Finance Confidence Modelling of Staff Productivity in AWE Buildings

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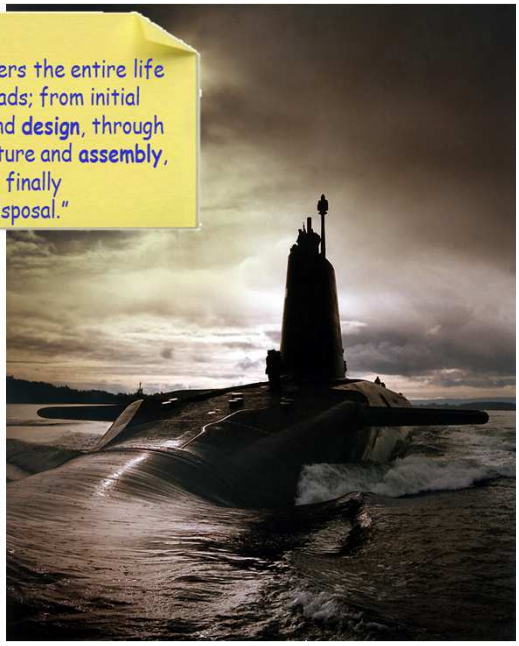
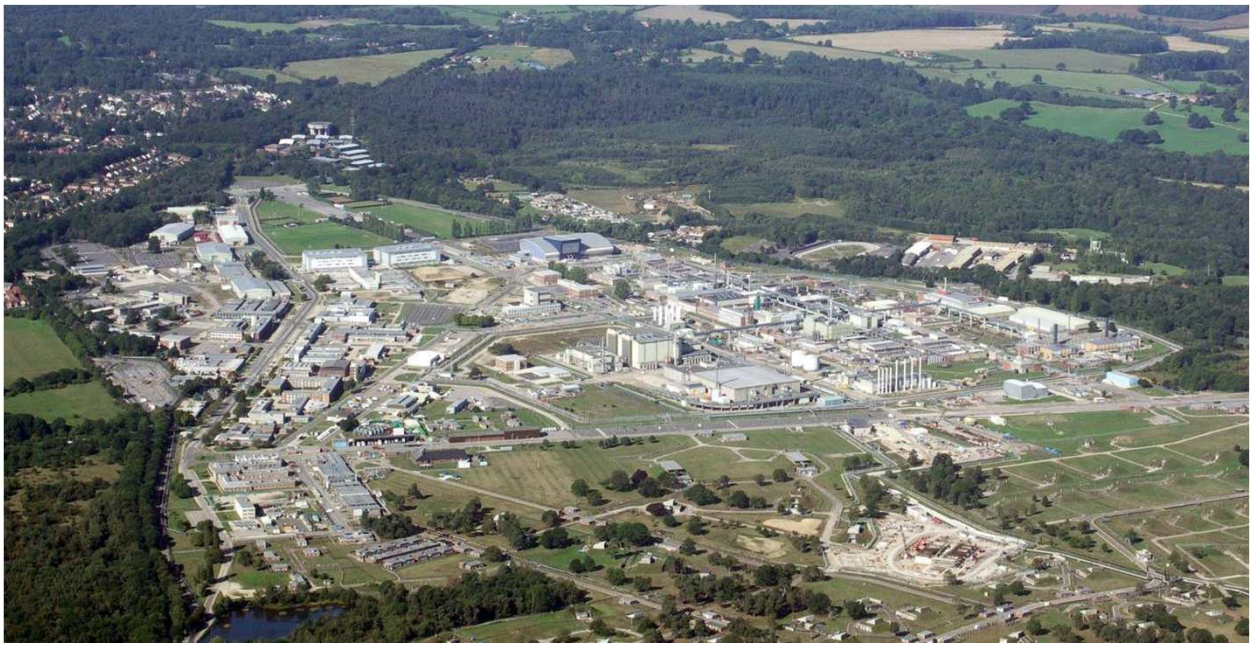
Introduction to AWE

"Our work at AWE covers the entire life cycle of nuclear warheads; from initial concept, assessment and **design**, through to component manufacture and **assembly**, in-service **support**, and finally decommissioning and disposal."

