Decommissioning in the UKCS

Mapping the supply chain, identifying SWOTs and making recommendations to optimise a key industry growth area

A collaborative study from Scottish Enterprise, Decom North Sea and Accenture

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DECOM North Sea

accenture

Scottish Enterprise

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Executive Summary

With many offshore facilities in the UKCS nearing end of life, and an aggregated forecast spend of £35 billion by 2040[1]; decommissioning will present not only increased opportunities but also increased challenges for the supply chain.

Recognising this, Scottish Enterprise, in partnership with Decom North Sea and Accenture, carried out an exercise to map the decommissioning supply chain; assessing capability and capacity; and identifying strengths, weaknesses, opportunities and threats. This led to the development of a proposed common structure for the supply chain and recommendations for improvement.

Research was carried out in collaboration with suppliers and operators and had four key elements: a Supplier Questionnaire, a Supply Chain Mapping Workshop, Face to Face Operator Meetings and Desktop Research.

Supplier capabilities and capacities were mapped for each phase of the decommissioning lifecycle and for the activities that sit within each phase. Suppliers rated themselves on a capability index of 1-5, with level 4 being classed as the "industry desired capability". The results showed that there are varying capabilities across the supply chain phases, as seen in figure 1:

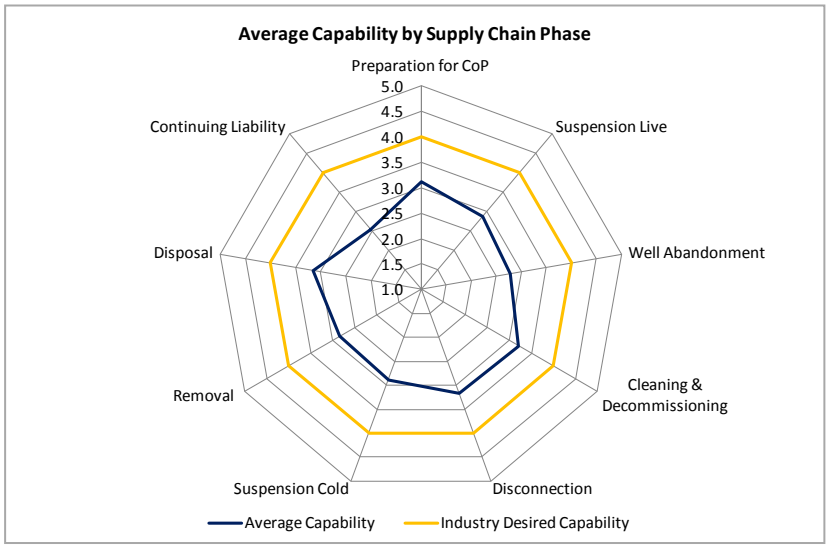


Figure 1

Two high level conclusions can be drawn from this analysis:

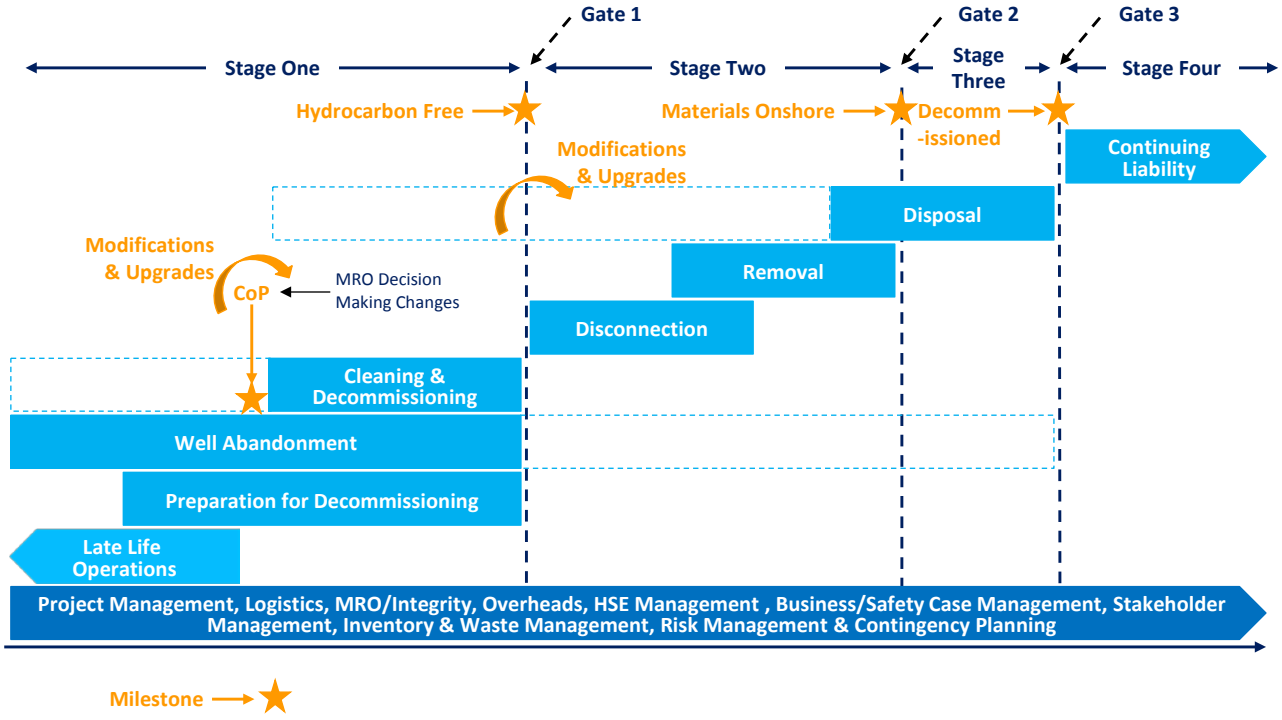
1. With capability varying by 27%, pockets of supply strength and weakness exist along the supply chain
2. With the average capability for the whole supply chain being 2.95, intervention is required in order to position services appropriately to meet forecast future demand

Qualitative analysis of the strengths, weaknesses, opportunities and threats across each phase was carried out to contextualise the quantitative results displayed above and throughout the study. This analysis indicated that the supply chain already has many inherent strengths but also identified multiple challenges. These challenges are addressed in the recommendations section of each phase in this study.

[1] 2013 Activity Survey, Oil & Gas UK

Incorporating feedback from the Supplier Questionnaire, Supply Chain Mapping Workshop and Face to Face Operator Meetings, a new supply chain model was developed. This map, seen in figure 2, aims to present a rationalised model that more realistically reflects the sequencing of activities in a live decommissioning project and identifies stages of synergy along the supply chain:

Figure 2: Recommended Decommissioning Supply Chain Phase Map



Finally, major challenges and opportunities were identified throughout the research process and are articulated in the Key Themes chapter which includes:

- Integrate planning
- Practice collaboration & bundling
- Plan & execute earlier
- Develop talent & resourcing
- Leverage supply strengths

The final key theme relates to leveraging the inherent strengths in the supply chain rather than focussing on capability, capacity and experience gaps. It concludes that, while there may be an average gap of 35% between actual and desired capability across the supply chain, by focusing on how areas of strength can be framed to optimise the supply and demand balance along the supply chain, the challenge ahead may be much reduced.

1.0 Introduction

1.1 Background & Objectives

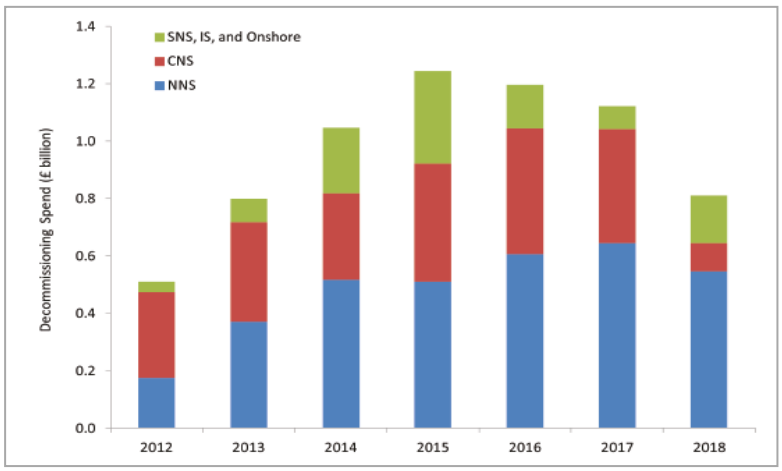
The UK oil & gas industry continues to be productive and show promise for the future. Despite declines in recent years, Oil & Gas UK anticipates that UKCS production rates will rise to 2 million boe per day by 2017 or sooner[2]. Moreover, with capital investment in the UKCS forecast to rise to £13bn in 2013[3], the industry has reason to be optimistic of further growth.

However, the North Sea remains one of the world's mature petroleum provinces and, despite new developments, many assets are reaching the end of their field lives and will require decommissioning.

It is estimated that the total industry cost of UKCS decommissioning in the next five years will amount to ~£5 billion, focusing on 40 platforms (and their associated wells, pipelines and subsea structures) across 80 fields[4]. To put this figure in context, latest estimates for the same period show that total decommissioning costs in arguably the world's most mature petroleum province, the Gulf of Mexico, will amount to ~$3 billion[5] – less than half the UKCS figure.

As Figure 3 demonstrates below, decommissioning spend across the UKCS will vary by region, with the NNS and CNS having considerably higher costs per asset than the SNS. This is owing to multiple factors such as typical structure weights, depths per region, distance from shore and prevalent weather conditions. Many other factors, such as asset type, regulatory requirements and decommissioning strategy, will also greatly affect the costs from one decommissioning project to the next.

Figure 3: Forecast decommissioning spend by region in the UKCS (in billions)



Source: *2013 Activity Survey, Oil & Gas UK*

Costs will also vary across different phases of the decommissioning value chain, with the Well Abandonment phase forecast to account for 44% of total costs while the Suspension Cold phase is

[2] 2013 Activity Survey, Oil & Gas UK
[3] 2013 Activity Survey, Oil & Gas UK
[4] 2013 Activity Survey, Oil & Gas UK
[5] Rigzone and Decomworld March 2013

forecast at just 0.03%[6]. These proportions, however, are an average of multiple cost forecasts and cannot be assumed to be accurate for all decommissioning projects due to the factors mentioned above.

These factors, variations and uncertainties make decommissioning cost forecasting a challenging activity but the latest upper estimate of total UKCS decommissioning spend is as high as £35 billion for the period through to 2040, with £31.5 billion of this to decommission existing installations and £3.5 billion to decommission new developments[7].

High oil & gas prices, improved recovery technologies and fiscal uncertainty have all played their part in delaying decommissioning projects. Given that only 57 structures are reported to be either decommissioned or in the process of being decommissioned to date[8], the UKCS sector can still be considered to be in an embryonic state.

However, with ageing structures reaching the end of their design lifespans, production rates declining and recently announced tax relief deeds allowing greater clarity in decommissioning decisions, a maturing of the UK sector seems imminent. This, in turn, will bring about significant opportunities and challenges for the supply chain.

Recognising this, Scottish Enterprise, in partnership with Decom North Sea and Accenture, carried out an exercise to understand the nature of opportunities and challenges that exist for supply chain companies in the decommissioning sector. The aim was to produce a decommissioning supply chain map which documents the strengths and weaknesses that exist within the supply chain and makes recommendations on intervention and support to help alleviate the weaknesses and exploit the strengths.

The exercise involved engaging suppliers and operators, as well as conducting research, with the objectives of:

- Mapping the capability and capacity of the supply market throughout the decommissioning lifecycle
- Identifying strengths, weaknesses, opportunities and threats (SWOTs) that exist across the decommissioning lifecycle
- Making stakeholder recommendations for the improvement of the supply chain
- Defining a supply chain structure for future use
- Representing the findings in a mapping document for industry use

The findings from the exercise are documented in this study.

[6] 2012 Decommissioning Insight, Oil & Gas UK
[7] 2013 Activity Survey, Oil & Gas UK
[8] DECC March 2013

1.2 Methodology

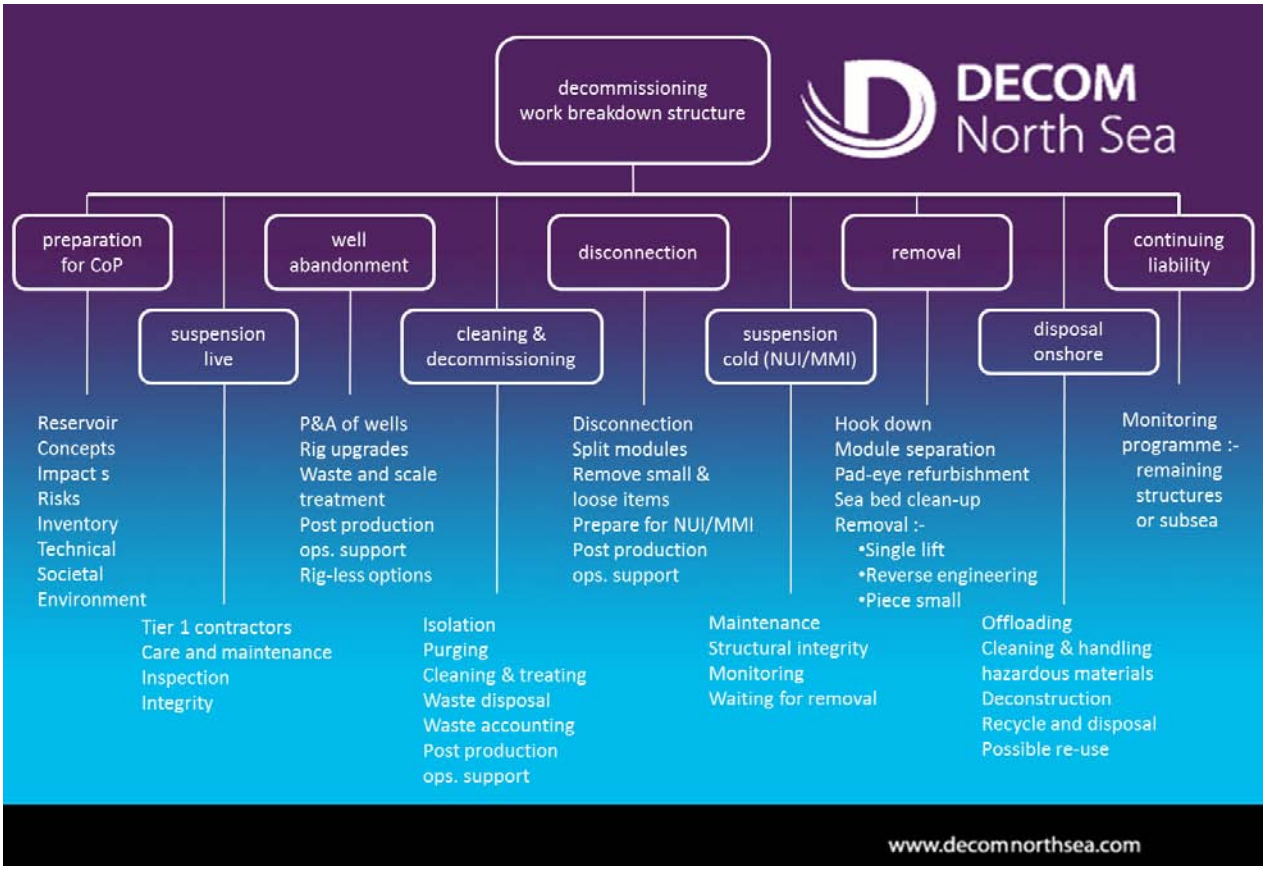
The methodology employed to carry out the study comprised four key elements:

- Supplier Questionnaire
- Supply Chain Mapping Workshop
- Operator Face to Face Meetings
- Desktop Research

Supplier Questionnaire

A supplier questionnaire was issued to 180 suppliers, including Decom North Sea members and other companies active in the UKCS decommissioning supply market. Suppliers were asked to rate their capability for each supply activity relevant to their service provision across the decommissioning lifecycle. The current industry accepted Decommissioning Work Breakdown Structure in figure 4 formed the basis of the breakdown by phase and activity.

