



Smart Work Centres : Economic Model and Logic

Connected Urban Development

Tuesday, 25 November 2008



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A. EXECUTIVE SUMMARY

A Smart Work Centre (SWC) allows service sector employees to work efficiently and effectively from an office that is not controlled by the employer. A SWC offers a high speed wireless connected environment, with telepresence like communication facilities. These technologies allow employees to undertake their tasks without travelling to some corporate location.

The main economic benefit is realized through reductions in real estate requirements. Connected workplaces require materially less space per employee and have higher utilisation rates compared to offices, while retaining a pleasant working environment.

Environmental benefits are realised through reduced per capita power consumption and heating and cooling requirements due to reduced office space.

Based on a series of assumptions, the analysis shows a ten year benefit of € 6,898 in shifting one employee from a traditional office to a SWC. In addition, there is a reduction of 1.15 tonnes per year in greenhouse gas emissions.

Figure 1 below shows the net cash position over ten years of shifting 100 employees from traditional working environment to a SWC.

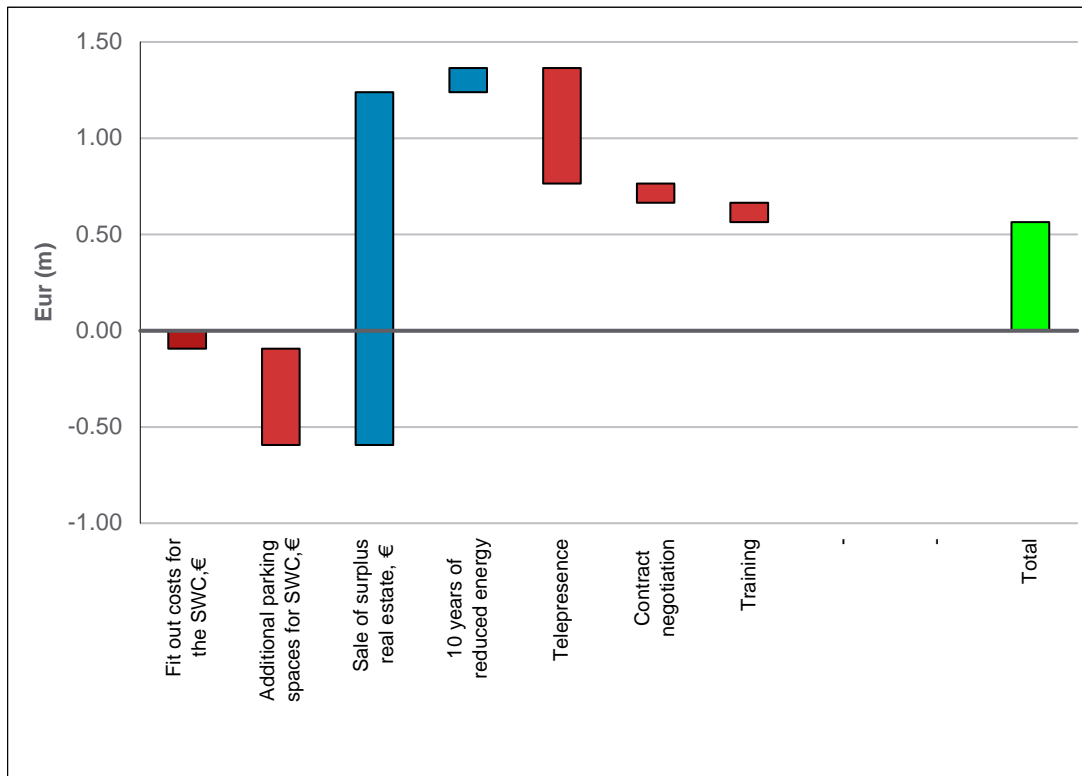


Figure 1: Net cash position after 10 years (100 employees)

B. INTRODUCTION

Smart Work Centres (SWCs) provide a decentralised connected workplace for employees to collaborate and work. A SWC provides high speed secure wireless connectivity and telepresence like communication facilities in an appealing working environment,

This paper documents the economic and environmental costs and benefits of a company 100 full time equivalents (FTEs) to a SWC. These 100 FTEs may represent a larger number of employees as some may work less than five days in the SWC.

The model looks at ten year period and calculates the overall benefits which can be obtained from using the facilities. These benefits will then be shared between the owners of the facilities, employees and employers.