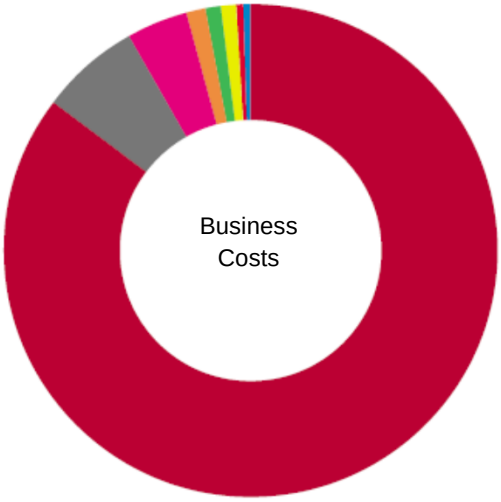


AWE site



AWE site

Cost of an office



A breakdown of business costs

- Salaries of occupants 85%
- Building – construction cost 6.5%
- M&E services – running and maintenance 4%
- Furninshings and furniture – capital cost 1.25%
- Building – maintenance 1%
- Cleaning, security etc 1%
- M&E services – depreciation 0.75%
- Furnishings and furniture – maintenance and depreciation 0.5%

\+ Marketing, PR, IT, training, PI & Insurance

- Amortised building costs and furniture

(Salary = 85%, Amortised Capital = 1.5%, Operation = 7%, Other = 6.5%)

Source: *The Impact of Office Design on Business Performance*, CABE (2005)

