Nuclear Workforce Model formulae for implied recruitment to match internal supply to programme demand

Terms

n - year

n_0 - first year of range

S_n - Supply workforce (the current workforce – retirements to year n)

D_n - Programmed demand level in year n (in FTEs)

α_n - Attrition rate in year n for the existing workforce

β_n - Attrition rate in year n for workforce recruited between n_0 and n

A_n - Available workforce in year n, after retirement and attrition are accounted for

g_n - Gap between available workforce and demand

C_n - Compound attrition

G_n - Post recruitment gap

Y_n - in year recruitment additional to that implied by R_{n-1}^{Annual} . A manual addition

R_n^{Annual} – implied annual net required recruitment

$R_n^{Cumulative}$ - cumulative total of R_n^{Annual} for years n_0 to n

Available Workforce

$$A_{n_0} = \begin{cases} S_{n_0} \times (1 - \alpha_{n_0}) & for \quad S_{n_0} \times (1 - \alpha_{n_0}) > 0 \\ 0 & for \quad S_{n_0} \times (1 - \alpha_{n_0}) \leq 0 \end{cases}$$

$$A_n = \begin{cases} A_{n-1} \times (1 - \alpha_n) - (S_{n-1} - S_n) & for \quad \left(A_{n-1} \times (1 - \alpha_n) - (S_{n-1} - S_n)\right) > 0, \\ 0 & for \quad \left(A_{n-1} \times (1 - \alpha_n) - (S_{n-1} - S_n)\right) \leq 0 \end{cases}$$

Gap

$$g_n = A_n - D_n$$

Definition: deficit is negative. Implies recruitment required.

Compound Attrition

$$C_n = \begin{cases} g_n \times (1 + \beta_n) & for \quad g_n < 0 \\ g_n & for \quad g_n \geq 0 \end{cases}$$

If there is a deficit, additional recruitment is required to offset attrition from the newly recruited cohort. Where there is a shortfall, g_n and C_n are negative. Attrition from new recruits (assumed not to include retirement), β_n, makes C_n larger in magnitude, i.e. more negative.

Gap Post-recruitment

$$G_N = C_N + \sum_{n_0}^{N-1} R^{Annual} + \sum_{n_0}^{N-1} Y$$

G_n shows the difference assuming that preceding years' recruitment, $\sum_{n_0}^{n-1} R^{Annual}$, has taken place. $\sum_{n_0}^{n-1} Y$ allows for additional recruitment in any of the previous years.

Annual Required Recruitment

$$R_n^{Annual} = \begin{cases} -G_n & for \quad G_n < 0 \\ 0 & for \quad G_n \geq 0 \end{cases}$$

The Annual Net Recruitment Requirement is the negative of the (deficit) gap post-recruitment. If there is a surplus the annual net recruitment is zero.

Cumulative Required Recruitment

The Cumulative Recruitment Requirement is simply the sum of all annual requirements to date.

STEVE BENNETT   June 2015

$$R_N^{Cumulative} = \sum_{n_0}^{N} R_n^{Annual}$$

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