Figure 4: Decom North Sea Work Breakdown Structure



NB - “activities” are the listed items beneath each of the established nine “phases”

Suppliers rated their capability in relevant activities, from level 1 to level 5, using the criteria from the capability index below:

Capability Levels	Descriptors (experience, technology, technical resources, headcount, funding)
Level 1	Very limited
Level 2	Limited/Not Proven/Under Development
Level 3	Established/Proven
Level 4	Proven Track Record/Innovative/Industry Recognised – "Where we want to be"
Level 5	Best in Class/Industry Benchmark

Note: Level 4 was described as "Industry Recognised" and was therefore considered a self-defined benchmark of "Where we want to be" for suppliers when completing the questionnaire. This capability benchmark is used as a key reference point throughout the study.

Suppliers were also asked to indicate whether they had decommissioning experience for each of the nine phases, as well as to provide input on their view of key industry SWOTs.

The supplier questionnaire received input from 85 suppliers and analysis of the output has informed the statistics and graphs throughout this study.

Supply Chain Mapping Workshop

A workshop was held with representatives from around 50 Decom North Sea member companies. The workshop focused on defining supply activities and identifying SWOTs across the phases of the decommissioning lifecycle.

In order to define the activities, a list of proposed activities per phase was drafted using the industry Decommissioning Work Breakdown Structure together with additional research. Workshop attendees were asked to validate these proposed lists, adding activities thought to be relevant and removing those considered extraneous, duplicated or misplaced.

The session then split into breakout groups to discuss the SWOTs per decommissioning phase.

Feedback from each of the sessions was discussed and captured. This was aggregated and analysed to help define the supply chain map.

Operator Face to Face Meetings

A series of individual face to face meetings were held with eight key UKCS operators who either have confirmed or potential decommissioning projects in the pipeline. These sessions were used both to gain feedback on the results from the supplier questionnaire and workshop; and also to incorporate the views of operators into the research and final study.

Desktop Research

Desktop research was also carried out including market reports, industry studies and other available research. This included the following sources:

- *2013 Activity Survey*, Oil & Gas UK
- *2012 Decommissioning Insight*, Oil & Gas UK
- Research from Oil & Gas UK's Task Group 3
- *Review 268, March 2013*, Society of Petroleum Engineers
- Rigzone and Decomworld, March 2013
- DECC Decommissioning Website, March 2013
- Rushmore Reviews Database, March 2013
- *UKCS Offshore Decommissioning Report 2010-2040,* Douglas-Westwood

Final Report

Following these four elements, quantitative and qualitative research data was collected, analysed and is presented in this study.

The document maps the decommissioning supply chain by providing analysis of the service experience, capability and capacity for each of the activities across the decommissioning lifecycle, as listed in the Decommissioning Work Breakdown Structure map. It also provides a SWOT analysis for each of the nine phases.

The study concludes by proposing a new supply chain structure and guidance on how it might vary by decommissioning strategy. There is also analysis and recommendations on key supply chain themes running through all the phases of the decommissioning lifecycle.

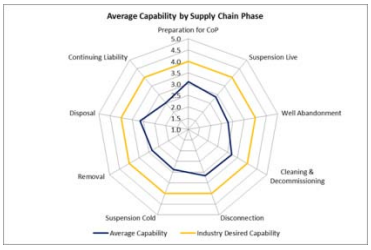
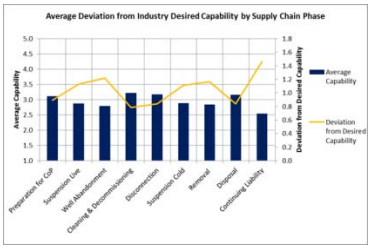
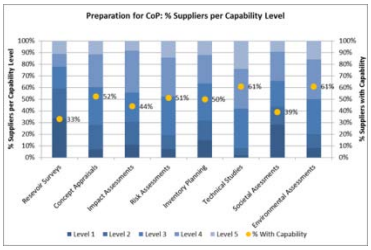
Limitations of the Study

It must be noted that the results of this research and the analysis found in this study are a product of the aggregated views of those that took part in the supplier questionnaire, supply chain workshop and face to face meetings. The study is limited to the suppliers and operators that took part and does not reflect the capabilities or opinions of all suppliers and operators in the UKCS. This material cannot be considered an exact representation of the supply market but rather an indicative picture of current market trends, movements and sentiments.

It should also be stressed that, as an aggregated opinion of multiple industry stakeholders from supplier and operator organisations, the contents of this document are not the direct opinion of Scottish Enterprise, Decom North Sea or Accenture.

Guide to Graphs

The data received via the supplier questionnaire was analysed and is represented in graphical format throughout sections 2 and 3 of the report. The guide below clarifies the use and meaning of these graphics:

Graphs and Graphics	Description
Average Capability 	▪ These graphs depict the rolled-up average capability of suppliers per activity or per phase ▪ These graphs reflect the questionnaire responses submitted by suppliers when asked to rate their own capability per activity in each phase of the supply chain ▪ The blue line shows the capability of suppliers per activity or phase. The yellow line highlights level 4, which the criteria defined as "industry recognised" and is considered the benchmark capability level at which suppliers wish to be
Deviation from Industry Desired Capability Level 	▪ These graphs depict the same data as the average capability graphs, but highlight the gap between desired capability and what capability suppliers are at now ▪ The blue columns show the average capability per phase or activity while the yellow line demonstrates the deviation between current and desired capability levels ▪ These graphs intend to clearly demonstrate the gaps between current and desired capability
Supplier Capabilities by Activity 	▪ These graphs depict the proportion of suppliers that rated themselves in each capability level for each activity in the questionnaire ▪ The yellow scatter dots show the percentage of questionnaire respondents who stated they had capability (of any level) in a given activity. This can be taken to be an indicator of industry supply capacity ▪ These graphs intend to demonstrate a more granular reflection of supplier capability than the average capability graphs by showing the proportion of suppliers per capability level

Glossary of Abbreviations

The following abbreviated terms are used frequently throughout the study:

Term	Definition
CNS	Central North Sea
CoP	Cessation of Production
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
FPS	Floating Production System
GBS	Gravity Based Structure
HLV	Heavy Lift Vessel
HSE	Health, Safety and Environment
ITF	Industry Technology Facilitator
JV	Joint Venture
LSA	Low Specific Activity Scale
LWIV	Lightweight Intervention Vessel
MMI	Minimally Manned Installation
MRO	Maintenance, Repair and Operations
NCS	Norwegian Continental Shelf
NNS	Northern North Sea
NORM	Normally Occurring Radioactive Material
NUI	Normally Unmanned Installation
OPEX	Operational Expenditure
OSPAR	Oslo Paris Convention
P&A	Plugging & Abandonment
ROI	Return on Income
ROV	Remotely Operated Vessel
SEPA	Scottish Environment Protection Agency
SNS	Southern North Sea
SWOT	Strengths, Weaknesses, Opportunities and Threats
UKCS	UK Continental Shelf

2.0 Supply Chain Analysis at Phase Level

The decommissioning supply chain mapped in this study consists of the nine phases of the established decommissioning lifecycle:

- Preparation for CoP
- Suspension Live
- Well Abandonment
- Cleaning & Decommissioning
- Disconnection
- Suspension Cold
- Removal
- Disposal
- Continuing Liability

Within each of these phases sit multiple lower level activities (taken from the Decommissioning Work Breakdown Structure for the purpose of this mapping) and together they constitute the supply chain. The next chapter analyses each phase at activity level, while this chapter considers the supply chain at phase level.

These phases may or may not all feature in a decommissioning project as projects vary considerably depending on their strategy and many other influencing factors. Similarly, these phases may run sequentially but will often overlap significantly.

Figure 1 shows the average supply market capability per supply chain phase. Cleaning & Decommissioning is the phase with the highest average supplier capability at 3.22, while Continuing Liability has the lowest at 2.54.

The average supplier capability across the supply chain is 2.95, with only 44% of the phases having a capability at or above level 3. This may seem fairly low but one operator commented that this level demonstrates a vast improvement, suggesting that the blue circle in figure 1 would have been far more contracted five years ago.

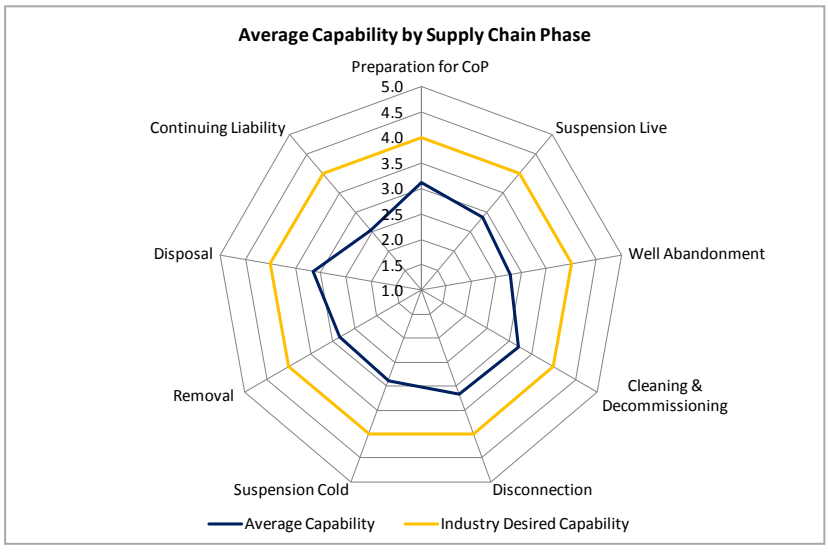


Figure 1

Figure 5 demonstrates the deviation between average supplier capability and the industry desired capability per phase. The capability gaps vary from 0.78 to 1.46 below the industry desired capability, with Cleaning & Decommissioning, Disconnection and Disposal displaying the smallest gaps, while Continuing Liability, Well Abandonment and Removal show the greatest.

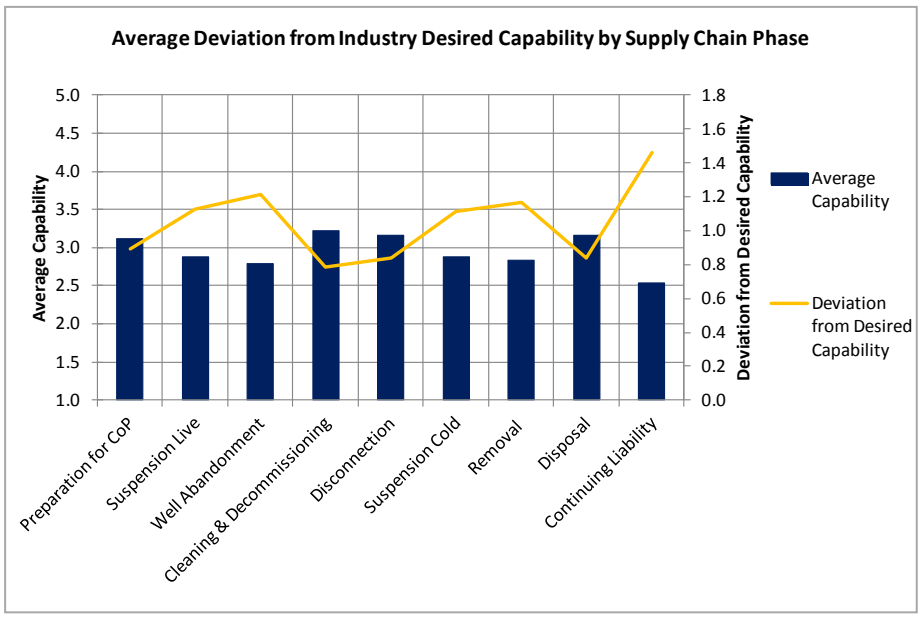


Figure 5

The mean capability gap across the supply chain is 1.05, meaning the industry would have to improve its current capability by 35% to be in line with the desired level of service provision.

Figure 6 shows average capability mapped against the percentage of total forecast spend by phase in the next five years[9]. Taking spend to be an indicator of demand, this graph serves to highlight the imbalances between current supply capability and future demand per phase.

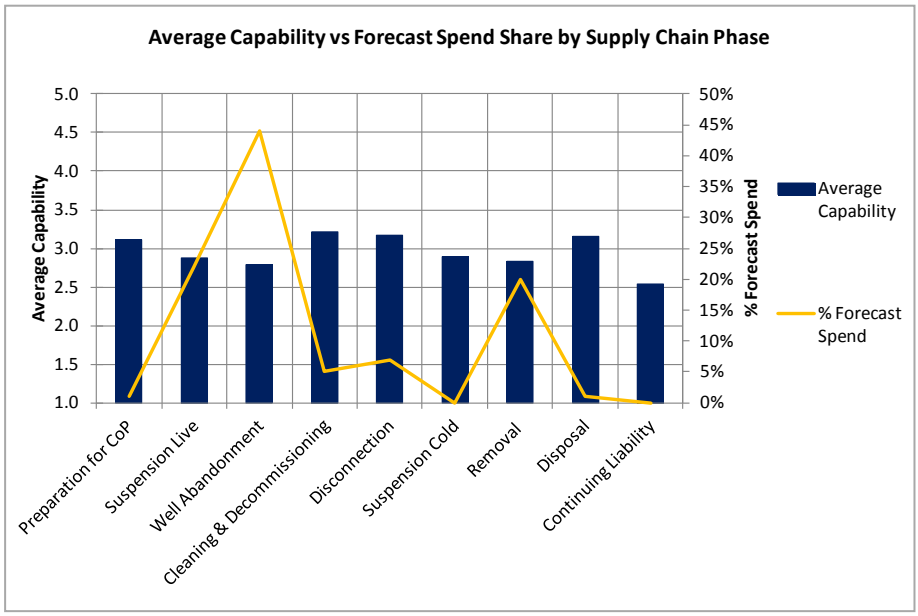


Figure 6

The most noticeable insight is that two of the phases with the highest forecast spend, Well Abandonment at 44% and Removal at 20%, have the lowest capabilities, at 2.78 and 2.83 respectively. Although supply capacity must also be taken into consideration, this significant imbalance of demand and capability should be considered an indicator of where the sector needs to quickly improve.

Conversely, Disposal has a disproportionately strong capability of 3.16 compared with its 1% share of future spend. This supports the theory addressed later in the study: that the strength in the Disposal market could be leveraged earlier or even elsewhere in the supply chain to smooth out supply and demand imbalances.

[9] Research from Oil & Gas UK's Task Group 3

Figure 7 demonstrates the percentage of all suppliers that said they had capability per phase, contrasted against the percentage of all suppliers that stated they had actual decommissioning experience per phase.

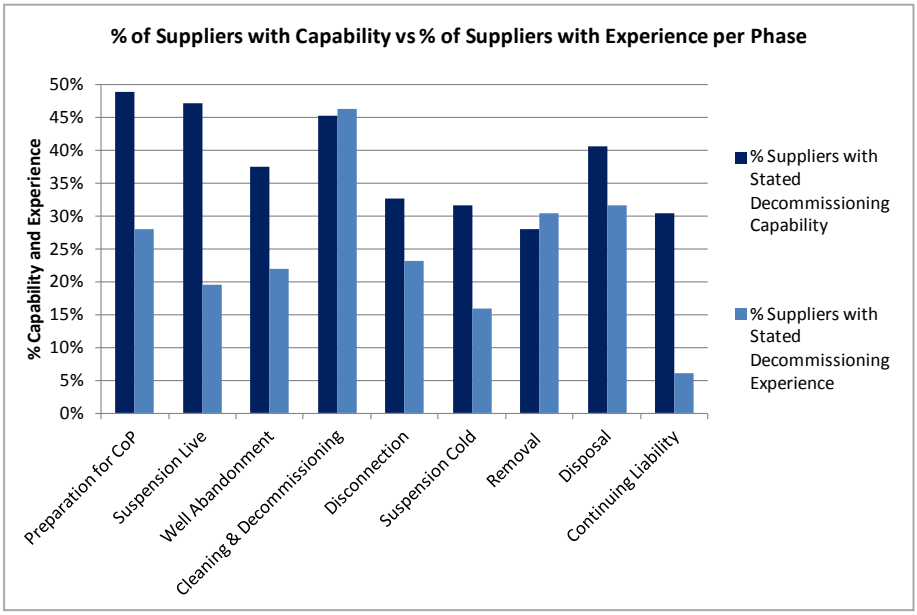


Figure 7

The graph highlights a generally low level of tangible decommissioning experience in the supply market; Cleaning & Decommissioning being the phase with the most experience at 45% and Continuing Liability the least at just 6%. Across the supply chain, the average percentage of suppliers with actual decommissioning experience is 25%.