10% salary costs = annual property costs

Productivity = more output for same staff/costs

Productivity = same output for less staff/costs

Mixed site

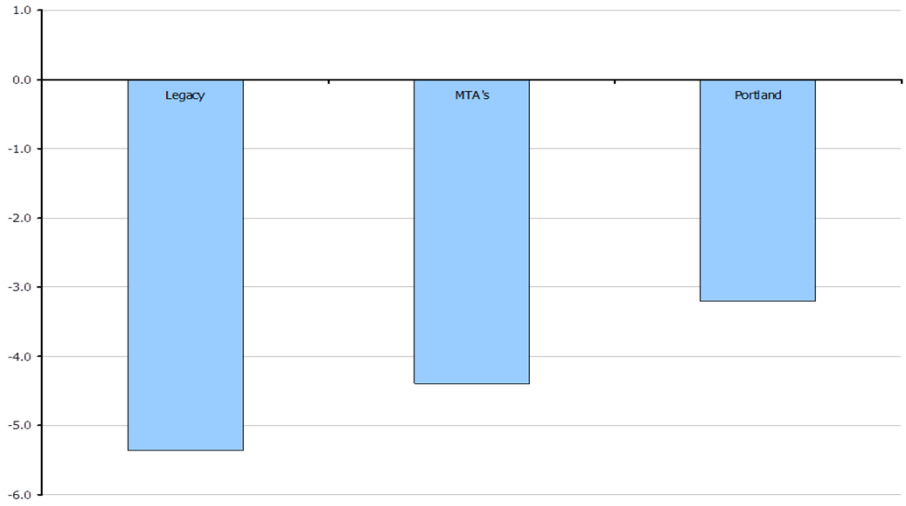
Legacy

MTA's

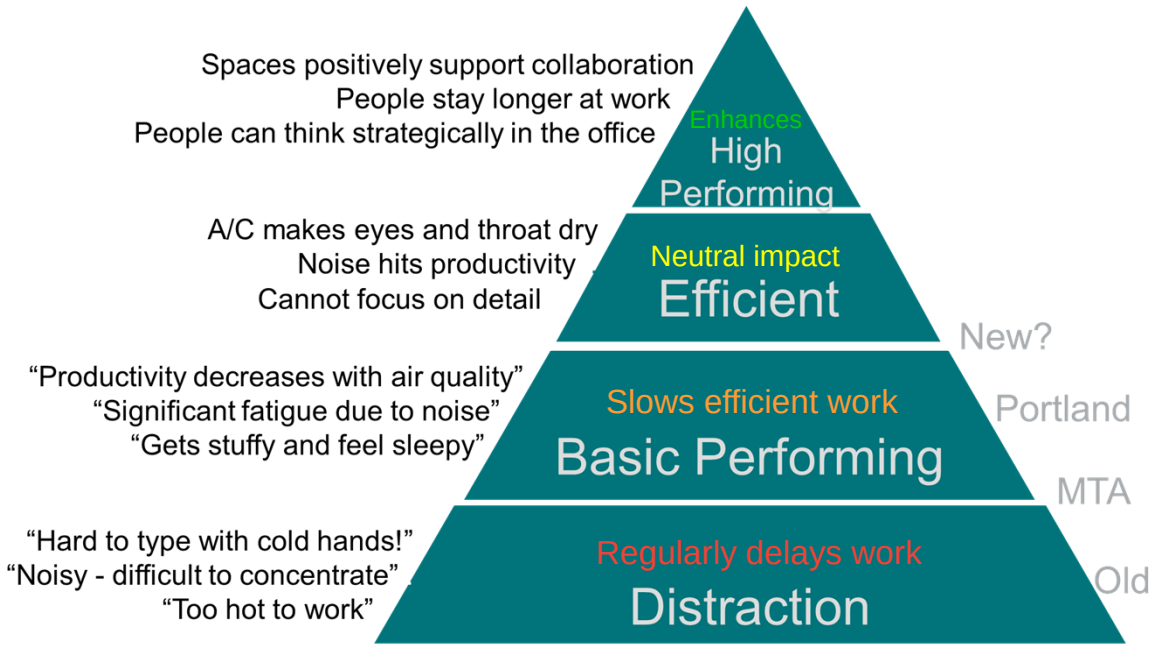
Portland House

Self-reported productivity

Please estimate how you think your productivity at work is decreased or increased by the environmental conditions in the building?



The performance pyramid



AWE facilities assessment model

Remaining life before major investment		
A	50 years plus	Good condition
B	20 years plus	In acceptable condition for its use.
C	5-20 years	Major repair of replacement needed soon
D	unusable within 5 years	Substantial risk of immanent breakdown

Cost per sq.m		Total occupancy costs
A	Lower quartile	Lower quartile
B	Median-low quartile	Median-low quartile
C	Median-high quartile	Median-high quartile
D	High quartile	High quartile

Office space per person		Workstation area per person
A	Below 10sq.m per NIA	Below 10sq.m per FTE & desk sharing
B	Space efficient	10-12 sq.m per FTE and 50%+ vacant
C	Space inefficient	12-14 sq.m per FTE
D	Wasteful of space	Above 14sq.m per FTE

OR

Space utilisation (Labs, stores etc		For non offices - space effectively utilised
A	To capacity	Busy
B	Underused	Potential to increase capacity
C	Rarely used	Rarely or ineffectively used
D	Empty	Empty space, decommissioning, including u

Fit for Purpose		Functional suitability
A	High performing	Space for high performing teams
B	Functional	Functionally satisfactory
C	Below standard	Below an acceptable standard
D	Unsuitable	Unsuitable for its current use

Right Location		Location suitability for AWE needs
A	Ideal	Ideal location or 'impossible' to relocate
B	Suitable	Acceptable or expensive to relocate
C	Making do	Located in a low or zero investment zone
D	Relocation needed	Located in a area required for other uses

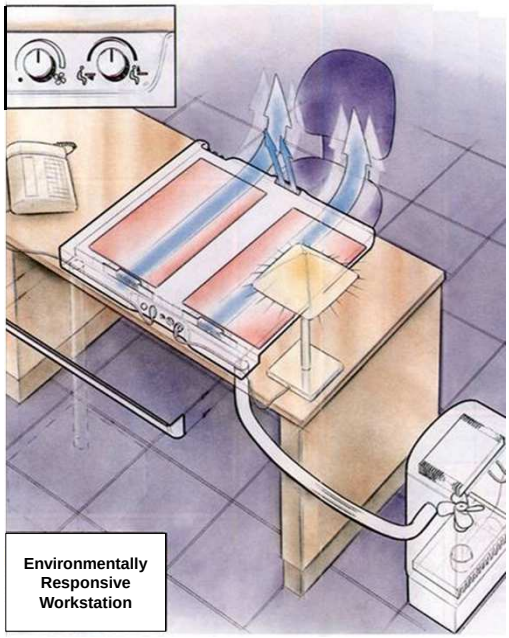
Environmental sustainability		Low impact and efficient use of resources
A	Best practice	Above current standards
B	DREAM standard	To current standards
C	Average to Poor	Below current standards
D	Wasteful of resources	Wasteful of resources

Is productivity important?

