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The Potential Model

- calculating the financial feasibility of work health investments

Introduction

The Potential Model is created to calculate the financial feasibility of work health related measures. It differs from typical health economic cost-benefit analyses in the sense that it is aimed at simulating the economic consequences of an investment from a business firm point of view. This means that not only the immediate real losses, like sickness absences, are taken into account, but also the indirect financial consequences, like effects on over time work. The model was planned in the beginning of this decade by Professor Guy Ahonen, together with Mr. William Strigård and his colleagues at Miljödata, in Sweden. The model was based on the Productivity Model developed by Dr. Maurice Oxenburgh in the early 1990s. A Finnish version of this model, the Tervus model, was developed in the mid-1990s by Guy Ahonen and Tuulikki Luopajärvi.

The name "Potential" refers to the option that the model can be used to calculate potential financial effects of work health measures. When making an ex ante calculation we talk about expected potential effects, in the case of an ex post calculation we speak of a realised potential.

The basic logic of the model

The model is an input-output model, or a before-after model. It compares to states of affairs; the one before a measure or investment and the one after the intervention. The effects of the differences between these two states are calculated in order to establish the financial benefit, created by the investment. Also the cost of the investment is calculated. Both the cost and the benefit are calculated on annual basis. For multi-period calculations annual effects are transformed to present value, by using calculation interest rate.

Basically the calculation principle looks like this:

Annual Profit = Annual Benefit - Annual Cost

Cost calculation (Input)

Annual Cost is calculated as the sum of annual depreciation of long term investments and annual operating costs, like this:

Annual Cost = Annual Depreciation of Investment + Annual Operating Costs

Benefit calculation principle

The overall assumption when calculating the benefit is that the real value of work equals the total cost of labour divided by efficient work hours. This assumption is based on the principle that a company, when making an investment is able to cover its current costs by selling what is produced by its personnel. Otherwise the company would go bankrupt. Basing on this assumption, the calculation must include all labour costs, the number of all annual paid work hours, and the number of all annual non-productive work hours. Basically the calculation of benefits is based on the total cost of productive work hours. Ultimately the benefit is dependent on changes in either productive hours or the cost thereof.

The Potential Model includes in the calculation of the value of work hours normal wage costs and productive work hours (Figure 1). Normal wage cost consists of average nominal wages multiplied by % based wage costs, plus absolute wage costs. Productive work hours consist of normal annual paid work hours, reduced by sickness absences, training hours, other non-productive hours and work hours lost due to labour turn-over.

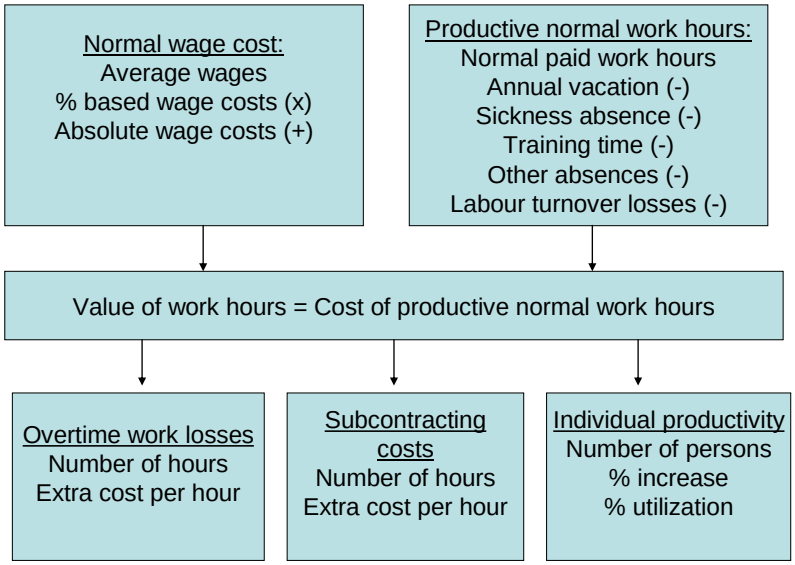

Figure 1. Calculation of the value of work and what it affects in the Potential Model

The value of work is calculated by dividing annual normal wage cost by the number of productive normal work hours.

The value of work hours is used when calculation the costs of overtime, subcontracting and individual productivity changes. The principle is that all costs per hour for overtime and subcontracting which go beyond the company's cost of normal productive work hours are considered extra costs for the company. Calculation of the value individual productivity changes is also based on the value of normal work hours.

The monetary value of the benefits produced by a change in working conditions is the equal to the changes produced on any of the elements of the above factors (Figure 2).

The above calculation principle assumes that there is "normal" work and "extra" work, with the implication that normal work is the base for pricing the products and services of the firm. Extra work is "price taker" in the sense that extra costs incurred by it cannot be charged from the customer. An alternative principle would be that all work and its costs would be considered normal. Then the costs of productive work hours would increase and the monetary value of calculated benefits accordingly. The adopted principle can be considered a cautiousness principle. The calculation principle also ignores profits, which would add both to the total value and potential benefits.

