Best Practices and Approaches to Supply Chain Management

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Innovation by experience

Objectives

Provide information available regarding both the capability and capacity of the supply chain(s) relevant to new civil nuclear build programs, including aspects of the planning, construction, operation, maintenance, waste management, and decommissioning of a nuclear power plant or nuclear industry

Aditionally, indicate:

- **where some of the more valuable elements of the SC may lie, for both a new build program and for opportunities for export**
- **the potential issues within SC, both local and global, which may threaten a new build program**

The major aims

- to identify the scope (capability & capacity) of the nuclear SC
- to give an initial view of expertise and/or the potential to complete new nuclear build (local and overseas nuclear builds)
- to give a preliminary, qualitative assessment of some of the most valuable elements of the SC (e.g. identify the value chain)
- to give brief view of the critical points (gaps or „pinch-points“) within SC, both local and global, which could threaten new build program

The major aims at identifying:

- where the country has either existing expertise and resources, or potential opportunity, to support a nuclear new build program
- the value chain in a nuclear new build program i.e., what is the value of each element of the SC, in a rank order of what adds most value
- where and how local companies can best obtain market share in a new build program
- which aspects of a new nuclear build program will provide the best community benefit through, e.g. the creation of incremental skills and high value, sustainable jobs based within the country
- what can the country best export to other new nuclear power programs, either new build or decommissioning
- what would be the need to develop or produce, which currently (or in future) cannot be obtained from overseas suppliers without long delays, which could ultimately threaten both the security and affordability of energy supplies
- what investment is needed in any capability and capacity

SC elements considered (greater or lesser extent):

- Planning & licensing
- Up-front services - infrastructure, professional services (legal, insurance, finance, etc.)
- Engineering and design services
- (Nuclear) consultancy services
- Project management
- Civil construction
- On-site erection/fabrication
- Nuclear island plant and equipment (e.g. RPV, SG, heavy forgings, pressure piping, pumps, valves, etc.)
- Non-nuclear island plant and equipment (e.g. steam turbines, generators, switch gear, transformers, etc.)
- Balance of Plant (BOP)
- Nuclear fuel supply
- Plant commissioning
- Plant operation
- Nuclear waste management and disposal (and/or recycling)
- Plant decommissioning
- Skills (or skilled workforce), which underpins all other SC elements

SC elements considered (greater or lesser extent):