- A 2-5% change in productivity equivalent to the capital build cost [Royal Academy of Engineering]
- Wages are 72x energy costs
- One of the most effective cost cutting measures – to stop the drain of staff productivity

Research studies

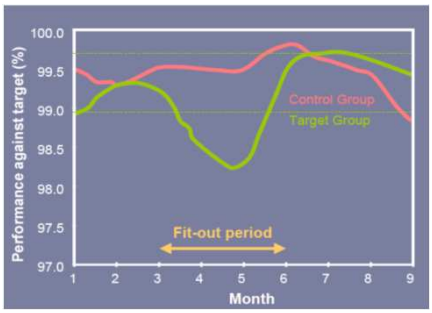
- 75 studies
- 134 productivity reports
- Independent variables:
  - light
  - noise
  - temperature
  - ventilation
  - control
  - furniture
  - space
  - general



Relevant research

- Lockhead Martin Building
  - 6 year payback on energy measures
  - Absenteeism dropped 15% & productivity rose 15%
  - One year payback & helped win $1.5b contract
- MOD Abbey Wood
  - Staff productivity used in Investment Appraisal
  - Direct correlation between temperature and £ loss
- War coding software
  - 600 developers in 92 companies
  - Upper quartile 2.6x better
  - Low correlation with software, experience, salary
  - Significant correlation with environment

Intervention studies in the real world



BT Call Centre

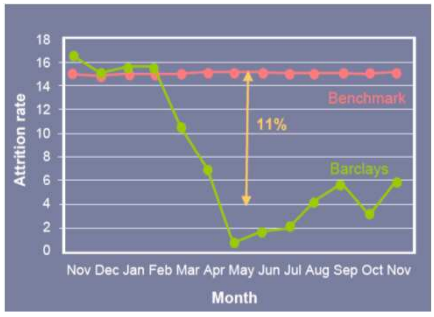
call rate

Barclays HRSS

absenteeism

US Post Office

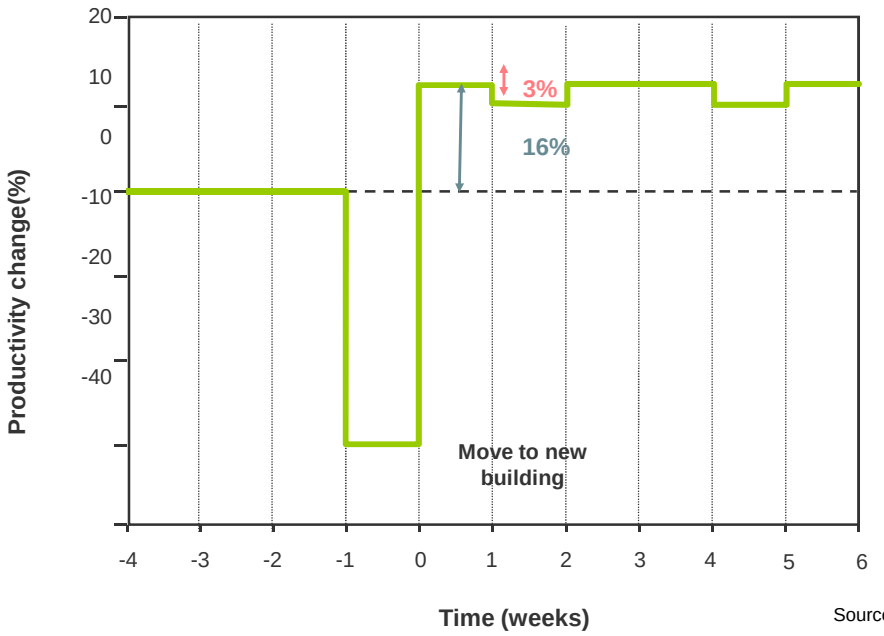
mail sorted



Barclays HRSS

staff turnover

Intervention studies in the real world



West Bends Mutual

Insurance claims processed

Source: Kroner, Stark-Martin & Willemain (1992)