Perhaps the starkest insight from figure 7 is the gulf between stated experience and stated capability. For the Continuing Liability phase, there is a 400% gap between the number of suppliers that said they had experience and the number that said they had capability. The average gap between experience and capability is 94% (including two phases that anomalously had higher average experience than capability), suggesting that a significant number of suppliers either think their capabilities elsewhere are transferrable to decommissioning requirements or have developed their decommissioning capabilities without securing the opportunity to use them.

However, if decommissioning activity ramps up to meet forecasts over the coming years, suppliers will gain more experience and a closing of the gap between stated capability and stated experience should take place.

3.0 Supply Chain and SWOT Analyses by Phase

The following nine sub-chapters provide insight and analysis of the supply activities within each of the nine phases of the decommissioning lifecycle.

Each sub-chapter covers a phase and contains an overview of the activities; an analysis of each activity's capacity and capability; and a SWOT analysis for that phase. The sub-chapters also conclude with some recommendations to improve supply chain operations per phase.

Please note that this content is the aggregated opinion of the suppliers and operators consulted and not necessarily the views of Scottish Enterprise, Decom North Sea or Accenture.

3.1 Preparation for CoP

The Preparation for CoP phase incorporates the activities necessary to conclude production on an asset and transition into a decommissioning project. The phase has two main facets: data gathering and planning. The former largely consists of studies, surveys and assessments, while the latter uses that data to develop a decommissioning plan which must be approved by the Department for Energy and Climate Change (DECC). The Decommissioning Work Breakdown Structure lists the following activities as part of the Preparation for CoP phase:

- Reservoir Surveys
- Concept Appraisals
- Impact Assessments
- Risk Assessments
- Inventory Planning
- Technical Studies
- Societal Assessments
- Environmental Assessments

The Preparation for CoP phase typically takes a number of years to complete due to the rigorous research and planning required. Typically the phase will begin in an asset's late life and overlap with later phases in the decommissioning lifecycle such as Well Abandonment. The major risks of the phase are the potential lack of scope clarity, not getting the necessary regulatory approvals and the difficulty of forecasting time and cost accurately.

Capability & Activity Analysis

Figure 8 demonstrates the average capability of suppliers by Preparation for CoP activity. Reservoir Surveys is the activity with the lowest average supplier capability, at 2.41, while Technical Studies is the activity with the strongest average capability at 3.72. At just 0.28 below the industry desired capability, Technical Studies is actually the activity with the highest average capability across the entire supply chain.

Overall, the average capability level across the 8 activities is a relatively strong 3.11, with 75% of the activities having a capability at or above level 3.

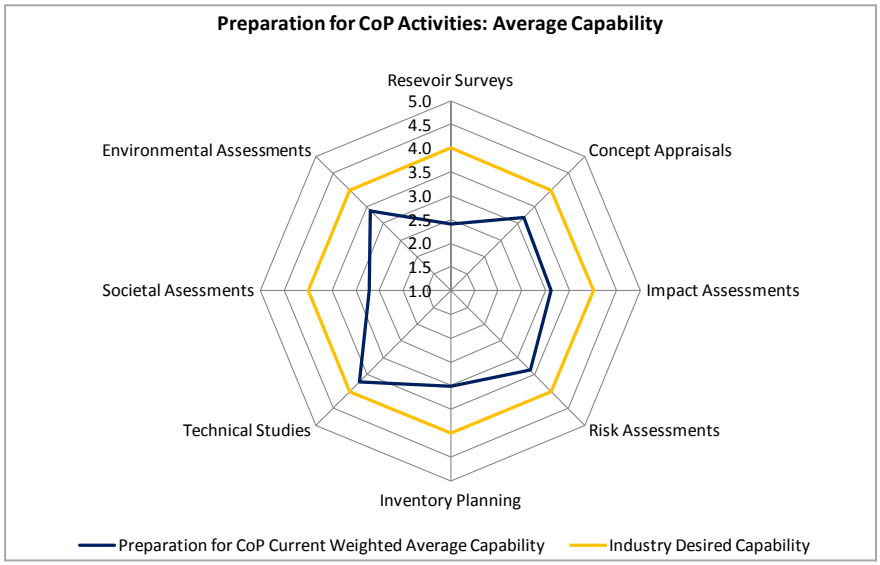


Figure 8

Figure 9 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights, Societal Assessments and Inventory Planning present the major capability gaps alongside Reservoir Surveys. At the other end of the spectrum, Environmental and Risk Assessments are the next strongest activities after Technical Studies, averaging at 0.62 and 0.64 below the desired capability level respectively.

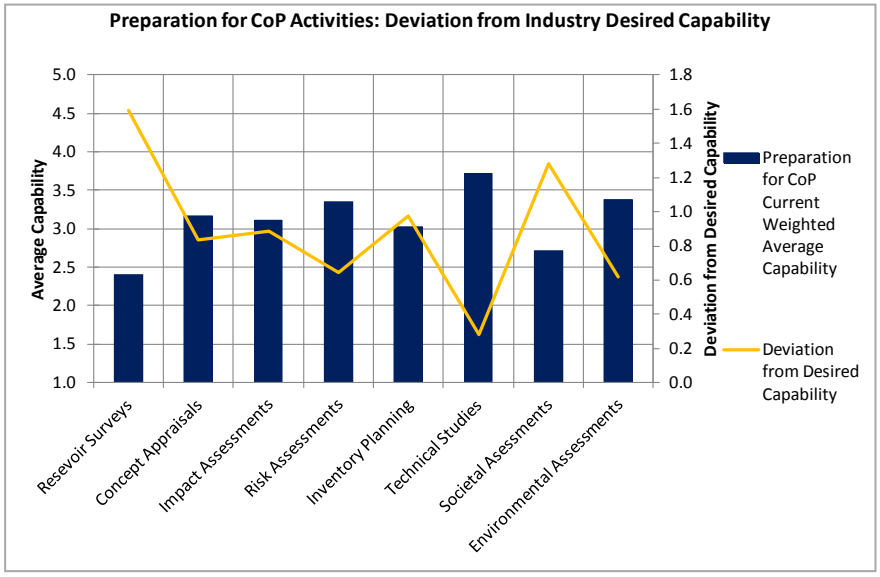


Figure 9

Figure 10 shows the proportion of suppliers by capability level for each activity. Technical Studies has the highest share of suppliers with level 5 capability, at 24%. Impact Assessments, despite only having the fifth highest average capability, also demonstrates a strong concentration of high capability suppliers, with 34% rating themselves level 4. Reservoir Surveys has the highest proportion of suppliers with very limited capability, 33% being at level 1.

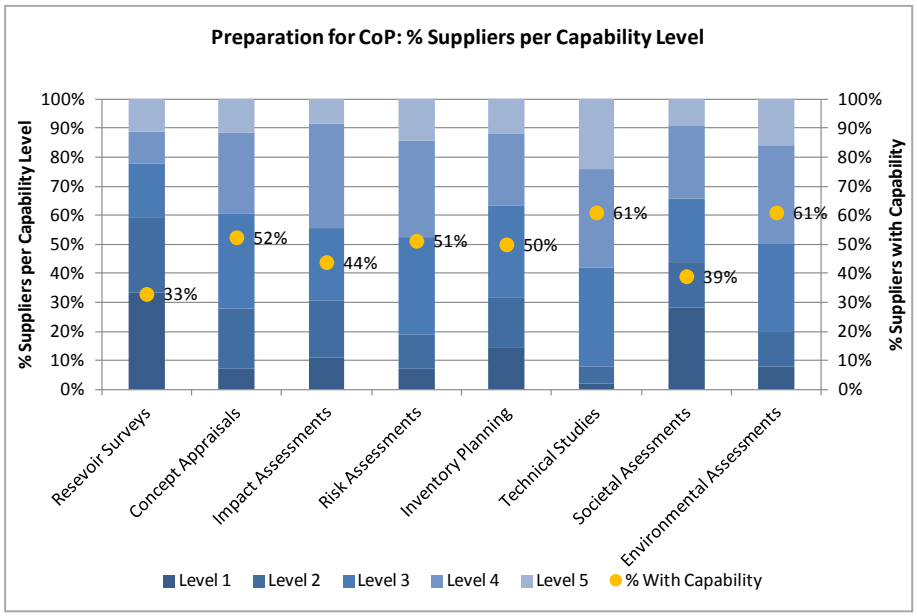
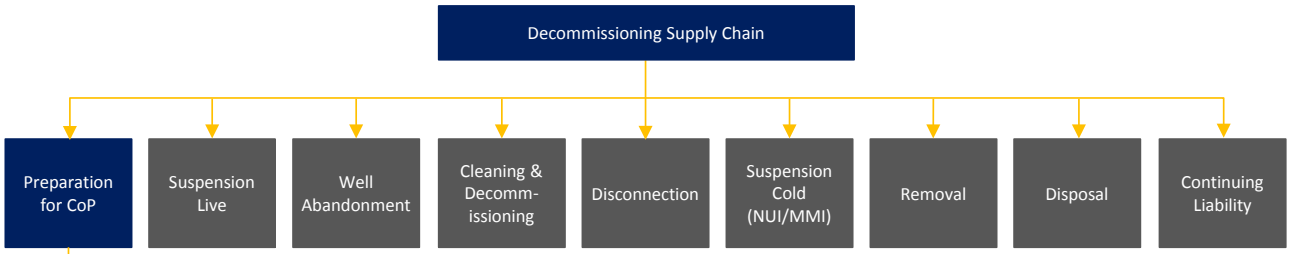
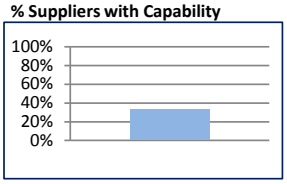
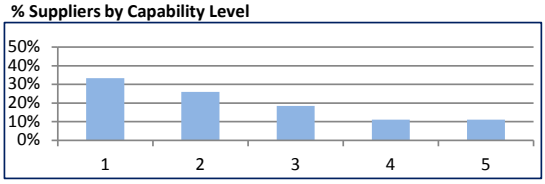
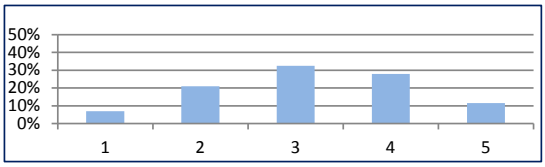
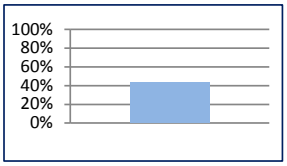
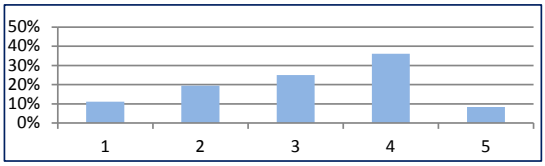
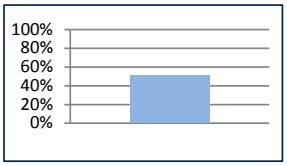
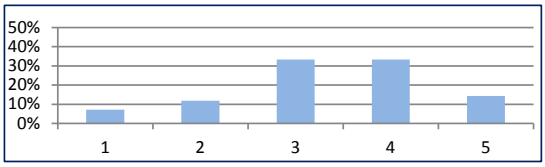
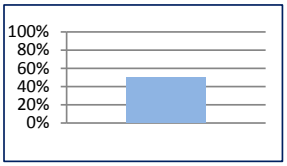
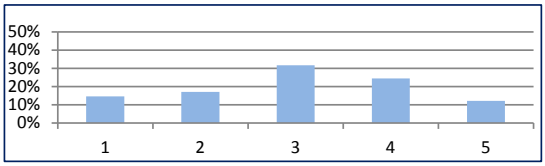
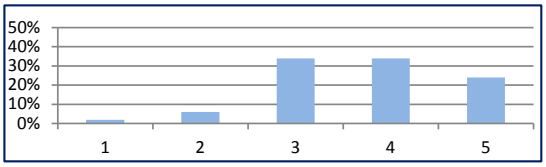
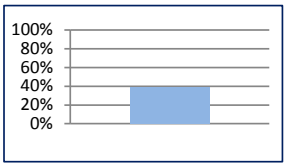
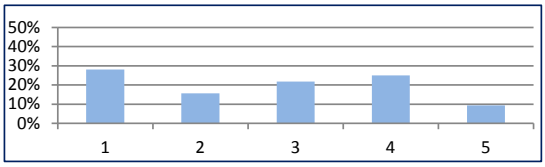
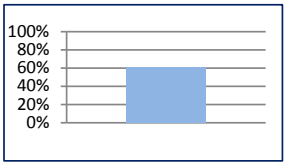
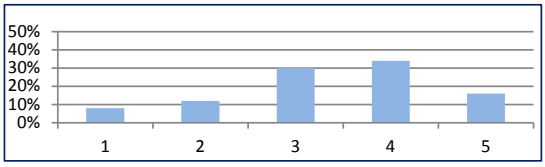


Figure 10

This section shows analysis of supplier capacity and capability by activity:



	Activity Overview	% Suppliers with Capability	% Suppliers by Capability Level
Reservoir Surveys	▪ Reservoir related surveys, studies and planning ▪ Reservoir Surveys is the least capable activity of the phase with a weighted average capability of 2.41		
Concept Appraisals	▪ Decommissioning concept appraisals, research and planning ▪ This is an activity with strong average capability for the phase and a majority of 52% of suppliers having some capability		
Impact Assessments	▪ Impact related assessments, planning and stakeholder engagement ▪ This is a relatively strong activity with level 4 being the most common capability		
Risk Assessments	▪ Financial, operational and reputational risk related assessments, studies, plans and mitigations ▪ This is a strong activity with an average capability of 3.36		
Inventory Planning	▪ Inventory (materials, equipment, waste and hazardous materials) assessment and planning ▪ This activity has reasonable capacity with 50% of suppliers demonstrating some capability		
Technical Studies	▪ Technical related research, surveys, studies and planning ▪ Technical studies is the strongest activity in the phase with 61% of suppliers responding and an average capability of 3.72		
Societal Assessments	▪ Societal related assessments, studies, engagements and plans ▪ This has the opposite capacity figures to technical, with just 31% showing capability. The average level was 2.72		
Environmental Assessments	▪ Environment related impact assessments, studies, mitigations, stakeholder engagement and plans ▪ This has fairly strong capability, averaging 3.38		

SWOT Analysis

Strength	Description
Strong engineering community	The UKCS has strong engineering knowledge, capabilities and supply capacity
Strong asset knowledge	As the same suppliers who have serviced an asset during its operational life will normally continue to provide services for this phase, they bring strong knowledge of the asset hardware and infrastructure
Strong late life infrastructure management capability	With field lives often being extended in recent years; knowledge, capability and compliance have become strength areas in infrastructure late life management
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record
Innovative technologies available	Innovative technologies, such as online inspections, thermal imaging and improved survey capabilities, are helping to improve the standard of Preparation for CoP activities
Open attitude to collaboration and innovation	The decommissioning supplier and operator community is open not only to knowledge sharing and discussion, but also to ideas around collaboration and alliances. This attitude is fostered by the work of industry organisations such as Decom North Sea
Strong survey capability	Suppliers perceive a collective strength at surveys and studies, including the following areas: engineering, impacts, options, environment, waste, hazards, wells, infrastructure, subsea and costs

Weakness	Description
Poor continuity of work	There is a lack in continuity of work, with very few companies having provided Preparation for CoP services for more than one decommissioning project. This is preventing investment and the development of any knowledge capital
Incumbent suppliers dominate this space	As listed in the strengths, operators tend to contract out this phase to suppliers who have been servicing the platform during its productive life. However, this limits the involvement of other suppliers with capabilities in this space
Lack of specific lessons learned	IP protection limits specific knowledge sharing between suppliers
Unclear late life process	There is no clear end of life process and no triggers as to when activities need to take place. Without this, planning and streamlining services will be inhibited
Non-committal attitude to late life	There is a perceived lack of commitment and urgency when an asset becomes redundant
Lack of CoP planning structure	CoP planning is a weakness because there is no agreed structure or coherent approach to planning the phase