The model focuses on incremental costs. For example, telephony costs are unlikely to materially change as a result of using the SWC and are not analysed. In addition, companies are already paying for traditional office space and the fit out costs for a SWC are the incremental costs above that for traditional workspaces.

The remainder of this document shows the model structure along with the assumptions and calculations required to estimate the incremental costs and benefits.

C. MODEL STRUCTURE

There are two principal benefits that are realised from shifting from traditional offices to a SWC. These are:

- 1) A reduction in the space required per employee. SWC do not have fixed offices and space is better utilised.
- 2) A reduction in the power used per employee. Printers and other devices are centralised reducing the average plug load per employee.

C.1 SPACE REQUIREMENTS

The model assumes that 100 employees in a traditional office setting would require around 2,230 square metres of space, some 22.30 square metres per employee. Each square metre is assumed to have a real estate value of € 1,973 per square metre.

A SMC uses less space per employee and the following ranges are available in the model, depending on the configuration of the SWC.

SWC space allowance	M2
High	10.69
Medium	13.01
Low	15.80

Figure 2: Space requirements under SWC

Under a Medium scenario, the 100 employees in the SWC would require 1,301 square metres, a net reduction in office space of 929 square metres. At the assumed value, this produces a one off benefit of € 1,832,690 .

C.2 ENERGY REQUIREMENTS

A traditional office is estimated to consume around 186.22 KWHrs/m²/ year for office equipment and lighting and 2.37 therms/m²/year of natural gas for heating. The reduction in office space per employee leads to a commensurate reduction in electricity and natural gas use.

The model assumes that a building consumes around 186.22 KWhr/m² and prices electricity at €0.15 per KWhr and natural gas at €2.25 per therm. The reduction of 929 square metres, at the modelled price of electricity yields an annual benefit of € 25,946 in electricity savings.

In addition, this space reduction does not require heating. At 2.37 therms/m² the reduction of 929 square metres yields a natural gas benefit of € 4,949 each year.

Against these energy savings are an increase in the ICT load per person as a result of the wireless connectivity. Figure 3 below shows the changes in ICT use based on shifting to a SWC. Note that the most material component is the increase in cooling to remove human body heat.

Summary Electricity Consumption, kWh/m ² /year	Traditional Office	SWC
ICT direct power consumption	24.7	25.4
Cooling to remove ICT heat	74.7	76.9
Cooling to remove human body heat	38.2	65.4
Other (lighting, ventilation, cooling from solar, etc.)	48.7	48.7
Total	186.2	216.3

Figure 3: Summary Electricity Consumption, kWh/m²/year

This leads to an additional cost of €5,867 per year for the transfer based on the 30.1 KWHr/m²/year increase, for 1,301 square meters remaining, priced at €0.15 per KWH.

C.3 SWC INFRASTRUCTRE COSTS

The model assumes that a SWC would attract a one off additional cost of €72 per square metre to provide furnishing, wireless technologies etc. Note that this cost is incremental to the usual maintenance and furnishing costs in a traditional office.

C.4 PARKING

SWC may encourage more people to drive to work, rather than use public transport. While employees may offer difference incentives to encourage use of public transport the model assumes that additional parking will be required compared to traditional city offices.

In the modelled example there is an additional 42 people working in the same space compared to traditional offices. To retain the conservative nature of the analysis, these are assumed to require parking at a one off cost of €12,000 each. This leads to a one off cost of -€499,848 .

C.5 OTHER

Other incremental costs are indicated below:

- A contract negotiation cost of €100,000

- Training costs of € 1,000 per employee
- A 3 screen Telepresence unit, costing € 200,000 with an annual bandwidth cost of € 40,000 .

D. ENVIRONMENTAL CALCULATIONS

The introduction of SWCs will also impact greenhouse gas emissions. Given the complexity of this area the model only looks at the incremental use of energy and does not attempt to calculate embedded carbon.

The model uses 0.78 tonnes of Carbon Dioxide equivalent gases (CO₂e) per 1,000 KWHrs of electricity and 5 metric tonnes CO₂e for each 1,000 therms of natural gas.

Changes in electricity consumption provide the main GHG benefit. Before SWC, the company would have used 186.22 KWHr/m² in the 2,230 m² space. This indicates 415,261 KWHrs/year, some 324 tonnes.

Using the SWC requires some additional power per square meter, 216.3, applied to a smaller area, 1,301 square meters. This provides 281,398 KWHrs/year electricity use (219 tonnes), a reduction of 133,863 KWHrs each year (104 tonnes). Over ten years this provides an avoided GHG emission of 1,044 tonnes.