Research studies extract

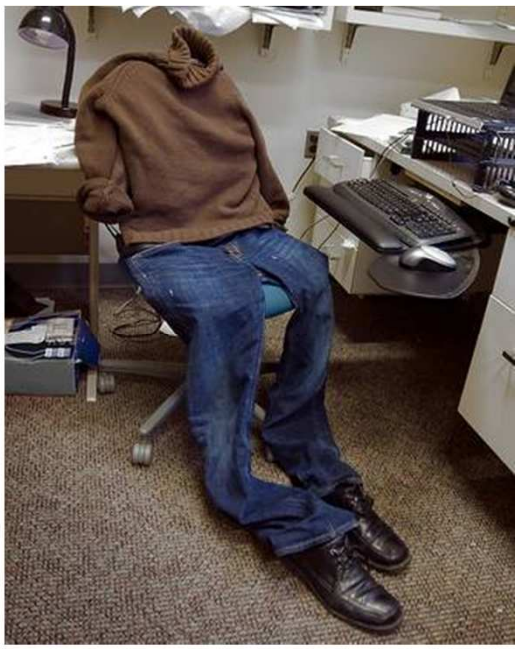
Factors	Sub-factor	Source	Nature of study	Environment	Measure	% effect
L	Illuminance	Barnaby (1980)	Increased illuminance from 550 to 1100 lux and to 1600 lux for paper-based work	Office	Business Metric	2.8
L	Illuminance	Barnaby (1980)	Increased illuminance from 550 to 1100 lux and to 1600 lux for paper-based work	Office	Business Metric	8.1
L	Illuminance	Čabák (1973)	Increased illuminance from 100 to 1000 lux for textile plant	Heavy industry	Manual Task	20.0
L	Glare	Chui (1991) - Adams et al	Impact of glare on reading speed and error	Laboratory	Performance Task	3.0
L	Glare	Chui (1991) - Adams et al	Impact of glare on reading speed and error	Laboratory	Performance Task	7.0
L	Illuminance	Chui (1991)	Increased illumination at Federal Agency, proof reading	Laboratory	Performance Task	5.0
L	New Lighting	Hedge et al (1995)	Introduction of up-lighting for PC work	Office	Perceived Performance	3.0
L	Glare	Heschong (2003)	Longitudinal study of office, effect of glare from open blinds, self adminsitered mini tasks	Office	Performance Task	17.7
L	View	Heschong (2003)	Longitudinal study of office, effect of view from desk, self adminsitered mini tasks	Office	Performance Task	12.5
L	Illuminance	Heschong (2003)	Longitudinal study of office, effect odaylight, self adminsitered mini tasks	Office	Performance Task	0.4
L	View	Heschong (2003)	Longitudinal study of call centre, compared view out wth no view, call handling time	Call centre	Business Metric	6.0
L	View	Heschong (2003)	Longitudinal study of call centre, compared distance form window, call handling time	Call centre	Business Metric	4.0
L	View	Heschong (2003)	Longitudinal study of call centre, compared partiton height, call handling time (11-18%)	Call centre	Business Metric	13.3

Weightings – Metrics

Based on exercise with OPN

	Literature	*OPN*
▪ Absenteeism	30%	67%
▪ Attrition	0%	65%
▪ Business metric	80%	68%
▪ Survey/opinion	3%	50%
▪ Perceived performance	33%	48%
▪ Manual task	15%	47%
▪ Performance task	33%	51%
▪ Review/estimate	3%	35%

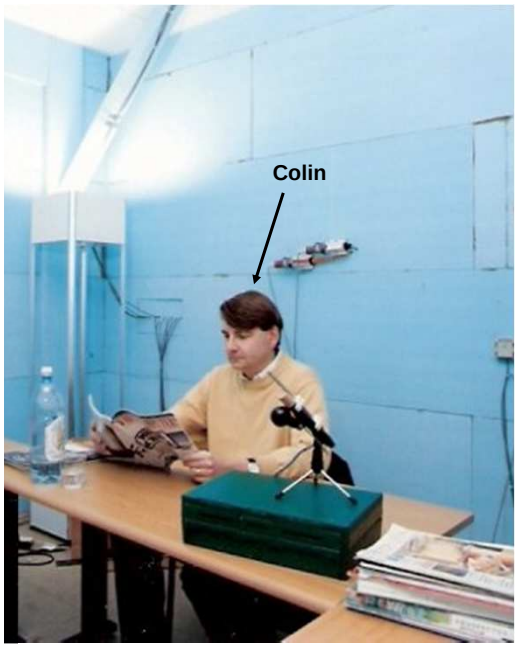
Source: Wyon, Fisk & Rautio (2000), Seppänen, Fisk & Lei (2006)