Weakness	Description
Non-integrated approach	Productive late life activities and Preparation for CoP activities are treated in a siloed manner which can be inefficient and fail to capture synergy
Duplication of efforts	Supplier perception that some Preparation for CoP activities, such as studies and surveys, are duplicating work already done or on-going and fail to leverage that existing work
Regulatory bottleneck	DECC has limited capacity to approve submissions and turnaround multiple plans, slowing the demand for Preparation for CoP suppliers

Opportunity	Description
Change to 'late life mindset'	If the current Preparation for CoP phase were considered more to be part of the asset's late life phase, it would be perceived more as productive and profitable, rather than the current sense of it being purely obligatory. Aligning decommissioning with late life activities would also foster more collaborative and innovative ideas and partnerships
Standardise planning and delivery	Develop a standardised approach to the phase so that delivery can be more structured and efficient, allowing suppliers to know where and when their points of entry are
Plan for end-to-end decommissioning project	Developing a plan that spans beyond the initial phases of decommissioning will benefit suppliers and operators alike by creating increased visibility, allowing better sequencing and highlighting clearer opportunities for collaboration
Attack later activities during this phase	Some activities such as Well Abandonment planning, plugging & abandonment and online cleaning can be performed prior to CoP. This would offer supplier opportunities and improve project delivery for operators in terms of quality, time and cost

Threat	Description
Uncertainty of work	The multiple variables that make the timing of decommissioning uncertain – legislation, oil price, improved recovery techniques, currency fluctuations, confidential commercial decisions – create uncertainty for the supply chain, preventing investment in resources and knowledge development and inhibiting proper planning. This affects all the phases but can be particularly problematic for Preparation for CoP as the first phase of the decommissioning lifecycle and hence the first that needs visibility of demand
Lack of standard practice	Without many precedents and lessons learned, the supply market cannot prepare themselves for the work and must do it on an exceptions rather than rules basis
Duration unknown	Without precedent, the duration of the Preparation for CoP phase is unknown. This makes scheduling difficult for operators and suppliers

Threat	Description
Lack of competition	If the incumbent suppliers always get this work then there will be no competitive marketplace for these services, potentially jeopardising innovation and development of technology and ideas, as well as competitive pricing
Poor planning/rushed execution	Slow coalescing of different plans tends to lead to a rapid final concentration of effort which may jeopardise optimal delivery

Summary

Supplier involvement in the Preparation for CoP phase can be limited as much of the planning and forecasting is done in-house by the operators. Moreover, the suppliers that are contracted for the phase are often the incumbent suppliers that have been servicing the asset during its operational life, hence reducing opportunities for other capable suppliers.

However, the many studies and surveys required by the phase are usually contracted out, allowing further suppliers to get involved. Moreover, were there a change of mindset to consider Preparation for CoP more as part of an integrated late life period, there would be further scope both for suppliers to get involved and for operators to capture efficiencies in project delivery.

Recommendations

Recommendation	Description
Encourage 'late life' mindset	Examine and articulate the benefits of treating operational end of life and the early decommissioning phases as one continuous, synergised stage
Define late life process	Bring together experts to define a standardised, gated and transparent approach to late life decisions and operations
Encourage a more diverse supply base	Encourage or look to incentivise the usage of diverse suppliers, allowing more to develop requisite knowledge to enter this sub-market and add maturity to it
Develop standardised decommissioning project planning template	Bring together experts to define an optimised and standardised planning template that will allow for better sequencing, longer horizon planning and better integrated activities throughout the entire decommissioning project

3.2 Suspension Live

The Suspension Live phase is the bridge between an asset reaching CoP and the commencement of physical decommissioning activities. The phase largely consists of maintaining the integrity of the asset and carrying out any surveys that couldn't be done while the asset was still operational, before decommissioning commences. The Decommissioning Work Breakdown Structure lists the following activities as part of the Suspension Live phase:

- Tier 1 Contractors
- Care & Maintenance
- Inspection
- Integrity

Depending on a given project's decommissioning strategy and factors such as security and sequencing of supply, the phase duration can vary from days to years. Operators will try and reduce the length of time that an asset is in the Suspension Live phase as it is typically expensive due to the ongoing cost of maintenance, overheads and support services before decommissioning begins. The major risks of the phase are incorrect provision for maintenance (overspending on an asset that will be decommissioned anyway), poor asset integrity and the potentially low level of motivation for a phase which bridges a time gap rather than delivering decommissioning activities.

Capability & Activity Analysis

Figure 11 demonstrates the average capability level of suppliers by Suspension Live activity. Integrity is the activity with the strongest capability at 3.10, while Care & Maintenance is the weakest with 2.71. The activity capabilities vary within a relatively narrow range of 0.39 and 75% of the activities sit within Level 2 capability criteria, averaging 2.87 as a phase.

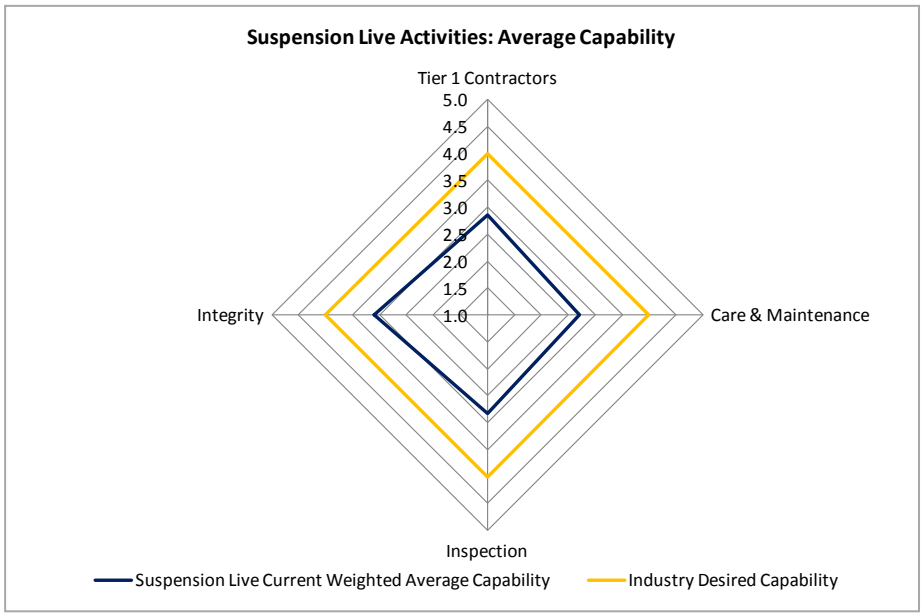


Figure 11

Figure 12 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights, Care & Maintenance is the activity with the greatest shortfall between actual and desired capability, 1.29 below the industry desired level. The average gap between current and desired capability for the phase is 1.13, meaning the activities would need to improve their capabilities by an average of 39% to achieve the desired level.

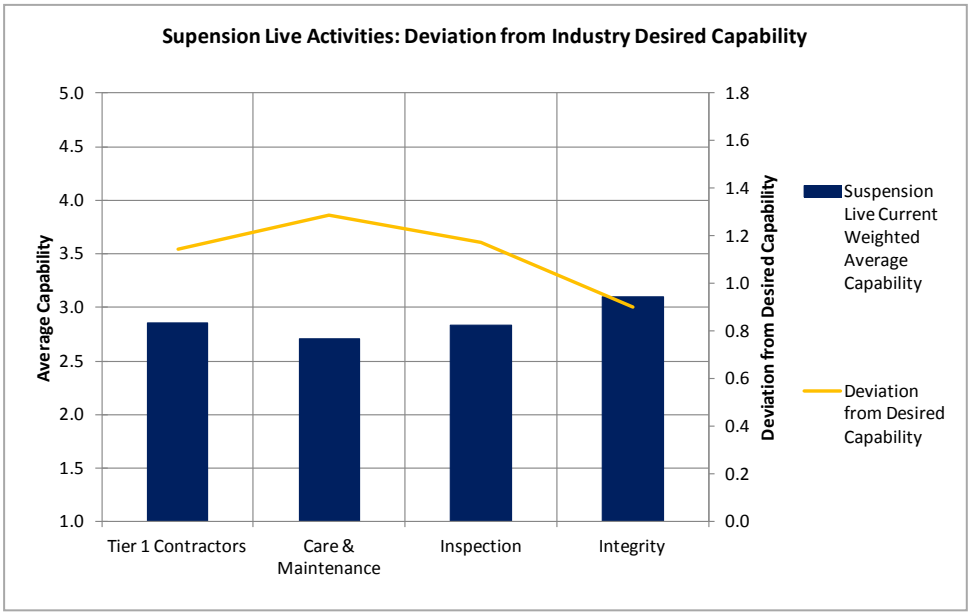


Figure 12

Figure 13 shows the proportion of suppliers by capability level for each activity. Interestingly, the Tier 1 Contractors activity shows polarised capabilities, having the greatest proportion of both Level 1 and Level 5 suppliers across the phase, accounting for 36% of its supply pool.

Across Suspension Live there is similar capacity of supply, ranging from 43-51%, while 55% of all suppliers with capability in the phase rated themselves at either level 2 or level 3.

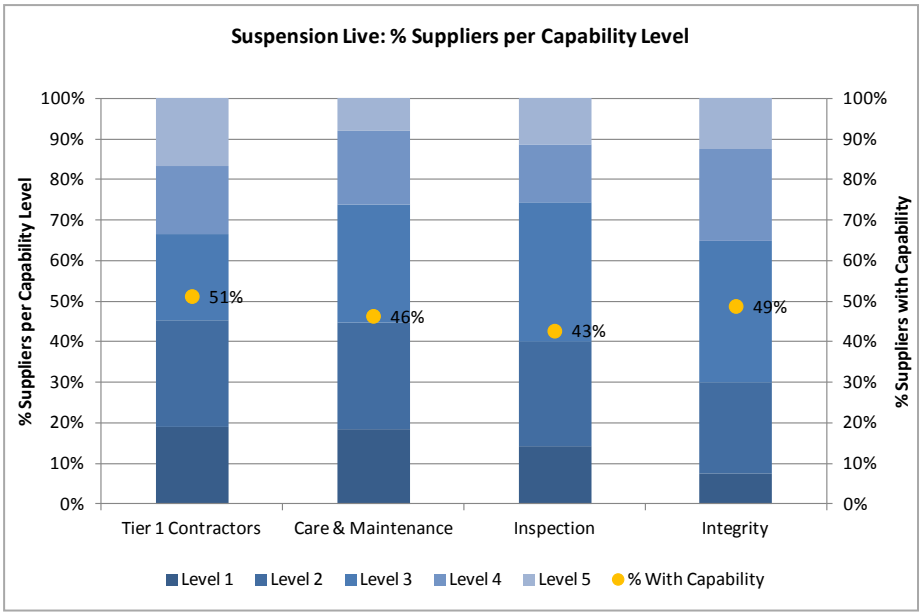
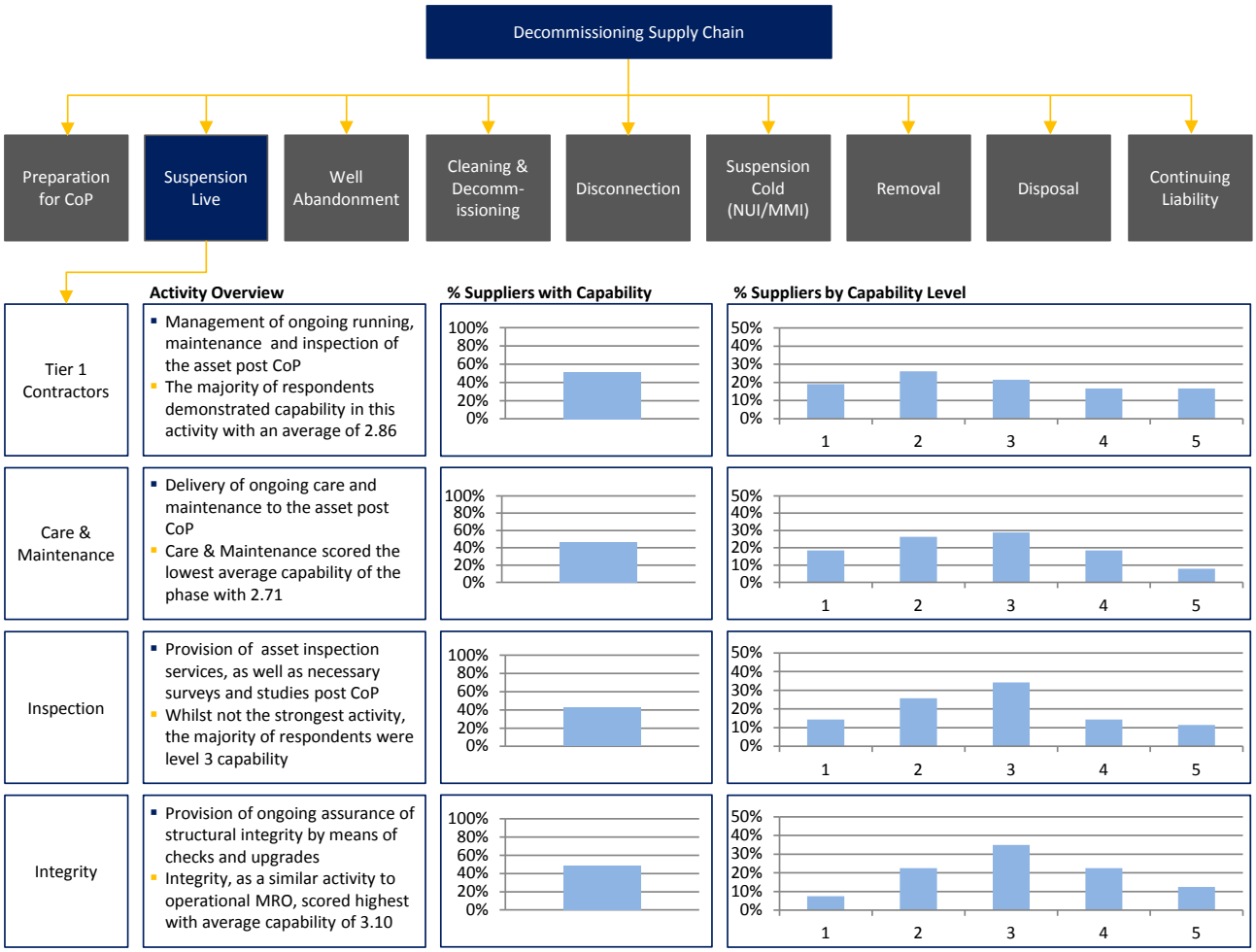


Figure 13

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Strong engineering community	The UKCS has strong engineering knowledge, capabilities and capacity
Strong asset knowledge	As the same suppliers who have serviced an asset during its operational life and the Preparation for CoP phase will normally continue to provide services for this phase, they bring strong knowledge of the asset hardware and infrastructure
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record
Strong survey capability	Suppliers perceive a collective strength at surveys and studies, including the following areas: engineering, impacts, options, environment, waste, hazards, wells, infrastructure, subsea and costs

Weakness	Description
Incumbent suppliers dominate this space	As listed in the strengths, operators tend to contract out this phase to suppliers who have been servicing the platform during its productive life, which limits the involvement of other suppliers with capabilities in this space
Poorly defined phase	Suspension Live is not a clearly delineated phase from start to finish. The lack of clarity in terms of timing, activities and opportunities may prevent more suppliers becoming involved
Few suppliers required	Suspension Live is, comparatively, more a phase in time than supply activities. The lack of demand for supplier services makes it an unprofitable area for suppliers whilst still being an expensive phase for operators through running costs

Opportunity	Description
Better define phase	If Suspension Live were better defined in terms of timing, requirements and opportunities, there would be scope for more suppliers to be active in it and consequently a more competitive market
Integrate with other phases	Since there is some commonality in the activities, timing and supply requirements, this phase could be integrated with others such as Preparation for CoP, Well Abandonment and Cleaning & Decommissioning

Threat	Description
'Non-opportunity' attitude	There is a perceived attitude that the phase is an expense to operators but not an opportunity to suppliers. If not altered, this negativity might be a self-fulfilling prophecy
Lack of competition	If the incumbent suppliers always win this work then there will be no competitive marketplace for these services, potentially jeopardising innovation and development of technology and ideas, as well as competitive pricing
Overrunning	If the Preparation for CoP, Well Abandonment and Cleaning & Decommissioning phases are not properly planned and sequenced, this phase could be longer than forecast, escalating costs and causing potential issues

Summary

Suspension Live is a phase that is both expensive for operators and not greatly profitable for the supply chain; the majority of spend being on overheads and support services. Supply market possibilities are also hampered by the continued presence of the incumbent suppliers from the asset's operational life. However, if integrated with other phases, Suspension Live could present improved options for suppliers and operators alike.

