$  years multiplied by the discount coefficient

$\frac{1}{(1+i)^n}$ , when interest on interest will

be paid according to  $p$  % (RIISTAMA & JYRKKIÖ 1982).

### **Material and methods**

#### *Sampling*

The study material was collected by interviewing randomly selected 95 dairy farmers in the municipality of Pielavesi. The occupational safety and health situation of their production machines and buildings was inspected. In addition, the need for personal

protective devices was assessed. The researcher tested personally the condition of the safety devices of machines.

### *Estimation of costs*

The replacement values and present values of the protective equipment of machines, and current values of tractors were estimated on the basis of the price of spare parts and additional equipment, the value of which was inquired with the help of a special form directed to four big sales companies.

The costs of difficult repair work on machines (clutch, brakes etc.) were calculated according to the hourly charge of service stations. Minor repair work was estimated according to the hourly wages of farm workers.

The cost of raw material for repairing buildings was calculated on the basis of retail prices, and the cost of labor on the basis of the wages of construction workers. The costs of mounting and devices were asked from special enterprises.

The costs due to personal protectors were assessed on the basis of the apparent need of the protectors.

In case where the exact prices or work input were lacking, the researcher estimated the costs of repair according to earlier experience. The average social insurance costs and travel costs were added to the wage costs.

### *Principles of calculation*

Because exact knowledge of the effective duration of safety investments was not available, the following assumptions were made in order to render the annual costs of the different investments comparable with each other:

- the period of amortization of a cow shed was 15 years
- the period of amortization of machines was 7.5 years
- the durability of personal protective devices was 1 year
- the interest rate was alternatively 0, 5 or 10 %

The annual cost of machines (7.5-year period) and cow shed (15-year period) was calculated according to the amortization formula (HONKO 1979, RIISTAMA & JYRKKIÖ 1982):

$$\overline{c}_n i = \frac{i (1+i)^n}{(1+i)^n - 1}$$

The annual cost due to personal protectors was multiplied by the discount factor (HONKO 1979, RIISTAMA & JYRKKIÖ 1982):

$$\overline{a}_n i = \frac{(1+i)^n - 1}{i (1+i)^n}$$

This procedure gave the capital value costs due to personal protectors at the beginning of the 15-year period.

### *Farms*

The farms had on the average 14 hectares cultivated land of their own, plus 3 hectares rented land. The cow house was 30 years old (repaired 10 years ago) on the average. The average number of milk cows was 11, and that of calves and beef cattle was 8.

Milking was done by hand on 10 % of the farms, by a bucket milking machine on 50 %, and by a pipeline milking machine on 40 % of the farms.

Manure was removed by hand on 60 % of the farms, mechanically on 5 %, and a liquid manure system was used on 35 % of the farms.

The »number one» tractor on the farms was equipped with a safety cabin in 90 % of the cases. The tractor was 7 years old, on the average, and had been used for 3 540 work hours. The older, extra tractor was equipped with a safety cabin in 30 % of the cases. It had been used for 9 850 work hours, on the average, and was 18 years old.

## **Results**

### *Implemented investments*

The present value of the implemented safety and health improvements rose to FIM 22 000 per farm in 1983. The biggest part of this sum

Table 1. The cost already invested in labor protection, FIM/farm.

Cost item	Present value	Replacement value	Annual cost; calculated from the replacement value
	FIM	FIM	interest rate 10 %
Cow house	2880	5015	659
Machines			
Tractor	16818	21783	4339
Trailer	398	662	130
Guards of tractor tools	1152	2443	480
Combine harvester	284	681	134
Chainsaw, mill, etc.	194	287	56
Personal protectors	—	395	395
Total	21724	31266	6133

had been allocated to acquiring the protective guard and other equipment for tractors, nearly FIM 17 000. The safety cabin (FIM 15 000) and the warming and ventilation device (FIM 1 400) were the most expensive single cost items. The protective equipment of tractors caused also the highest annual maintenance cost (FIM 4 350 at an interest rate of 10 %). The cow house could be maintained at the present level with the annual sum of FIM 330—660. The replacement value of in-

vestments was nearly FIM 10 000 higher than that of the present value (Table 1). The annual »maintenance» cost varied from FIM 4 200 to 6 100 depending on the interest rate.

#### *The correction of the remaining deficiencies*

If labor protection had been corrected to the level fulfilling the general norms and expectations set for a good working environment at once in 1983, the total cost would have risen to FIM 12 000 per farm. For a 15-year period these costs would have come to FIM 23 000—36 300 per farm. Converted to the annual level this would have meant FIM 2 400—3 100 per farm (Table 2).

Roughly half of the annual costs would have been due to the acquisition of personal protectors (FIM 1 450) and half of the protector costs would have caused by the protectors used in forest work. The repair of the cow house and the machines would have each cost about FIM 400—800 per farm.

#### **Discussion**

The present value of the labor protection investments in 1983 was about FIM 22 000 per farm, and there still remained need to invest an additional FIM 12 000 per farm in order to eliminate the remaining deficiencies in

Table 2. Correction costs of the deficiencies in cow houses, machines and personal protectors, FIM/farm.