PRE-BUILD DESIGN

CONSTRUCTION

OPERATION

DECOMMISSIONING

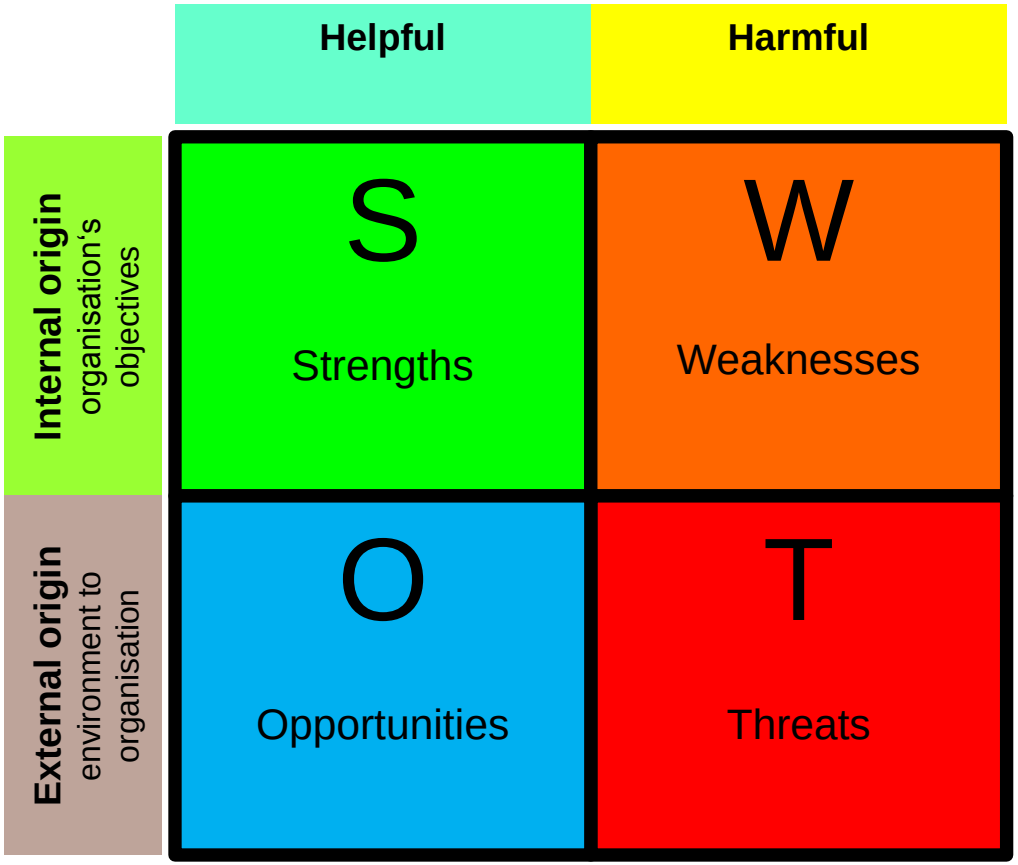
General summary of the status of the *„country“* nuclear industry and its supply chain for nuclear new build program

- To carry careful survey for significant opportunities for country‘s companies to supply into, and provide services to, a nuclear new build and global new build programs, and the SC capability in most of the areas required to support such programs
- To extend of the country‘s company involvement in the SC which will depend on the structure of new build consortia and the choice of reactor design. Additional opportunities to become part of the vendor‘s global supply chains!
- Local companies can provide services which cover all aspects of the „Pre-Build“ (Design) phase of a nuclear new build program
- Identify local based companies which could provide Project Management Services for individual projects forming the overall new build program
- All elements of civil construction (i.e., Building & Construction of the nuclear and turbine islands, BOP and supporting infrastructure) and On-site Fabrication could be undertaken by local companies
- Manufacturing facilities and experience capable of supplying a large number of components (Plant & Equipment) required for NPP

General summary of the status of the *„country“* nuclear industry and its supply chain for nuclear new build program (cont'd)

- There is a number of SC issues (***pinch-points***), related to global capacity, e.g. in case of ultra-large forgings for manufacture of NSSS equipment and turbine generator rotors, and the fabrication of NSSS equipment itself. This relates to both new build projects and to nuclear life time extension programs which require replacement parts
- To identify significant issues associated with the availability of skilled workers, across the whole SC, and considering strong competition from overseas new build programs for nuclear skills (i.e., in engineering/technical consultancy)
- Significant major threats currently to SC development, are those related to the timeliness of the various Government facilitative actions, in particular licensing assessment process
- In addition, clear signals are needed by the SC before investment in capability and capacity, and skills development will be made
- Elements of Operation and Decommissioning of NPP can be provided by local companies, although some investment would be needed

SWOT Analysis of SC



SWOT Analysis for SC

- Strengths, Weaknesses, Opportunities and Threats of/for the SC could be given as shown below (not exhaustive!):

Strengths *(could be considered as important)*

- ✓ A highly skilled and experienced resource base, active across all aspects of the nuclear energy sector
- ✓ Proven major project management and engineering capability
- ✓ Expertise in operating nuclear assets (for power generation and nuclear processing) and in life time extension
- ✓ Design, manufacture and installation of advanced components and equipment
- ✓ World renowned academic institutions, leading-edge research and development
- ✓ Strong link between energy sector and main financial and trading center, which together with a full range of professional services, would make the country a key location for new energy development