Recommendations

Recommendation	Description
Integrate with other phases	Integrate this phase with others such as Preparation for CoP, Well Abandonment and Cleaning & Decommissioning to allow suppliers and operators to better plan and sequence activities, as well as capturing supply synergies across the phases

3.3 Well Abandonment

Well Abandonment covers the preparation for and execution of the plugging & abandonment of wells that are no longer producing. The phase involves preparing infrastructure to facilitate abandonment, carrying out the abandonment either with a rig or using rig-less techniques and the consequent waste management required. The Decommissioning Work Breakdown Structure lists the following activities as part of the Well Abandonment phase:

- P&A of Wells
- Rig Upgrades
- Waste & Scale Treatment
- Post Production Ops. Support
- Rig-less options

The Well Abandonment phase can take many years to complete with multiple exploration, appraisal, suspended and production wells all requiring abandonment. Some wells of up to 30 years old have yet to be abandoned, and there are often structural integrity issues and other complexities which can cause timelines to stretch and costs to escalate. This is reflected in the Oil & Gas UK figures which forecast Well Abandonment to be the most expensive phase in the decommissioning lifecycle over the next five years, amounting to 44% of total decommissioning spend[10].

The major risks for Well Abandonment are poor rig and well condition, poor well access and integrity and the availability of rigs and vessels, including LWIVs.

[10] 2012 Decommissioning Insight, Oil & Gas UK

Capability & Activity Analysis

Figure 14 demonstrates the average capability level of suppliers by Well Abandonment activity. Waste & Scale Treatment is the activity with the highest capability, averaging 3.05, while Rig Upgrades was the weakest supply activity with 2.37. Being 1.63 below the industry desired capability, Rig Upgrades is the activity with the lowest average capability across the entire supply chain.

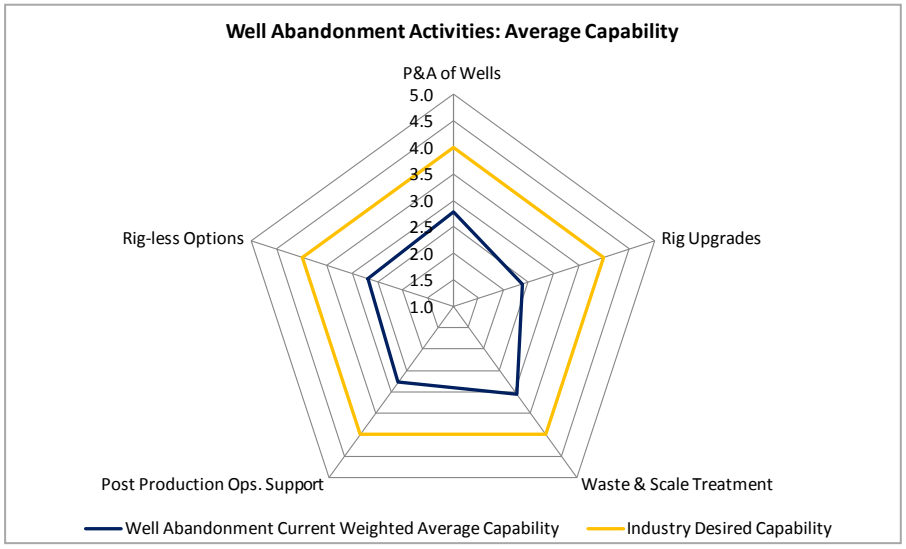


Figure 14

Overall, the average capability level across the 5 activities is a relatively low 2.78, with 80% of the activities having a supplier capability level of 2.

Figure 15 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights, all the activities require fairly significant improvements in order to match the desired capability level, with the exception of Waste & Scale Treatment. On average the service provision for activities in the Well Abandonment phase needs to improve by 44% to reach the desired capability level.

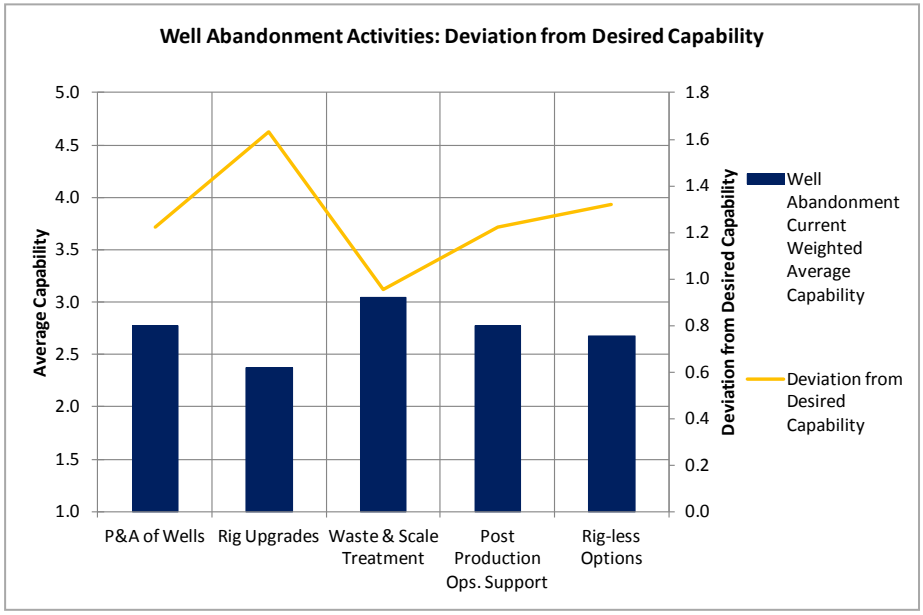


Figure 15

Figure 16 demonstrates the proportion of suppliers by capability level for each activity. The activity with the strongest supply capability is Waste & Scale Treatment, with its largest segment of suppliers (38%) rating themselves at level 3, whereas the weakest supply activity, Rig Upgrades, has its largest segment of suppliers rating themselves at level 1 (41%). P&A of wells demonstrates a polarised supply pool with 59% of suppliers describing themselves as either level 1 or level 5.

In terms of supply capacity, the percentages of suppliers with capability per activity sit within a narrow 14% range, Waste & Scale Treatment having the highest percentage of capable suppliers and Rig-less Options having the lowest.

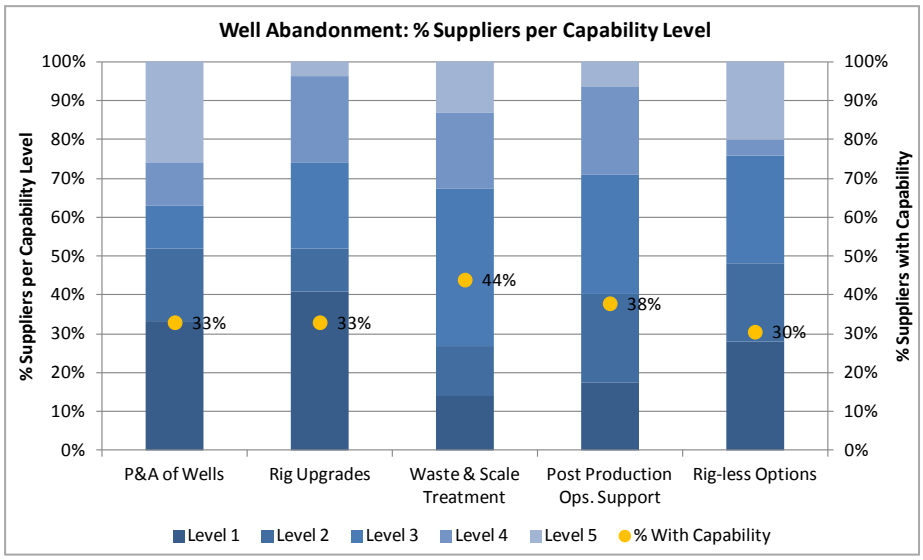
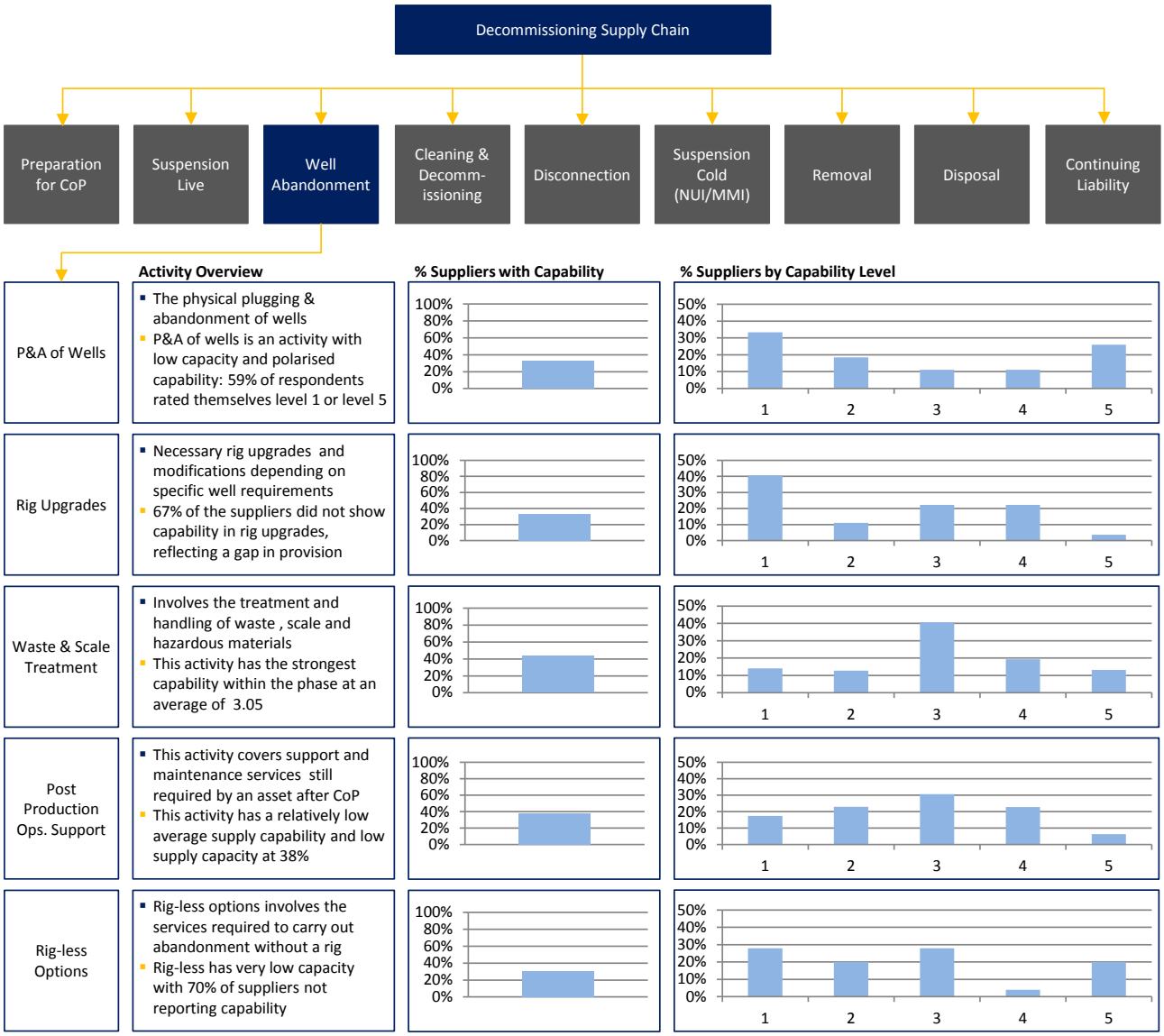


Figure 16

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Mature well servicing market	The market for associated well services such as drilling, completions and interventions has extensive knowledge, tools, technology, experience and capability
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record
Strong forum	Well Abandonment has been widely identified as a phase requiring focus and there are multiple organisations, events and publications that provide a forum for discussion, debate and knowledge sharing
Regulatory knowledge	Suppliers are familiar with and compliant to the UKCS regulatory framework
Local knowledge	The UKCS service providers have strong knowledge both of the well assets and the environment they are in
International expertise	The presence of global players in the UKCS provides a source of knowledge, technology and experience of complex well situations and well abandonments from other regions
Culture of improvement	Suppliers are keen to recognise and act upon areas where improvements to performance can be made

Weakness	Description
P&A not mature	While the market for wells services is mature, the specific capability and experience for plugging & abandonment is not as strong
Focus on development activities	Both suppliers and operators would rather focus attentions, strategies and resources on the more lucrative well development activities such as drilling and completions. This means both the supply provision and the demand pipeline for Well Abandonment activities are not as strong
Resourcing issues	Well Abandonment is under-resourced for the potential demand ahead since specific training is scarce, few resources are assigned to it (compared with development activities), suppliers struggle to attract talent due to “unglamorous” perception and existing talent is migratory
Misunderstanding of complexity	There is a sense that many outside of the Well Abandonment community do not understand the potential complexity of plugging & abandoning a well, perhaps assuming it is the same as intervention, and therefore underestimate what the challenges, costs and timeframes might be
Well integrity	At 34%[11], the current rate of well integrity issues in the UKCS is much higher than many operators realise. These issues, if not properly mitigated, are increasing the complexity, cost and timing of plugging & abandonment

[11] *Review 268, March 2013*, Society of Petroleum Engineers

Weakness	Description
Barriers to entry	The entry costs for new wells companies in the UKCS are too high, in part due to the cost of compliance to local regulations
Lack of standard approach	With comparatively little Well Abandonment experience, there are no standard practices in place, heightening risks and creating cost forecasting issues. Where guidelines have been assembled, they are usually too prescriptive to address the 'unknown unknowns'
Regulators	There is a perceived lack of resource and lack of knowledge in the regulator bodies
Inexperienced Crews	While Well Abandonment arguably presents the greatest challenges in the wells business, commercial considerations and lack of resource often dictate that it is serviced by the least experienced teams. This is exacerbated by the lack of specialist technical resources available
R&D barriers	Scalability of innovation is currently limited by commercial constraints and strict regulations
Business as usual approach	Without understanding the unique and complex nature of abandonment challenges, there is a tendency from some to use standard drilling tools for these purposes, impacting cost appreciation
Unclear demand profile	There is a lack of clear demand profile for Well Abandonment, leading to suboptimal capability investment and poor project sequencing
Poor well knowledge	With many wells having been suspended decades ago, their current condition is often poor without the operators knowing. A lack of regular integrity checks, as well as old and lost documentation augment the issue and cause stretched timeframes and costs at abandonment time
Low equipment capacity	The available capacity of equipment such as rigs, vessels and cranes is poor, causing supply bottlenecks

Opportunity	Description
Better and earlier planning	Planning is key to successful Well Abandonment and should be undertaken earlier to allow longer lead times, better understand the wells, plan for issues and prevent overruns and cost appreciation down the line. If integrated with other early phases in the decommissioning process, cost and time efficiencies could be gained from synergies such as not having to re-engineer infrastructure for one phase alone
Gather information earlier	To mitigate abandonment issues stemming from poor knowledge of the well's condition or even because of the condition of the well itself, information gathering should start earlier. Well logging and integrity checks prior to abandonment would prevent later issues as well as stimulating the supply market. Ideally, regular information gathering on wells would be a common late life practice
Execute earlier	If abandonment of suspended and Exploration & Appraisal wells took place during a field's operational life rather than during

