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The nuclear workforce: modernising learning, development and knowledge management

Business drivers

During last year's WNA Annual Symposium, Dr Aris Candris, President and Chief Executive Officer of Westinghouse Electric Company, highlighted the critical need for efficient management of knowledge, and its effective transfer to a new generation of workers.

It is worth reminding ourselves of some of the statistics he quoted, which form the backdrop to this paper:

- 58% of engineers at nuclear utilities are over 48 years old;
- 35% of the workforce could retire within the next 5 years; and
- hiring has been extremely low or non-existent for many years (late 1970s to early 2000s).

Although the pace of hiring is now growing, such patterns remain generally representative of risks to the future capability of the workforce amongst operators, regulators and throughout the global supply chain.

After all, engineering industry culture traditionally called for an extended learning curve, building experience progressively through periodic job rotations over many years. Yet today's entrants are more mobile, more flexible and more ambitious; the key imperatives include:

- accelerating the pace at which the new wave of trade apprentices and graduates will be able to contribute;
- ensuring that the career path lives up to their expectations; and
- managing emergent knowledge in a continuous auditable process, with less reliance on individual memory.

This paper compares and contrasts modernisation efforts with a focus on the UK context:

- sector-level approaches;
- organisation-level approaches;
- innovations in working practices

which should provide a basis for symposium delegates to review opportunities in their own territory and sector.

Sector-level approaches

Government intervention to help UK engineering sectors, which have the potential to provide relatively high economic growth and new jobs over the next decade, is finally back in vogue. In July 2009, Lord Mandelson (the UK Secretary of State for Business) announced the allocation of £150m over the next two years to fund companies' advanced manufacturing development projects in areas such as aerospace, nuclear components, electronics and microchip design.

WHAT ARE THE SCENARIOS FOR THE NUCLEAR LABOUR MARKET IN PARTICULAR?

Cogent (the Sector Skills Council for Science-based Industries) recently confirmed that due to the current age profile, merely to replace the current nuclear generating expertise in the coming years will give rise to challenges of skills supply, retention, re-skilling and up-skilling [1].

Regarding the potential future UK **operating** workforce projection to 2025, Cogent used a replacement capacity model, which takes into account the impact of improved technology of new power station designs, and estimated a shortfall across all skilled categories of around 8,000 (excluding contractors), representing a workforce gap of 30-40%, which needs to be closed.

Regarding **new build**, the UK Nuclear Industry Association recently updated its study of the UK supply chain capability, and concluded that UK resources would be adequate to service a modest build rate [2]. However, Clive Smith, Director of Nuclear Skills at Cogent, has emphasised that up-skilling solutions will be essential since the standards of quality and competence for nuclear new build will be orders of

magnitude greater than for other UK construction and manufacturing projects.

HOW WILL NUCLEAR-RELATED TRAINING BE RAMPED UP AND CO-ORDINATED?

At the request of nuclear employers, the National Skills Academy for Nuclear was established in 2008 as a wholly-owned subsidiary of Cogent in order to create, develop and promote world class skills and career pathways to support a sustainable future for the UK nuclear industry and hence to mitigate the risks of the gaps in both technical and vocational skills.

By partnering with public agencies, industry associations, universities, training providers and employers, and developing recognised competence standards and transferable qualifications, the necessary transformations are being pursued across a broad front, from schools through to continuing professional development.

The popularity of completing a UK engineering degree and entering the industry has shrunk by about one third over the past six years. This highlights the fact that much work still needs to be done with school pupils and at undergraduate level in order to increase the attractiveness of an engineering career and with that the probability of success in closing the medium-term gap.

Organisation-level approaches

At the recent UK Suppliers Forum entitled New Nuclear Opportunities, hosted by EDF Energy [3], the delegates were asked what they saw as the main people/skills challenges for new contracts. By far the leading concerns were reported as:

- the re-skill or up-skill of the existing workforce, listed by 34%; and
- winning enough business now to retain existing staff, listed by 30%.

Forward-looking organisations, which rely on mission-critical skills in order to drive competitiveness, quality and growth, are already increasing their investment in raw talent, training and knowledge capture. No doubt many fine examples are represented here at this symposium.

WHAT IS BEING ACHIEVED IN PRACTICE?

The Nuclear Decommissioning Authority has recently established its award-winning nuclear graduates programme, offering candidates a two-year series of placements backed by 20 stakeholder organisations and delivering comprehensive experience in business, science and energy generation. Significantly, the scheme offers graduates the opportunity to work across multiple sectors including processing, power generation, defence and new build as well as decommissioning, and then to pursue the career direction which is best suited to their ambition.

Given the opportunity to participate in the global nuclear renaissance, management teams are now convinced of the business case for more structured programmes to sustain and exploit vital know-how. Our client, BNS Nuclear Services, is pursuing this goal intensively - they stated: With our vast heritage of deep experience in Fuel Route and other capabilities, the preservation and refreshment of the company's unique skills, knowledge and experience is an immensely valuable asset, as the business grows.

Innovations in working practices

Back in 2004, Harvard professor Dorothy Leonard described the central paradox in transferring know-how as follows: people learn only by doing, but constantly reinventing the wheel is inefficient [4].

Leading organisations are now developing a better understanding of how this paradox can be resolved in practice: skills matrices, succession planning, knowledge harvesting techniques, Intranet-based search tools and improved access to document archives have been successfully deployed over recent years.