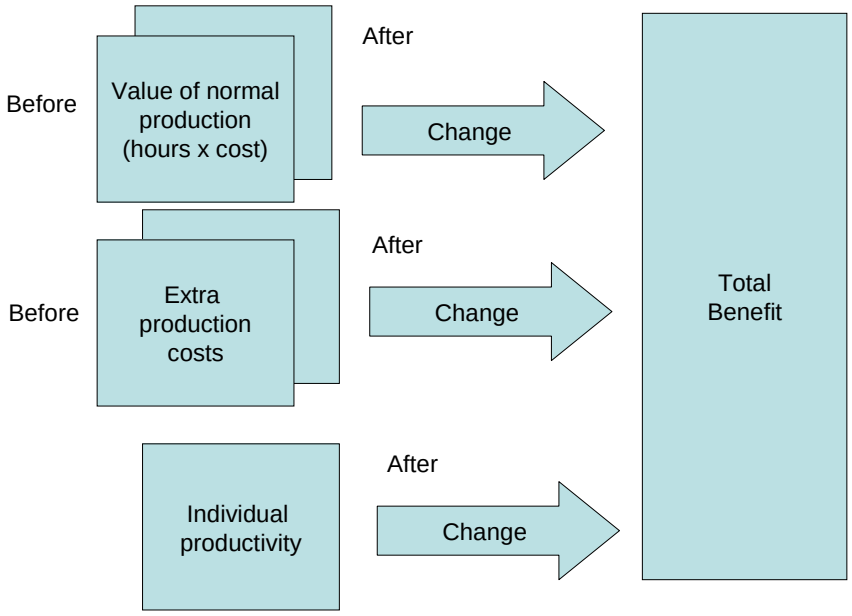

Figure 2. The principle of benefit calculation in the Potential Model

Calculation case

Below a calculation case is presented in order to illustrate how the model works. For clarity the case company has 1 employee and a nominal wage 10 € per hour.

First a table (1) with the basic data and its effects on the number of productive hours, the unit cost of productive work time and total value of production is presented.

Basic data

Element	Value	Productive hours	€/ efficient hour	Production value (cost)
Personnel (number of)	1			
Average wage (€/hour)	10		10,00	
Paid hours per week	40			
Work weeks per year	52	2 080	10,00	20800
Paid week holidays per year	8	2016	10,32	20800
Vacation days/year	25	1816	11,45	20800
Annual vacation wage addition	50 %	1816	12,00	21 800
Relative wage cost addition	33,00 %	1816	15,97	28994
Fixed wage costs per person (€/year)	100 €	**1816**	**16,02**	**29 094**

Sick-leave employee self-risk days	none			
Sick-leave days paid 100 % by employer	9			
Sick-leave days paid 40 % by employer	10 -			

Table 1. Basic calculation data in the Potential Model

As can be seen in the table, each additional assumption reduces the number of productive hours and increases the cost (=value) of productive hours. The total value of production equals the sum of all labour costs. The calculation of benefits can start when the current normal production situation has been properly recorded in the model. These include:

- sickness absenteeism and
- labours turn over

This will be done next.

Sickness absenteeism

The sick-leave component of the Potential Model takes into account the number of lost working days due to sickness, the employees self-risk periods and eventual compensations from insurance companies or public institutions. In Finland, for instance, there is no employee self-risk period related to sick-leaves, but the employer usually gets 60 % refund from the National Pension Fund (Kela) for sick-leaves which exceed 9 working days. In Tabl2 2 the effects of refunds is demonstrated. In the first row a 10 % sick leave during 3 different periods is assumed. Then each period is less than 10 days. In the second row only one seick-leave period is assumed. Then the employer gets a 60 % refund for all sick-leave hours beyond 9 days. As a result of this the labour cost, and value of work, goes down.

Sick-leaves	Productive hours	Change in prod. hours	€/ efficient hour	Production value (cost)	Production value change
Sick-leave 10 %, 3 periods	1608	-208	18,09	29 094	
Sick-leave 10 %, 1 period = 26 days	**1 608**	none	**17,42**	**28 009**	-1085

Table 2. The effect of number of sick-leave periods on production costs in the Potential Model

Personnel turnover

The production cost of personnel turnover is calculated by applying the productivity gap concept (Figure 3). The existence of the personnel turnover productivity gap is well known (c.f. Flamholtz 1989, 66). It appears as a result of leaving persons reducing their effort as a result of deteriorating motivation, cooperation and morale, and slowly increasing productivity of newcomers. The shape of the gap has been documented to be

like the grey area in Figure 3 (Ibid.). In the Potential Model the productivity reductions and increases are assumed to be linear. To calculate the value of the productivity gap only the number of annually leaving and arriving people and the average exit period (A) and introduction period (B) have to be entered to the model. The model assumes the value of the productivity gap to equal the product of lost hours and the value of a productive hour of the firm. Formally:

Value of the productivity gap = number of leaves x (C x A)/2 +
number of newcomers x (C x B)/2