Opportunity	Description
	decommissioning, there would be less well integrity issues and a quicker, cheaper decommissioning process. This would also provide smoother, more constant demand for the wells suppliers
Better collaboration	Closer collaboration across suppliers from product offerings to commercial approaches, such as campaigns and joint ventures, would improve supply offerings and better capture supply/demand synergies
Encourage campaigns	Linked to the above, exploring and articulating the costs and benefits of campaign approaches would encourage this form of collaboration
Integrated planning	Better planning, both of supply and demand, and of operational activities between different teams on a decommissioning programme, would allow for better sequenced activities and an optimised use of resources, leading to shorter timeframes and contained costs . A better view for future demand would also encourage investment in innovation and resource
R&D support	Better government and/or operator integrated support, funding and tax breaks for R&D without the pressure of commercial targets would encourage innovation. Modified regulation would also allow more innovative solutions. Norway should be taken as a benchmark for government/operator support for R&D
Legislation	There could be an opportunity for government legislation to stimulate the abandonment market. Examples exist in other regions such as the Gulf of Mexico and Norway where abandonment of idle wells or structures is mandatory after a given period of dormancy
Knowledge sharing	Knowledge sharing between suppliers with experience and those without would be beneficial. Lessons learned from other regions, such as the Gulf of Mexico and Norway, and other industries, such as nuclear and salvage, could also bring improvement opportunities
Explore subsea equipment options	Exploring the options for subsea equipment could provide more valuable alternatives to normal removal. These could include wellhead reefing, conductor re-use and better handling options
Develop rig-less capability	The rig-less market has scope for growth and would benefit from better LWIV provision
Training	Provide skills transformation training to leverage skills already available and create critical supply mass for Well Abandonment demand. This could include training onshore resources in offshore skills or training non-oil & gas resources in oil & gas skills
Cement	Cement holds two innovation opportunities: to develop a better alternative to cement for plugging wells or to develop a service that performs the assessment and assurance of cement integrity

Threat	Description
Well access	Poor access to wells can cause rapid cost escalation
Lack of checks	The common lack of early logging, monitoring and integrity checking of wells can cause issue, cost and time escalation down the line. This has been the case recently in the UKCS, with operators saying that 1 in 5 wells requiring abandonment is a "train wreck"[12]. This has led to an approximate doubling from the average forecast time to the average actual time required to abandon a well[13]
Unknown Complexity	The exact number and condition of the estimated ~5,000[14] wells requiring abandonment in the UKCS is not known, especially with regard to suspended and Exploration & Appraisal wells. Without being able to quantify this, the scale of the challenge is unknown and comprehensive preparation, including accurate cost and time forecasting, cannot be done
Abandoning too late	Not abandoning at an earlier stage of the process increases costs, heightens risks (structural, environmental, reputational and cost) and impacts planning
Risks delaying activity	The fear of environmental, cost, reputational and structural risks is causing operators to delay abandonment which, in turn, could further heighten those risks
Cost based mentality	The cost over quality mentality could compromise successful abandonment and increase environmental, cost, reputational and structural risks further down the line
Presence of international suppliers	The local supply market could lose out to larger international competitors in being awarded work
R&D leakage	Commercial and regulatory barriers to R&D may prevent the development of tools that will save time, improve performance and contain costs. These ideas may be taken elsewhere creating an R&D value leakage
Security of supply	Supply chain bottlenecks may cause significant delays and cost increases when demand increases down the line, particularly with regard to rig availability
Fiscal uncertainty	If the new fiscal regime fails to offer tax relief for abandonment activities prior to CoP, the opportunity to schedule abandonment activity at the optimum time – during productive late life – will be removed
NORM regulatory changes	The potential change in drill cuttings and NORM handling regulations may force the changing of practices, such as disposal routes and facilities, causing cost and time escalation

[12] Anecdotal operator feedback
[13] Rushmore statistics
[14] UKCS Offshore Decommissioning Report 2010-2040, Douglas-Westwood

Summary

Well Abandonment likely presents the greatest tests of all the supply chain phases given the size and complexity of the (known) challenges that lie ahead, as well as the generally low capability and capacity of the supply market.

With strength in the well servicing market, current capabilities could be transferred and tailored to suit abandonment needs. More knowledge sharing, better integrated planning and a focus on resourcing will likely be key to the success of the abandonment supply market.

Recommendations

Recommendation	Description
Plan and execute earlier	Earlier planning allows for more preparation, reduced complexity, less risks and therefore improved performance and heightened cost containment. Executing earlier mitigates integrity and timing issues, therefore containing costs and preventing overruns
Integrate plans	Integrated planning - operators to suppliers, and suppliers to suppliers – allows for better pipeline visibility, smoothes supply and demand, improves sequencing and presents greater opportunities for collaboration. This could be encouraged in pockets or managed across the sector from a central initiative
Broadcast the challenge	A push to broadcast the challenge and complexity of the UKCS Well Abandonment task ahead would stimulate operators to think more about their plans and investment, the government to consider support and regulatory revision and suppliers to further prepare their capability
Talent and resource focus	A co-ordinated drive for increased training and recruitment in the abandonment area, with a focus on transferring skills from similar sectors, would benefit suppliers and operators alike and be an exportable trade in years to come
Integrate with other phases	Since there is a degree of commonality to the activity, timing and supply requirements between this phase and others such as Preparation for CoP, Suspension Live and Cleaning & Decommissioning, the phases could be integrated. This approach would allow suppliers and operators to better plan and sequence activities, as well as capturing supply synergies across the phases

3.4 Cleaning & Decommissioning

The Cleaning & Decommissioning phase covers the removal of hydrocarbons and hazardous materials from infrastructure. The phase focuses on the shutdown of an asset; the isolation and freeing of hydrocarbons; depressurisation and draining; and the purging and cleaning of the process system and pipelines. The Decommissioning Work Breakdown Structure lists the following activities as part of the Cleaning & Decommissioning phase:

- Isolation
- Purging
- Cleaning & Treating
- Waste Disposal
- Waste Accounting
- Post Production Ops. Support

Cleaning & Decommissioning is an area of strong supply chain capability and therefore should not be a long or complex phase, though overruns do occur. While it sits between Well Abandonment and Disconnection in the industry map, Cleaning & Decommissioning can often overlap with other phases, especially in the advent of online cleaning.

The major risks associated with this phase are the accuracy of as-built information and documentation; the level of cleanliness required as an end point; access and safety issues on unmanned platforms; and the presence of hazardous materials.

Capability & Activity Analysis

Figure 17 demonstrates the average capability level of suppliers by Cleaning & Decommissioning activity. Waste Accounting is the activity with the strongest supply, rating at 3.39 on the capability index while Purging, with 2.97, is the weakest.

Rolled up, Cleaning & Decommissioning has the strongest average capability in the supply chain, at 3.22, with 83% of the activities having average supply capability levels of 3 or higher.

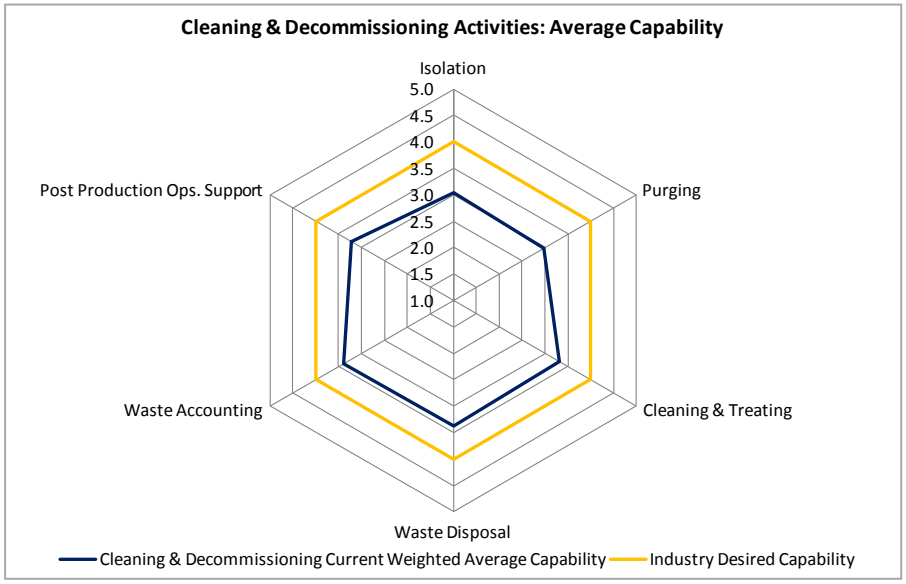


Figure 17

Figure 18 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights, Purging is the supply activity requiring the most improvement, being 1.03 below the desired industry capability. The gaps between current capability and industry desired capability range from 0.61 to 1.03, averaging 0.78. This means that Cleaning & Decommissioning supply activities need to improve by 24% to reach the desired capability level.

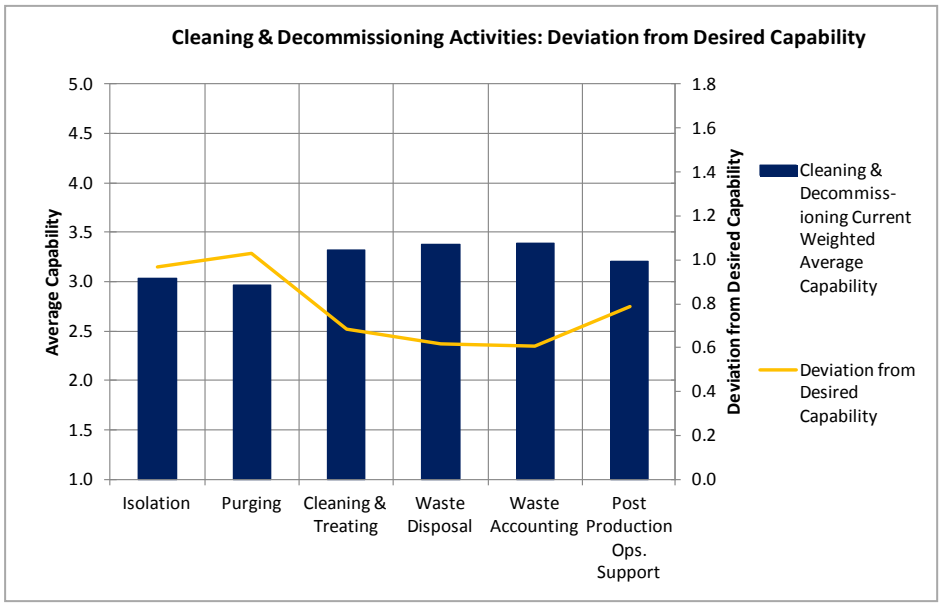


Figure 18

Figure 19 demonstrates the proportion of suppliers by capability level for each activity. The activity with the strongest supply capability, Waste Accounting, has the greatest proportion of level 5 suppliers at 21% while Purging, the activity with the weakest supply capability has the greatest proportion of level 1 suppliers at 20%. Across all phase activities, the most common supplier capability level, at 30%, is Level 4.

On average, 45% of suppliers can service the activities in the Cleaning & Decommissioning phase.

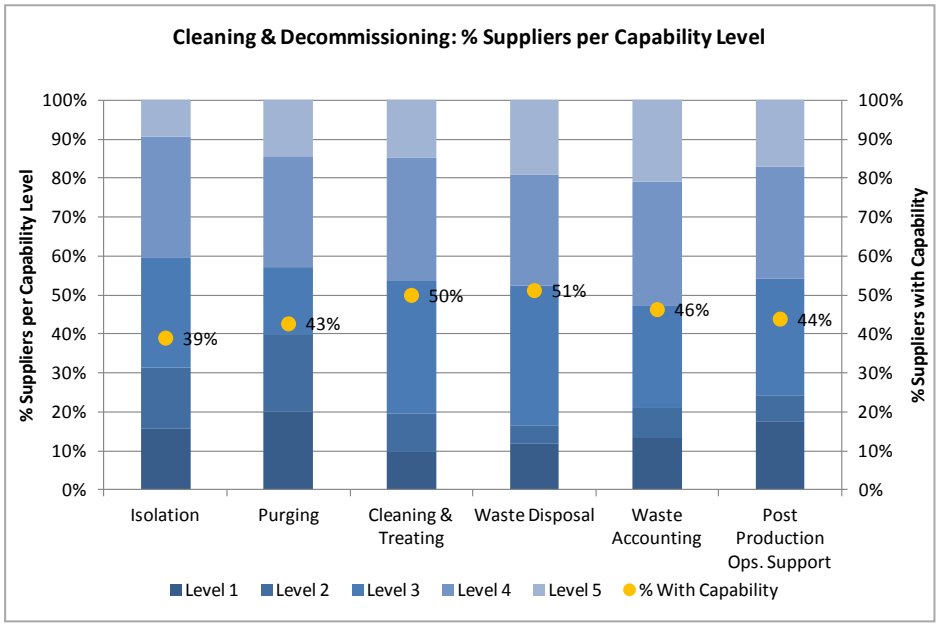
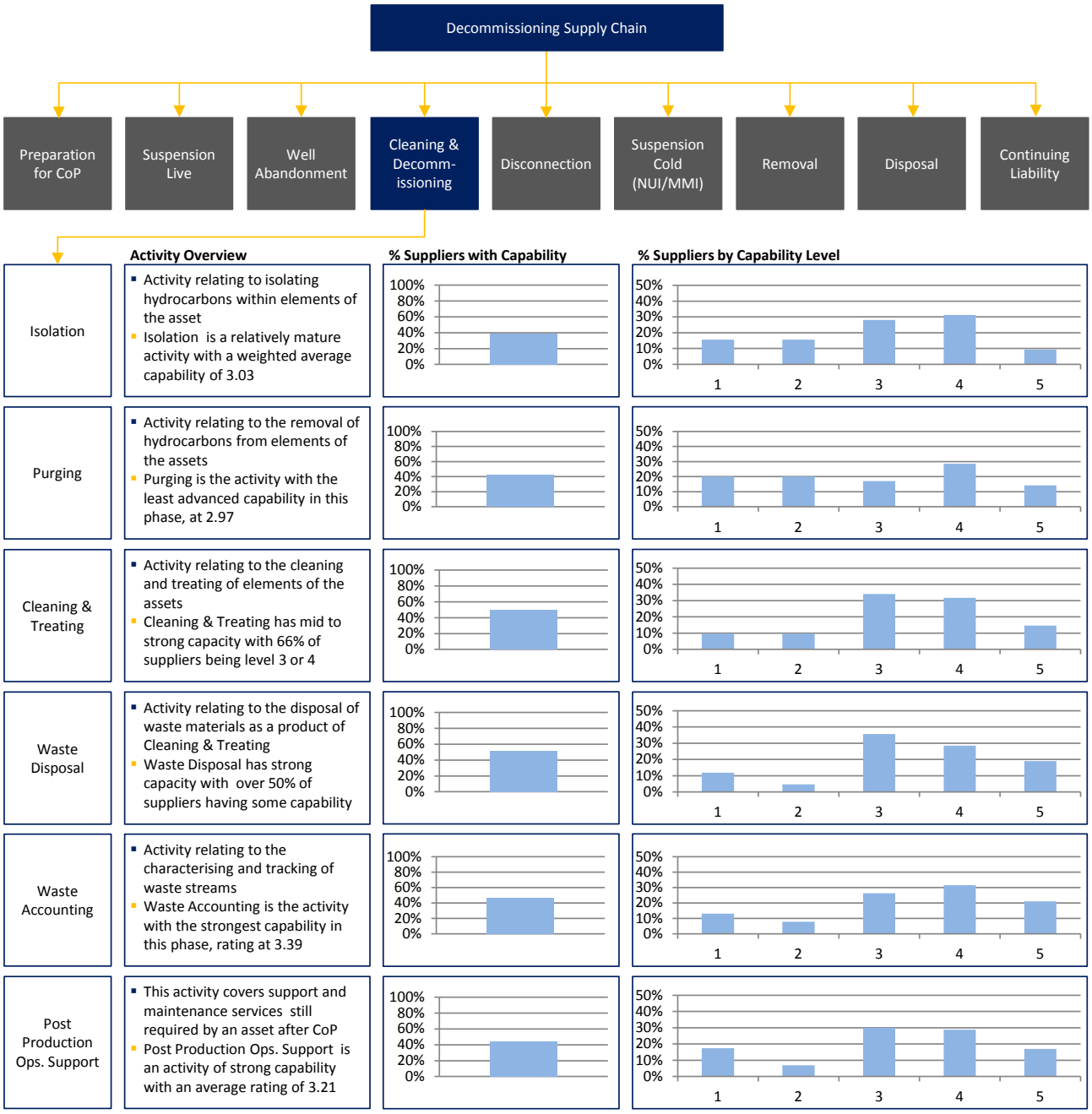