Organisations should now ready themselves to move beyond such catch-up activity and implement a systematic programme which integrates modern knowledge management principles with continuous learning and mainstream business processes. Some key elements of this progression towards a future **self-sustaining** capability are described below, based on our research and consulting experience.

WHAT IS THE BUSINESS CASE DRIVING THESE INNOVATIONS?

The return on investment is typically derived from three linked factors:

- acceleration of learning;
- embedding of process improvements; and
- structured decision-making.

An up-front effort is useful in order to define the scope of the organisational risks and opportunities, taking into account the existing demographic profile, succession plans, areas of work overload and future capability projections. From this baseline, a structured programme of improvement projects (each with tangible deliverables) can quickly be designed to build towards the to-be ways of working.

ACCELERATION OF LEARNING

The creation of more powerful ways to learn from experience (both historical and emergent) has been a long-held ambition, but with a new generation of engineers to train, the imperative is even greater. A very practical solution is to establish stronger, more explicit linkages between:

- the periodic download of tacit knowledge from specialists;
- the continuous upload of project experiences; and
- structured mentoring guides, which help the learner to work through an up-to-date curriculum.

The establishment and maintenance of these linkages need not be onerous: modern, low-cost e-learning software packages can be quickly populated to communicate valuable know-how in a way which is very accessible to the up-and-coming generation, familiar as they are with multi-media collaboration tools.

Significant improvements to key metrics such as time-to-competence for complex engineering roles have recently been demonstrated in practice, based on a set of re-usable and readily available mentoring resources.

Embedding of process improvements

In many engineering organisations, work throughout the project lifecycle is performed according to a set of

repeatable and, to a large extent, measurable processes. These include for example: bid preparation, conceptual design, safety case management, detailed design, unit commissioning and integration, planned maintenance and problem-solving.

Despite best intentions, how much effort has actually been applied to capturing know-how generated at milestone meetings such as design reviews; or via lessons-learnt mechanisms? In many cases, enterprise systems do not allow for the capture, review and exploitation of critical knowledge which can help to improve these core processes. What is needed are mechanisms which are either:

- so intuitive that staff do not even realise that they are in fact updating a knowledge base; or
- so valuable that staff willingly choose to participate, since they see the what's in it for me.

Fortunately, the emergence of web-based tools in the wider market has arrived at just the right time. Younger staff are relatively more comfortable working with interactive portals (such as the wiki) for collaborating and sharing ideas with work colleagues. Indeed our experience shows that with the right set-up, even much more seasoned nuclear engineering professionals quickly become engaged, realise how productivity on the day-job can be improved and are now achieving more from their IT facilities.

An accelerated roll-out of such low-cost tools can help quickly to build up a useful database of content within a knowledge-sharing environment and hence this becomes the way work gets done around here.

STRUCTURED DECISION-MAKING

The decision rationale technique allows project teams to create a graphical representation of complex decisions, as a by-product of conventional planning processes. This is done by capturing each option, the reasoning behind that option and the evidence which supports the judgement, in a simple, rapid and intuitive fashion. Templates ensure that the decision logic is properly constructed, supporting documentation is cross-referenced and an audit trail is created for the future.

Moreover, the build-up of a repository of cases and templates with expert annotation has been shown to

improve productivity and quality, and to reduce re-work. By linking this repository as a learning aid within mentoring guides (as above), further improvements are achievable.

With increasing globalisation of the enterprise and an extended supply chain such collaboration tools, which can provide instant availability of critical know-how at the point of need, are proving invaluable. Early indications of savings from mandating the technique as part of design review milestones have been benchmarked at between 10-15%.

Conclusions

In March 2008, the Wall Street Journal published an article [5] which highlighted the need for the modernisation of knowledge management:

Over the past 15 years or so, many large organisations have embraced the idea that they could become more productive and competitive by better managing knowledge ... but their knowledge-management efforts, while useful in some ways, haven't necessarily led to better products and services, more effective employees or superior work processes. What went wrong? Some firms stumbled by focusing their knowledge-management efforts solely on technology at the expense of everything else, while others failed to tie knowledge programs to overall business goals or the organisation's other activities. A new approach is needed if knowledge management is to transition into a more pragmatic discipline, one that can be used to improve specific job functions and work processes.

MODERNISATION IN PRACTICE - KEY SUCCESS FACTORS

At our client, British Energy, part of EDF, a systematic programme of work has been under way for several years in enhancing the skills, knowledge and training of the workforce. They stated that This has been fundamental to supporting our program of operational excellence and in programmes to secure lifetime extensions and to sustain valuable expertise. The training investment has also been increased to facilitate learning for the considerable inflow of new staff required to operate the assets through extended lives and to provide a core of skilled staff to deploy into new nuclear build.

Reflecting on the practical lessons learnt from such initiatives, we have further developed sets of guidelines for the strategy, implementation and technology aspects. The key factors for the success of a modernisation programme can be summarised as follows:

- measure and publicise the success of pioneering efforts; then prioritise a systematic programme of work with clear business goals, which will deliver a rapid return on investment;
- ensure that there is strong ownership and governance from senior stakeholders (even the most intuitive of new working practices may require mandating during early prove-out);
- where existing enterprise technologies (such as intranets and content management systems) can support knowledge sharing, build low-cost upgrades on top of what already exists; and
- implement innovative working practices which are aligned with robust business processes and with the human instinct to learn and collaborate, and hence can become self-sustaining.

In this paper, we have explained practical ideas for the modernisation of learning, development and knowledge management, linking them to the pressing needs of the nuclear workforce, with examples drawn mainly from UK experience.

References

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