SWOT Analysis for SC

- Strengths, Weaknesses, Opportunities and Threats of/for the SC could be given as shown below (not exhaustive!):

Weaknesses *(that shall be considered)*

- ✓ Number of country‘s based Engineering, Procurement & Construction (EPC) contractors with recent new nuclear power plant experience
- ✓ Availability of local capability for the production of the largest forgings required for the manufacture RPVs, SG and primary piping, as well as large steam turbine and turbine generator rotors
- ✓ Availability of local civil NSSS manufacturing capability
- ✓ Availability of local supply of major equipment for the non-nuclear (turbine) island
- ✓ Relatively high labor costs – labor content greater than in other regions of the world
- ✓ There is currently still a nuclear engineering skills gap

SWOT Analysis for SC

Opportunities *(could be included, some require investment)*

- ✓ Consultancy: technical and commercial feasibility studies and evaluation
- ✓ Detailed understanding and development of the Nuclear Safety case
- ✓ Project management of new plant construction (which can account for up to 15% of overall project value)
- ✓ Supply of raw materials (e.g., steel, cement, etc.)
- ✓ Civil engineering and construction (accounting for up to 25% of project value)
- ✓ On-site erection / installation
- ✓ Reactor plant sub-system module and product definition
- ✓ Supply chain management
- ✓ Specialist equipment supply (I&C, and electrical)
- ✓ Electrical, on-site installation
- ✓ Supply of large forgings for NSSS
- ✓ Supply of other forgings and castings for the nuclear island
- ✓ Specialist component supply (valves, pumps, cables, piping, etc.)
- ✓ Manufacture of nuclear island equipment, including SG, pressurizer and primary piping, and ist engineering support (with some investment)
- ✓ Manufacture RPV internals (with some investment)

SWOT Analysis for SC

Opportunities *(could be included, some require investment) …….*

- ✓ Manufacture RPV internals (with some investment)
- ✓ Operational and asset management and plant life extensions
- ✓ Integrated decommissioning project management and site management
- ✓ Decommissioning specialist equipment
- ✓ Integrated fuel and waste management / services and disposal

SWOT Analysis for SC

Threats (or risks) *(could be included)*

- ✓ The one of the major threats to SC for a new build program are those related to the timeliness of the various Government facilitative actions
- ✓ Shortage of skilled inspectors and engineers engaged in the process (within regulatory body), such that delays in the completion of this process and the possible knock-on effects of delays in the planning and licensing processes would affect confidence throughout the SC
- ✓ Significant and early activity in other markets which could result in resources and skills required for a country‘s nuclear new build program being „pulled“ from the resource pool
- ✓ The growing skills gap in the nuclear industry not being closed or narrowed within the required timescale (for new build start)
- ✓ Delays in strategic siting assessment and subsequent identification of suitable sites may also affect supply chain development, as utility companies and vendors may seek alternative markets

Recommendations for SC

- SC development activities should be initiated, which make potential SC companies aware of the opportunities of a nuclear new build program, and help companies develop capability and capacity to relieve SC „pinch-points“
- Additional SC „mapping“ should be carried out, including to lower areas of SC, to understand where the country has the expertise and/or the potential to complete for nuclear new build and in overseas nuclear builds
- To provide certainty to the nuclear industry and development of the SC, the Government impacts must remain on schedule to ensure that the indicative timelines are met. Recruitment of the appropriate number of skilled inspectors will be important to ensure that the licensing process runs to time
- Targeted support should be provided to companies seeking nuclear accreditation and qualification. Thus, the companies seeking accreditation or, as will be the case in a considerable number of cases, seeking to re-establish lapsed accreditations will need to commit considerable resources, both in terms of time and money, to secure nuclear qualification
- Companies must have access to education and training programs, and a supply of high quality graduates, which meet their needs in the development of a skilled workforces across all aspects of the nuclear supply chain, which will include the development of non-nuclear specific skills.

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Representative new plant pre-construction timeline