Figure 19

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Strong experience and knowledge	There is already a lot of experience and knowledge in the freeing, cleaning and purging activities
Strong supply capacity	There are already many cleaning companies operating in the UKCS supply chain, providing good capability, knowledge and technical resource; as well as mitigating supply chain bottlenecks
Shutdown strength	Operators and supply chain alike are experienced in the shutdown and cleaning of topsides
Technical knowledge	There is a strength in the offshore industry technical knowledge gained over the last 30 years
Innovation	Innovative technologies such as online cleaning and inspection are helping to drive quality, improve HSE, cut completion times and contain costs
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record

Weakness	Description
Disposal	There is weak capability for the disposal of offshore contaminants
Continuity of workload	There is a lack of continuous work, making it hard to retain knowledge and skills. This also creates low confidence in the supply chain which, in turn, reduces investment in capability
Hazardous materials	The capability is such that there is still uncertainty when mapping hazardous materials for topsides

Opportunity	Description
Onshore cleaning	Minimising offshore cleaning by moving as much to onshore cleaning as possible would reduce offshore man-hours. This, in turn, would reduce costs, time and HSE risks
Earlier cleaning	If the cleaning were done during the abandonment phase, or even prior to CoP with online cleaning technologies, there would not only be advantages of synergy and sequencing but also the opportunity to learn more about the modules earlier, helping to prepare for the Removal phase
Better link to Disposal	Cleaning and Disposal activities could be better integrated by involving the Disposal contractor earlier on in the planning and execution of the process. This could allow for more efficient waste management and better all-round planning and synergy
Change mindset	The mindset that all the cleaning must be completed *in situ* has to change before the practicalities of moving the process onshore (hence reducing expensive and risky offshore man-hours) can be considered

Opportunity	Description
Clean early	A module should be cleaned as soon as it becomes redundant in order to reduce future risks and to harness lessons learned in real time
Export capabilities	As the phase with highest supply capability, there is an opportunity to export these capabilities to new regions with decommissioning challenges - Canada, Australia, Brazil, Middle and Far East - and stimulate supplier growth
Learn from other industries	Cleaning & Decommissioning can learn lessons from other industries in terms of systems, processes and people. Nuclear decommissioning will be particularly of interest in terms of dealing with waste streams

Threat	Description
Complacency	There is a risk that future innovation and improvement will be limited due to the perception that Cleaning & Decommissioning is the phase with the strongest capability and capacity, therefore not needing further development
Hazardous materials Identification	The identification and characterisation of hazardous materials remains an issue for Cleaning & Decommissioning and therefore presents an HSE threat
Leaching	The possibility of further chemicals leaching after the initial cleaning presents an HSE threat

Summary

Cleaning & Decommissioning is an area of proven capability, capacity and experience. The supply market should guard against complacency and continue to look at innovation and improvement opportunities in order to remain competitive and sector-leading.

Recommendations

Recommendation	Description
Analyse cost/benefit of earlier cleaning	Bring together experts to quantify and analyse the costs and benefits of carrying out Cleaning & Decommissioning earlier in the decommissioning lifecycle. Publicise findings and encourage earlier cleaning if it proves beneficial
Analyse cost/benefit of onshore cleaning	Bring together experts to quantify and analyse the costs and benefits of carrying out parts or all of the Cleaning & Decommissioning process onshore. Publicise findings and encourage onshore cleaning if it proves beneficial
Integrate with other phases	Since there is a degree of commonality to activities, timing and supply requirements between this phase and others such as Preparation for CoP, Well Abandonment and Suspension Live, the phases could be integrated. This approach would allow suppliers and operators to better plan and sequence activities, capturing supply synergies across phases

3.5 Disconnection

The Disconnection phase involves cutting and separating elements of an asset in preparation for its removal and transfer to shore. The Decommissioning Work Breakdown Structure lists the following activities as part of the Disconnection phase:

- Disconnection
- Split Modules
- Remove Small & Loose Items
- Prepare for NUI/MMI
- Post Production Ops. Support

The Disconnection phase will vary significantly in scope and timing from one project to another, depending on the removal strategy. If an asset is to be removed by single lift then the Disconnection activities will be much reduced whereas, if the asset is to be reverse engineered, there will be high demand for Disconnection activities. Similarly, depending on how imminent the removal of the asset will be, it may be the responsibility of the Disconnection contractor to prepare the asset for NUI/MMI, increasing the supply activities.

The major risks associated with Disconnection are poor or incomplete execution of the Cleaning & Decommissioning phase; the limitations of temporary infrastructure capacity (for example lodgings); the live power system isolation; and the responsibility of having a high impact on the subsequent phases.

Capability & Activity Analysis

Figure 20 demonstrates the average capability of suppliers by Disconnection activity. The activity with the highest capability is Remove Small and Loose Items with 3.37 while, at 3.05, Post Production Ops. Support is the weakest.

Rolled up, Disconnection has the joint second strongest average capability across the supply chain, at 3.16, with 100% of the activities having average supply capability levels of 3 or higher.

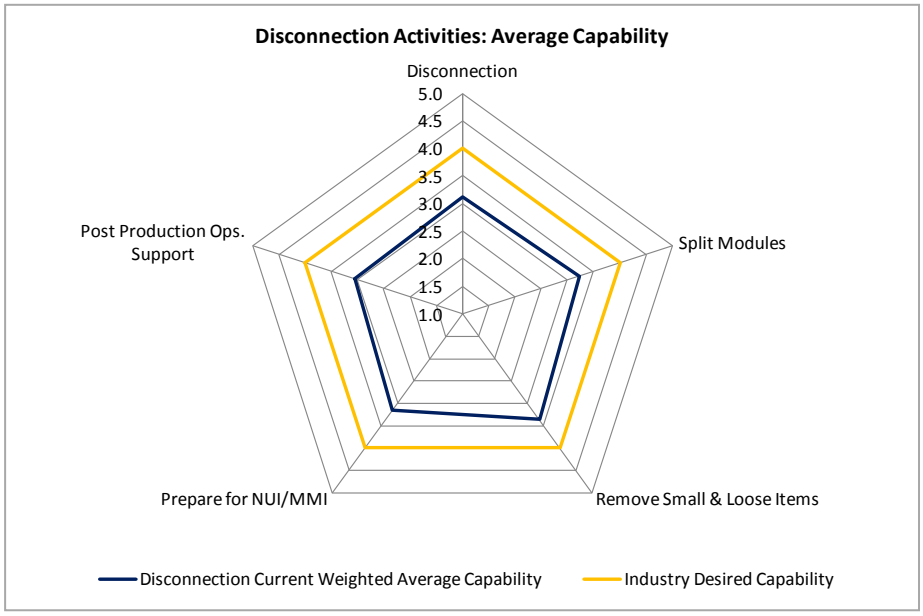


Figure 20

Figure 21 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights, Post Production Ops. Support requires the most improvement to reach the industry desired capability, with a gap of 0.95. The Disconnection and Prepare for NUI/MMI activities' supplier capabilities are not far behind, requiring improvements of 0.88 and 0.83 respectively.

The capability shortfall varies from 19% to 31% and averages 27%.

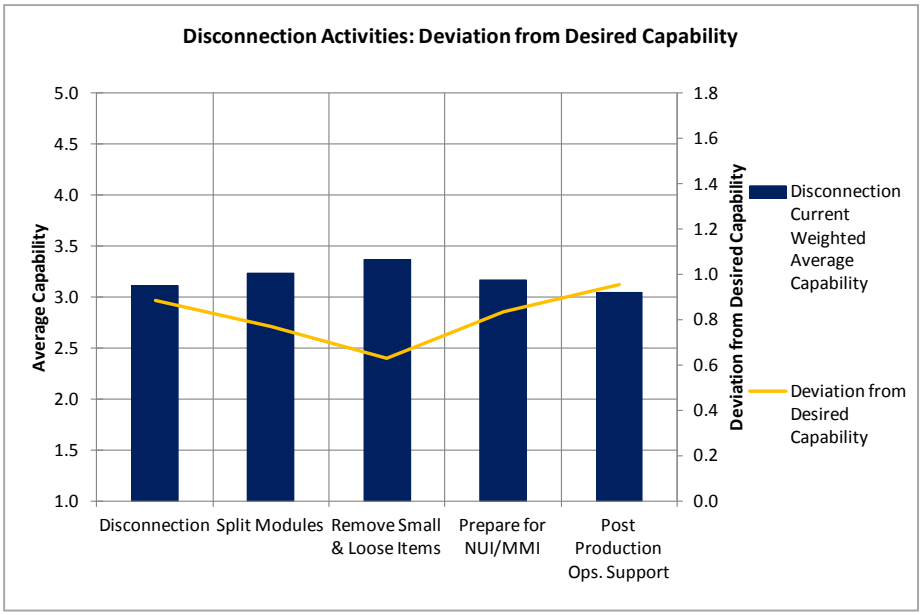


Figure 21

Figure 22 demonstrates the proportion of suppliers by capability level for each activity. The graphic illustrates that Disconnection has high concentrations of strong supply capability compared to other phases, with 56% of suppliers rating themselves at level 4 or 5 across the phase activities. However, the phase also has relatively low capacity, with an average of 33% of suppliers stating that they have capability in the activities.

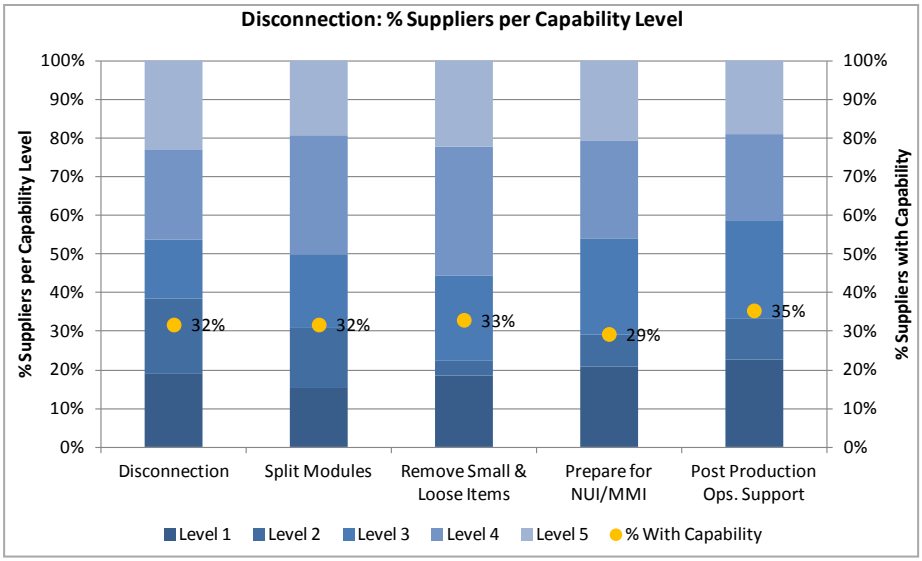
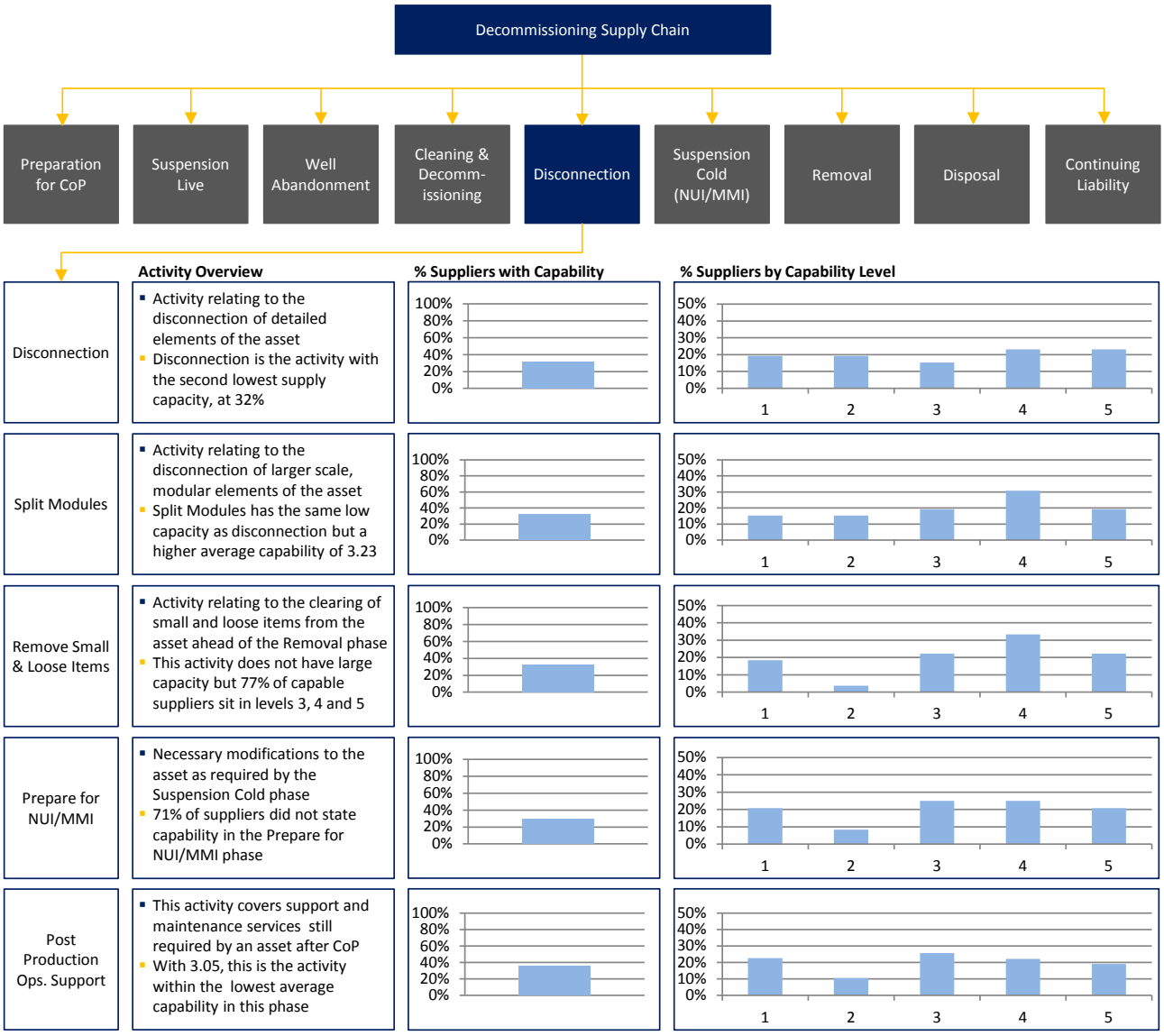


Figure 22

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Subsea cutting experience	There is already good experience in subsea cutting techniques, providing good knowledge, capabilities and capacity
Pipework and electrical experience	There is already good experience in pipework and electrical disconnection, providing good knowledge, capabilities and capacity
Subsea capabilities	Subsea capabilities and facilities are strong
Cutting technology	Various cutting technologies are available and proven for jacket disconnections
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record

Weakness	Description
Large diameter cutting	There is a shortage of capability for the cutting of very large diameter structures, for example concrete gravity based structures
Poor continuity of workload	There is a lack of continuous work, making it hard to retain knowledge and skills. This also creates low confidence in the supply chain which, in turn, reduces investment in capability
Restricted availability of subsea tools	The availability of subsea vessels and removal tools can be restrictive and act as a supply chain bottleneck, increasing project timelines and costs

Opportunity	Description
Clean prior to separation	Flushing and cleaning of export pipework prior to separation reduces risk and effort later on
Innovation	Technology innovation for cutting of large diameter structures such as concrete gravity based structures would solve the current capability shortfall
Integrate with other phases	Since there is a degree of overlap to the activities, timing and supply requirements between this phase and others such as Removal and Disposal, the phases could be integrated. This approach would allow suppliers and operators to plan, sequence and synergise across the phases
Reduce work	Pending OSPAR approvals, as much infrastructure as possible should not be disconnected but left in place. This will benefit operators by reducing the time and cost of a project but also potentially heighten environmental and reputational risk
Learn from other regions	Disconnection can learn lessons from other regions in terms of systems, processes and people

Threat	Description
Service not required	There is the possibility that, in the advent of single lift capability, there will be less need for Disconnection services in the supply chain, removing revenue streams for that pool of the supply chain
OSPAR changes	Forthcoming changes to OSPAR regulations may leave contractors unsure of how to operate, especially with regard to derogation
Reduced workload	If, pending OSPAR approvals, more and more infrastructure is left in place due to the benefits of time, risk and cost reductions for the operators; there will be a reduced workload and lower revenues for the supply market

Summary

Disconnection is another phase with strong supply capability, knowledge and experience. This strength is tempered, however, by the prospect that there would be less significant demand for Disconnection services in the future were single lift to become a more common removal technique. Derogation possibilities also pose a threat to the Disconnection supply market and it must therefore continue to develop and innovate to remain relevant and competitive.