This a 33% reduction in GHG as shown in the following table.

Greenhouse Gas Emissions, metric tons CO ₂ e/year	Before SWC	After SWC
Office Space		
- From electricity	324	219
- From natural gas	26	15
Non-office Space		
- From electricity	0	0
- From natural gas	0	0
Total	350	235

Figure 4: Greenhouse gas differences

E. CASH FLOWS

The cash flows associated with the proposal are shown below in Figure 5 and Figure 6. These show a net positive position with an economic gain of € 6,898 per employee over the ten year period.

Development cost for SWC, €	€ 593,138
Company gain from reduction in space, €	€ 1,832,690
Net real estate savings, €	€ 1,239,551
Reduced energy costs , €/year	€ 25,029
Telepresence, other costs, 10 year €	€ 800,000
Net economic gain, 10 year, €	€ 689,838
Value per SWC user, 10 year, €	€ 6,898

Figure 5: Net economics

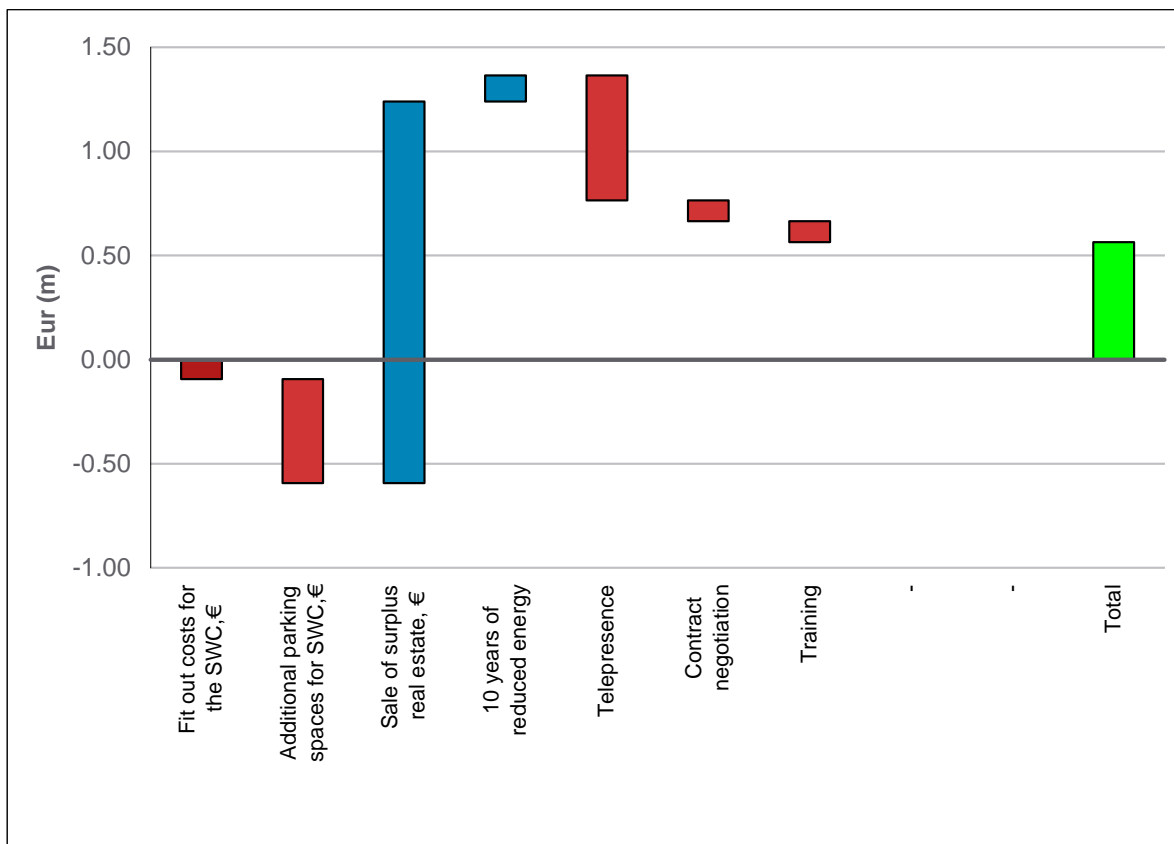


Figure 6: 10 year costs and benefits

F. CHANGE LOG

- 19 November, 2008: Change in “Watts heat removed/watts needed to run AC” from 3 to 0.3 ie an increase in energy use to remove heat as buildings are cooled most of the time.