Weightings – Environment

Based on exercise with OPN

	Literature	*OPN*
▪ Laboratory	25%	40%
▪ Simulated office	50%	53%
▪ Office	95%	82%
▪ Call centre	15%	70%
▪ Heavy industry	15%	35%
▪ Light industry	21%	46%
▪ Survey/poll	12%	40%
▪ Literature review	12%	39%



Source: Wyon, Fisk & Rautio (2000), Seppänen, Fisk & Lei (2006)

Weightings – Timing

Weighted for office utilisation and task time

▪ Manual task	1.0%
▪ Paper-based work	7.9%*
▪ PC work	24.0%*
▪ Heads down (processing)	31.9%*
▪ Overall office duties	63.5%*
▪ Overall call centre	79.3%*
▪ Absenteeism	8.4%**
▪ Attrition	15.7%**

Source: * AMA benchmarks, ** = CIPD

Productivity results – Single variable

Factor	Count	Unweighted Mean	CT Weighted		
			Mean	Lower Q	Upper Q
Lighting	17	9.5	1.1	0.1	2.0
Noise	10	27.8	1.4	0.2	1.7
Temperature	16	17.0	1.2	0.0	1.9
Ventilation	16	9.0	1.4	0.2	1.7
Control	10	8.0	1.2	0.3	2.1
Furniture	8	15.7	2.1	1.0	2.0
Space	3	24.1	3.5	1.7	4.4
Average	**80**	**15.9**	**1.7**	**0.1**	**2.0**

Productivity results – Predominant variable

Factor	Count	Unweighted Mean	CT Weighted		
			Mean	Lower Q	Upper Q
Lighting+	4	11.0	0.4	0.2	0.7
Noise+	3	52.0	2.6	0.6	3.7
Temperature+	8	12.0	0.7	0.1	1.0
Ventilation+	6	12.4	0.6	0.0	0.1
Control+	2	24.5	2.1	1.8	2.4
Furniture+	6	33.1	5.8	4.3	8.4
Space+	3	22.0	3.7	1.0	5.0
General	22	16.7	2.7	1.2	3.2
Average	**54**	**23.0**	**2.3**	**0.2**	**4.0**

Case study




Optimisation case study – Data

(currently 93.5% productivity)