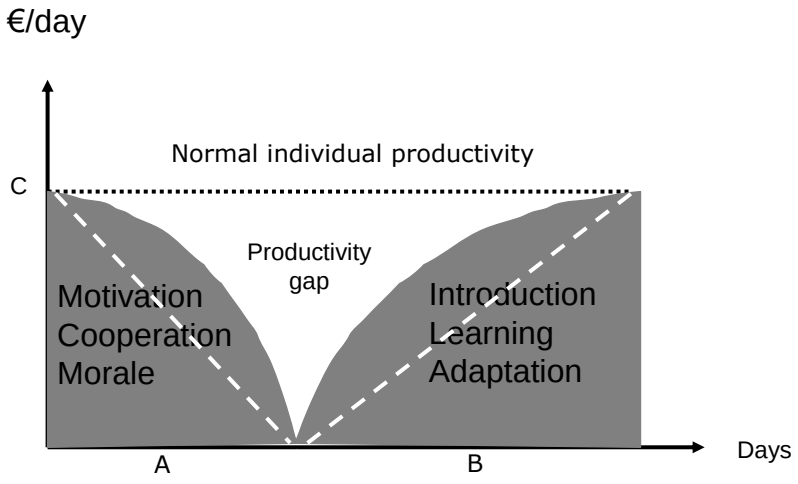

Figure 3. The Personnel turnover productivity gap.

In table 3 the cost of labours turnover with an exit period of 2 weeks and introduction period of 4 weeks for one person has been calculated. In the firsts row a basic calculation is made. In the second row sick-leaves have been included. Personnel turnover reduces the number of productive hours by 120. As a result the cost per each productive hour goes up (from 16,02 to 17,15 €/h). When the sick-leaves and related refunds are taken into account the cost (=value) and total production value go utterly down. The so reached values for normal productive hours, cost per productive hour and value of total production is used as base-values for benefit calculation.

Turnover	Productive hours	Change in prod. hours	€/ efficient hour	Production value (cost)
Turnover 1 pers per year, 2 weeks down, 4 weeks up, basic calculation	1696	-120	17,15	29 094

Sick-leaves included	**1 488**	**-208**	**18,82**	**28 009**
Base-values for benefit calculation	**1 488**		**18,82**	**28 009**

Table 3. The cost of personnel turnover in the Potential Model

Overtime, subcontracting and individual productivity

Overtime, subcontractor services, which replace own work and individual productivity lacks are considered as extra costs of production. They are not used as basis for the market price of the firm. Changes in these values do not change the calculation base-values of the firm. Table 4 below show how additions of 100 hours over-time work for a wage cost of 150 % and 200% of normal wage cost affects the production cost of the firm. Table 5 does the same concerning the effects of increasing individual productivity, assummed a 20 % increase of productivity for 1 person, who utilizes 50 % of the increased capacity.

Arrangement	Cost / normal hour	Change in prod. hours	€/ extra hour	Additional cost / Hour	Extra cost
100 hours overtime á 150 %	18,82	100	19,95	1,13	113
100 hours subcontracting á 200 %	18,82	100	26,60	7,78	778

Table 4. The cost of personnel turnover in the Potential Model

Individual productivity	Value of total production	People affected	Increased procuctivity %	Utilization %	Value of productivity change €
I person affected	31 096	1	20	50	3110

Table 5. The cost of personnel turnover in the Potential Model

Summary of effects on value of effective work hour

I Table 6 below a summary is given for how each component above affect the cost and value of efficient work hours. We can see that 10 € per hour gets transformed to 20,91 €/hour.

Component	added €/hour	€/hour
Nominal wage		10
+ percentual addition	3,3	13,3
+ fixed addition	0,0481	13,35
- paid holidays	-1,3437	12,00
- paid vacation days	4,0165	16,02
- sick leaves	2,0724	18,09
+ sick-leave refunds	-0,6749	17,42
- labour turnover	1,4047	18,82
+ over-time	0,4897	19,31
+ productivity	1,6000	20,91

Table 6. The effects of various components of the cost and value of the efficient work hour

Cumulative benefit calculation

In Table 7. the total benefit of reducing sick-leaves from 10 to 5 %, labour turn-over from 100% to 50 %, over-time from 100 hours to 50, the amount of subcontracting from 100 hours to 50 and increasing individual productivity by 10 % is calculated.

Effect	Change in prod. hours	Cost / productive hour	Price/ productive hour	Benefit/ productive hour	Productive hours	Benefit	Total product
Sick-leave reduction : from 10 to 5 %,	104	18,11	18,82	0,71	1 592	1128	29966
Labour turnover: 1 to 0,5 persons per year	60	17,46	18,82	1,37	1 652	2257	31096
Overtime: 100 to 50 hours	-50	19,95	18,82	-1,13	-50	56	
Subcontracting: 100 to 50	-50	26,60	18,82	-7,78	-50	389	

Individual productivity	165	0,00	18,82	18,82	165	3110	
Total benefit	**229**					**6940**	

Table 7.