Cost item	Present value of 15-year period			Annual cost		
	Interest rate, %			Interest rate, %		
	0	5	10	0	5	10
Cow house	6331	6331	6331	422	631	833
Machines						
Main tractor	2478	2098	1846	165	203	243
Additional tractor	4158	3521	3097	277	341	408
Main trailer	342	290	255	23	28	34
Additional trailer	118	100	88	8	10	12
Guards of tractor tools	756	640	563	50	62	74
Combine harvester	132	112	98	9	11	13
Chain saw, mill, grinder etc.	46	39	34	3	4	5
Personal protectors	21915	15165	11112	1461	1461	1461
Total	36276	28296	23242	2418	2751	3083

machines, cow houses including forage storages, and personal protectors. In other words, the theoretical total of the annual maintenance cost would have been FIM 6 600—9 200/farm, depending on the rate of interest. Vohlonen et al. (VOHLONEN, HUSMAN, KALIMO, NUUTINEN, TUPI & VIROLAINEN 1985) estimated that the correction of observed deficiencies would have cost about FIM 9 000 per farm in 1982. This calculation was done in a slightly different way.

Because the study material was fairly small, the results can be generalized to apply only to the Pielavesi community. If the sample could represent the whole country, the FIM 12 000 per farm as an additional cost to correct labor protection would mean FIM 1.5 billion, which could lead to an annual cost of FIM 240—310 million for cattle farms and FIM 310—400 million for all farms. The total cost would then be 2.3—2.9 % of the total production expenses of farming (Agrifacts 1986). In Finnish forestry the costs due to labor protection were 1.3 % of all round timber expenses in the 1970s (KLEN 1981).

As for the present value, the bulk of the investments had been directed to the machines. This is because the protective devices are fixed parts of machines and it is not possible to buy a machine without these devices.

The theoretical annual costs were surprisingly high concerning machines, cow houses and personal protectors. Some cost items were lacking, e.g. due to the polling of the cows and grain dryers. On the other hand, the effective duration of some investments is longer than presumed in this paper. In many cases it was difficult to separate labor protection costs from other production investments. This, of course, decreased the accuracy of the calculations.

Because no analysis on cost-effectiveness was done, it is impossible to assess the decrease in the number of accidents and health injuries achieved by the additional cost needed to eliminate still in 1983 the remaining deficiencies. However, this was not the target of the present study. It is obvious that the additional investment in labor protection decreases work-related injuries, provided other factors remain constant and provided behavior does not become more dangerous after introduction of the safety measures.

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## References

- Agrifacts' 85 about Finland. mat. Agricultural Information Center. Helsinki 1986.
- ANDREONI, D. 1986. The cost of occupational accidents and diseases. ILO. Geneva. Occupational safety and health series No. 54.
- HONKO, J. 1979. Planning and controlling investments WSOY, Porvoo, Helsinki, Juva (In Finnish).
- KLEN, T. 1981. Economic losses due to occupational accidents in forestry. Researches from The Institute of Occupational Health/No. 176. Helsinki. (In Finnish with English summary).
- RIIHTAMA, V. & JYRKIO, E. 1982. Operational accounting. *Ekonomia-series*. Weilin & Göös, Espoo. (In Finnish).
- RYYNÄNEN, V. & PÖLKKI, L. 1983. Agricultural economics. Kirjayhtymä, Helsinki. (In Finnish).
- VOHLONEN, I., HUSMAN, K., KALIMO, E., NUUTINEN, J., TUPI, K. & VIROLAINEN, R. 1985. Occupational Health Services for Farmers: a study based on an experiment in 1979—83 (in Finnish with English summary). Publication of the Finnish Social Insurance Institution. A:21. Helsinki.

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## Lypsykarjatilojen työsuojelukustannukset

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Toteutettuja työsuojelusijoituksia ja vuoden 1983 lopulla jäljellä olleiden työsuojelupuutteiden korjausten rahoitustarvetta tutkittiin haastatteleamalla 95 lypsykarjatilan emäntää ja isäntää ja tarkastamalla näiden kanssa tilan navetta, koneet ja henkilökohtaiset suojaimet. Laskelmat tehtiin vaihtoehtoisesti 0, 5 ja 10 prosentin korkokannoilla. Navetan työsuojelukorjausten kuoletusiäksi oletettiin 15 vuotta, koneiden 7,5 vuotta ja henkilönsuojainten kestoajaksi yksi vuosi.

Toteutettujen työsuojelusijoitusten nykyarvo oli keskimäärin 22 000 mk tilaa kohti. Pääosa kustannuksista oli aiheutunut traktorin turvalaitteista (17 000 mk), seuraavaksi eniten navetasta (3 000 mk) ja loput (2 000 mk) muista koneista. Vuositasolla työsuojelukustannukset traktorista olivat 4 350 mk ja navetasta 650 mk 10 % ko-

rolla. Jälleenhankinta-arvo oli 31 000 mk tilaa kohti.

Jos vuoden 1983 lopussa jäljellä olleet työsuojelupuutteet olisi korjattu, tästä olisi aiheutunut keskimäärin 12 000 mk:n lisäkustannus tilaa kohti. Vuositasolla tämä merkitsee 3 100 mk:n menoa 10 % korolla. Vajaa puolet tästä summasta olisi koitunut henkilönsuojaimista, navetasta ja koneista saman verran eli n. 800 mk.

Kokonaisvuosikustannus kohoaisi korkokannasta riippuen 6 600—9 200 mk tilaa kohti, jos jo tehdyt työsuojelutoimenpiteet olisi pidetty kunnossa ja tilakäynneillä havaitut työsuojelupuutteet olisi heti korjattu ja sen jälkeen jatkuvasti pidetty myös kunnossa. Sovelletulla laskentamenetelmällä saatu teoreettinen kokonaiskustannus nousi yllättävän korkeaksi.