Productivity barriers

Noise

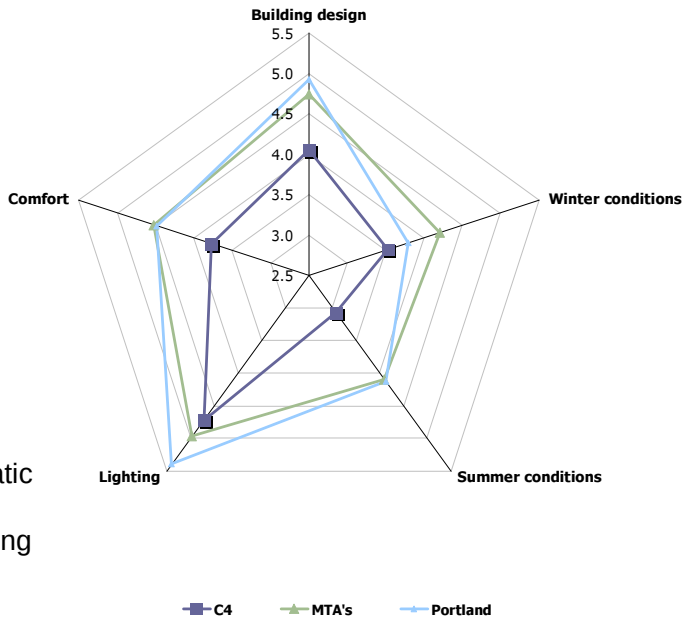
Issue in open plan

Acoustic consultant, acoustic panels, perforated plasterboard, study rooms

Noise +

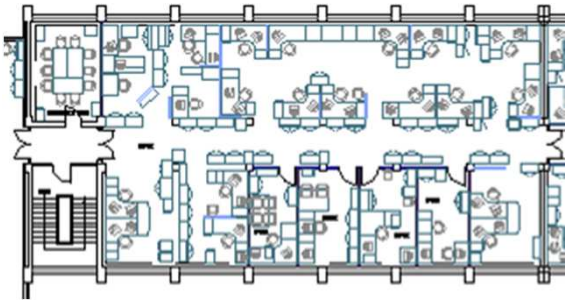
Too hot/ too cold/ glare

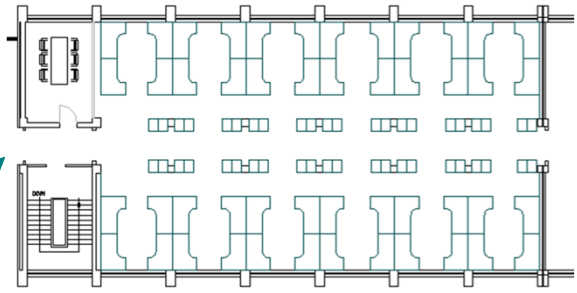
Skilled designers, double glazing, thermostatic radiator valves, insulate pipework, task lighting, team working furniture, brainstorming space, veneered finishes



Case study – Optimisation

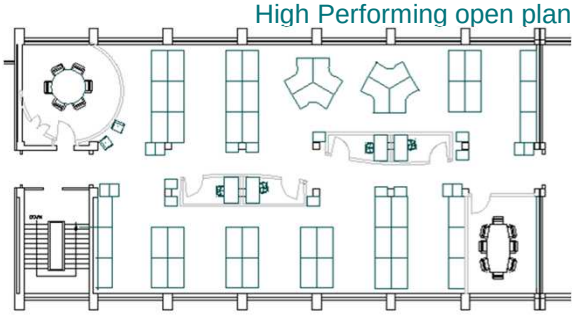
Legacy cellular





Basic open plan

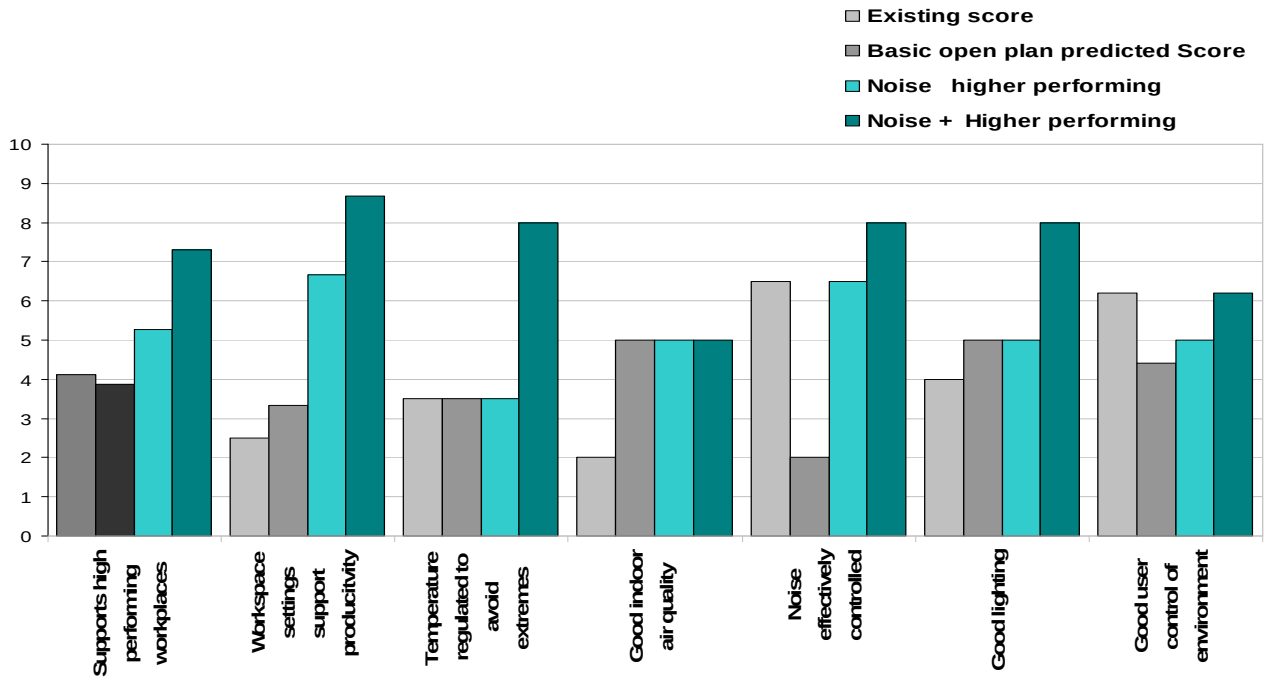
High Performing open plan



Spaces for:

- Concentrated work
- Informal team work
- Brainstorming

Defence estates evaluation process



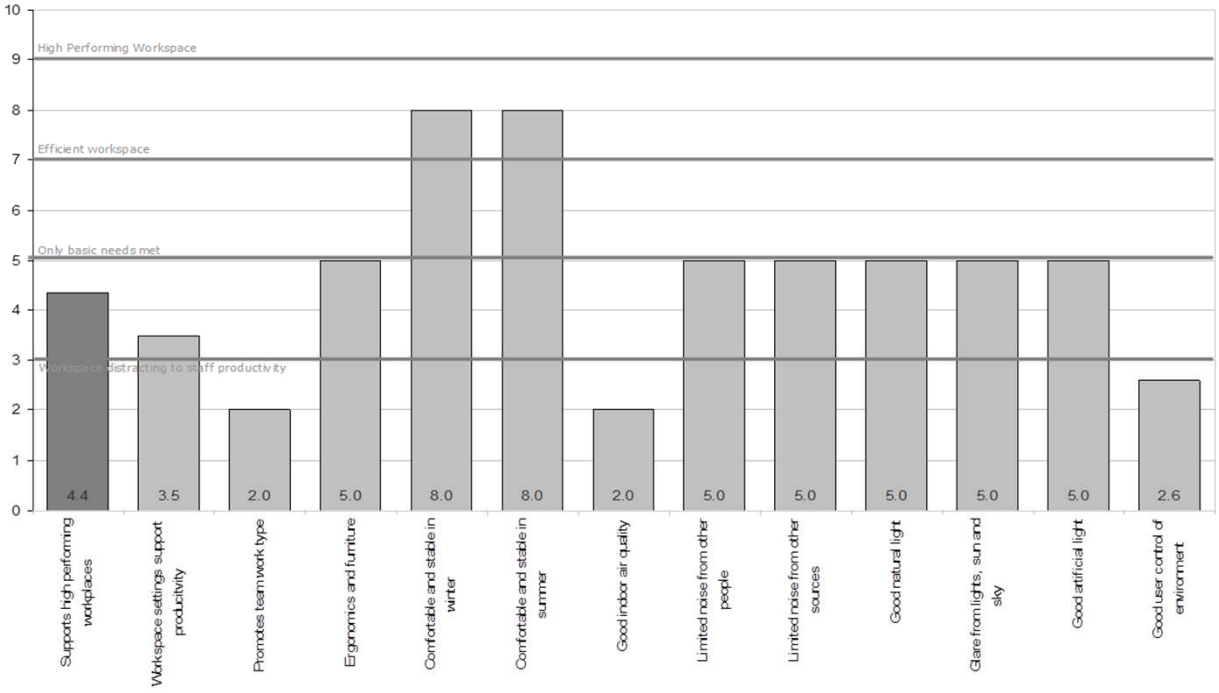
Case study – Investment appraisal

Basic Open Plan	£8,921,000	
Costs of 430 staff	£25,418,000	pa

Item	Noise	Noise+
Extra for higher performing	£141,500	£1,831,000
Probable improvement	45% of 1.4%	62% of 6.2%
% change in productivity	+0.6%	+1.6%
Staff cost saving	+£152,500 pa	+£406, 700 pa
Payback	1 year	5 years
Break-even point	+0.05 %	+0.6%

New office - Gemini

Gemini – Post completion



Next steps

- Incorporate into Investment Appraisals
- Publish
- Prove with case study