Recommendations

Recommendation	Description
Integrate with other phases	Since there is a degree of overlap to the activities, timing and supply requirements between this phase and others such as Removal and Disposal, the phases could be integrated. This approach would allow suppliers and operators to plan, sequence and synergise across the phases
Learn from other regions	Research and analysis should be carried out to see how lessons can be learned and harnessed from other regions in terms of systems, processes and people
Test place in the market	Disconnection suppliers should consult with operators, removal contractors and regulatory agencies to gauge the likelihood of reduced work stemming from single lift removal and jacket derogation cases in the future. From that, they can gauge probable future demand and set their strategies to match

3.6 Suspension Cold

The Suspension Cold phase is the bridge between an asset being hydrocarbon-free and disconnected and the commencement of removal activities. The phase largely consists of monitoring and maintaining the integrity of the asset. The Decommissioning Work Breakdown Structure lists the following activities as part of the Suspension Cold phase:

- Maintenance
- Structural Integrity
- Monitoring
- Waiting for Removal

Depending on a given project's decommissioning strategy and factors such as security and sequencing of supply, the phase can last anything from days to years (much like Suspension Live). Operators will normally try and reduce the length of time that an asset is in the Suspension Cold phase as financial and HSE risks are heightened when an asset is in 'lighthouse mode'. However, if there is a plan to re-use the platform or if there is a guaranteed and economical supply option in the future, an operator may choose to remain in Suspension Cold for a prolonged period of time.

The key risks for the Suspension Cold phase are deterioration of the structure; effects on users of the sea; unclear scope; inadequate maintenance and inspection; and a lack of clear guidelines.

Capability & Activity Analysis

Figure 23 demonstrates the average capability level of suppliers by Suspension Cold activity. The activity with the strongest supply capability rating is Structural Integrity with 3.14 while, with 2.71, Waiting for Removal is the weakest area of supply capability.

The average supply capability for activities across the phase is 2.89, with 75% of suppliers rating themselves at level 2.

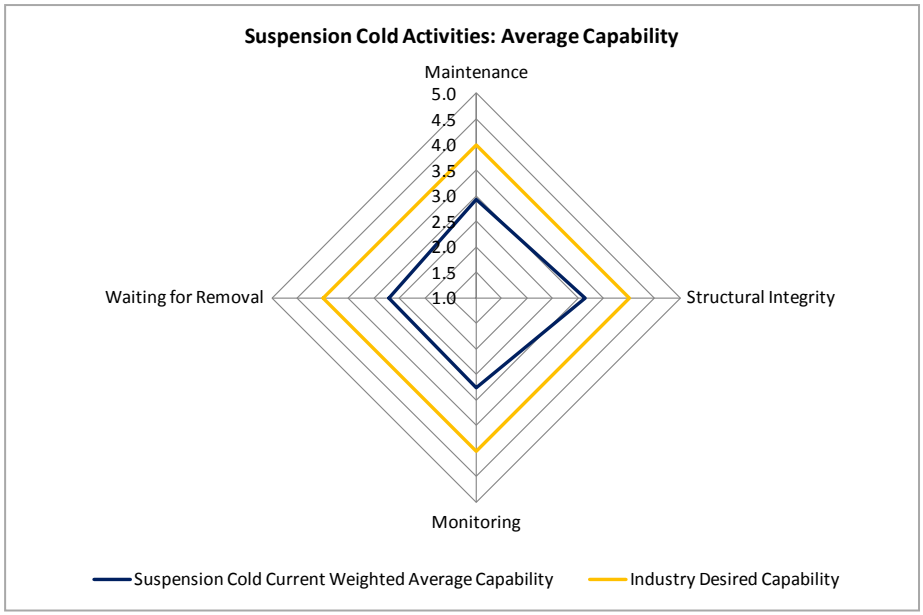


Figure 23

Figure 24 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights; Waiting for Removal, Monitoring and Maintenance all have sizeable capability gaps at 1.29, 1.23 and 1.08 respectively.

The range of supplier capability shortfalls across the activities is 14%, with suppliers requiring an average improvement of 38% to bridge the gap between current and desired capability.

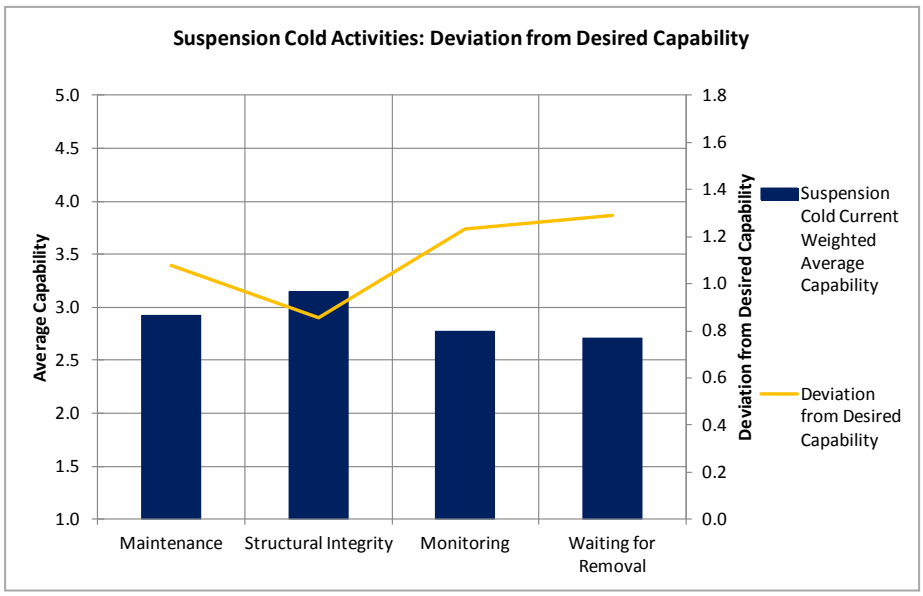


Figure 24

Figure 25 demonstrates the proportion of suppliers by capability level for each activity. This demonstrates that, while the largest segment of suppliers (35%) rated themselves al level 3, the high proportion of level 1 supplier capabilities (25%) dragged the overall ratings down.

Also of note is the relatively low level of capacity, with an average of 32% of suppliers offering some level of service for the Suspension Cold activities.

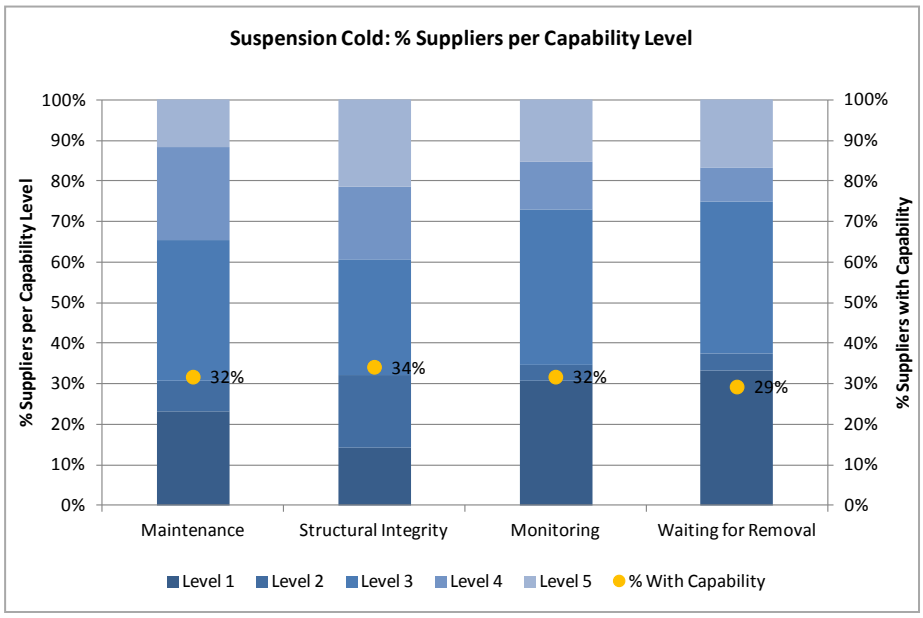
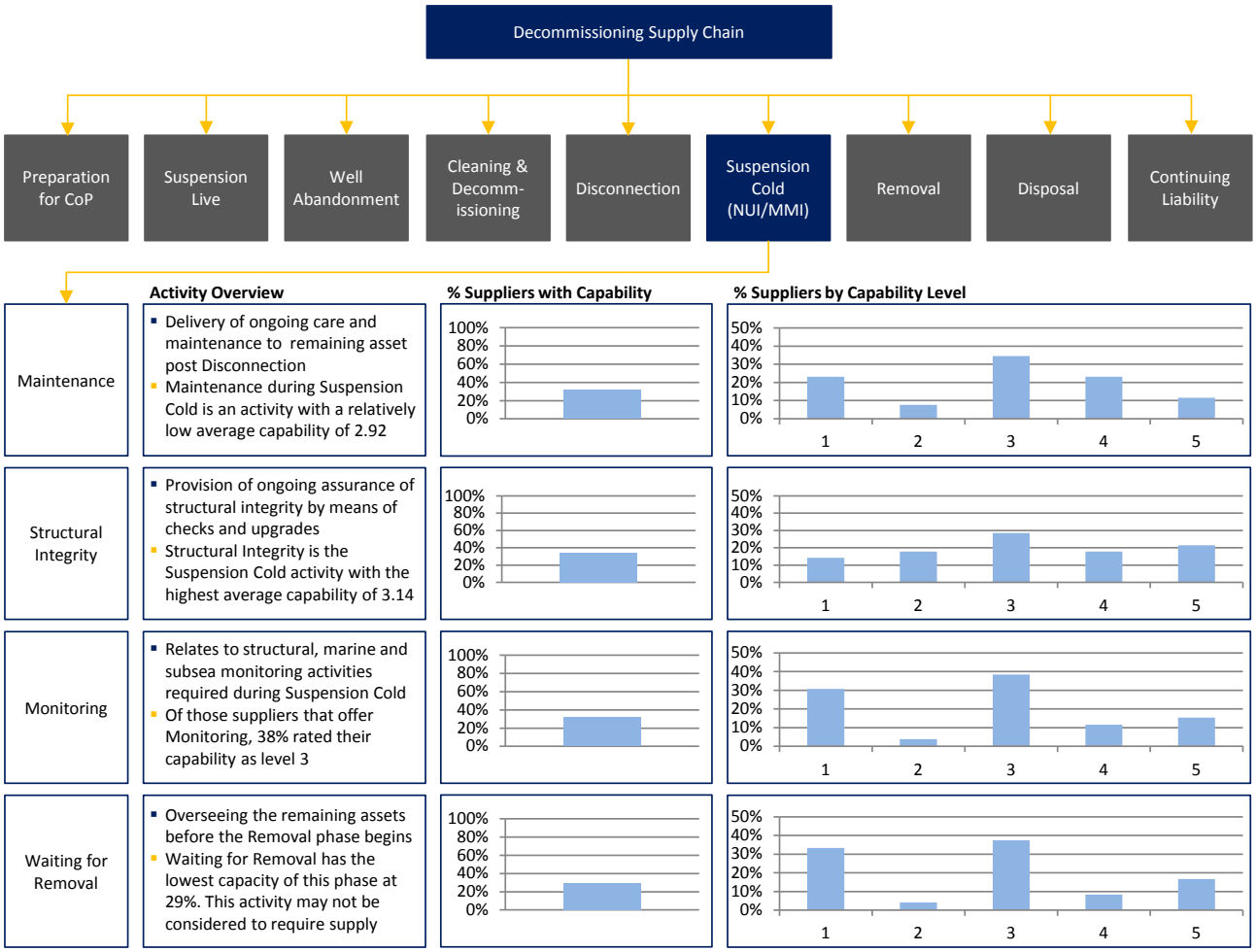


Figure 25

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Strong maintenance	There is strong maintenance and structural integrity capability, knowledge and experience in the UKCS
Non complex	The Suspension Cold phase is not considered to be complex
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record
Low costs	Costs are anticipated to be low for operators during this phase

Weakness	Description
Less profitable phase	The Suspension Cold phase provides little scope for supplier involvement and revenue generation
Rapid deterioration	It has been noted that there is a quicker deterioration of asset infrastructure during 'lighthouse mode' than when it is operational. This is because remaining equipment is not being used as intended and causes higher maintenance and integrity issues and costs

Opportunity	Description
Suspension Cold service offering	A packaged service for Suspension Cold – perhaps offering monitoring, integrity checks, maintenance and logistics – could fill a gap in the current supply provision
Increased Suspension Cold focus	When decommissioning activity ramps up, increased demand for removal capacity that currently doesn't exist may force longer Suspension Cold phases. This would force operators to invest more into the phase and potentially present more lucrative supplier opportunities
Integrate with other phases	Since there is some overlap in timing and supply requirements (maintenance, integrity and support) between this phase and others such as Disconnection, Removal and Disposal, the phases could be integrated. This approach would allow suppliers and operators to plan, sequence and synergise across the phases

Threat	Description
Underestimation of phase complications	There is a mindset that Suspension Cold is a phase that requires little attention and has minimal costs. However complications can arise, especially with regard to structural integrity and subsea infrastructure, causing increased complexity and escalating maintenance costs
Lengthening of phase	If planning is poorly executed, the Suspension Cold phase can last longer than anticipated – this would largely be a result of poor sequencing and securing of supply for Removal services
HSE issues	When a platform is in an MMI state, HSE risks arise due to not having the same level of support services. Dropped objects or personal injuries, for example, may not be attended to as quickly as in the stages prior to Suspension Cold

Summary

Suspension Cold, being a phase of uncertain length, as well as requiring few services, is not seen as a very profitable opportunity for suppliers or a productive phase for operators. Moreover, the rapid asset deterioration endemic of 'lighthouse mode' makes it a problematic phase. However, packaged service offerings and integrated approaches could help turn the phase into a positive for suppliers and operators.

Recommendations

Recommendation	Description
Packaged offering research	Bring together experts to quantify and analyse the costs and benefits of developing a packaged service offering for Suspension Cold. Publicise findings and, if it proves beneficial, encourage both suppliers and operators to consider these options
Integrate with other phases	Since there is some overlap in timing and supply requirements (maintenance, integrity and support) between this phase and others such as Disconnection, Removal and Disposal, the phases could be integrated. This approach would allow suppliers and operators to plan, sequence and synergise across the phases

3.7 Removal

The Removal phase involves the preparation, removal and transportation of an asset from its offshore position to an onshore facility where it then transfers to the Disposal phase. There are three major removal methods; single lift, reverse engineering and piece small, all covered amongst the activities in the Decommissioning Work Breakdown Structure map:

- Hook Down
- Module Separation
- Pad-eye Refurbishment
- Sea Bed Clean-up
- Removal – Single Lift
- Removal – Reverse Engineering
- Removal – Piece Small

Multiple factors, such as the location, weight, depth and age of a structure will dictate which removal method will be most cost and time efficient for a given project. Depending on what removal method is chosen, completion time can vary from weeks to months to years. Similarly, costs can greatly fluctuate from one project to the next.

The major risks for the Removal phase are the availability and costs of heavy lift vessels (HLVs); the availability of onshore yards to coincide with operators programmes; the dangers of innovative and untested approaches; getting the right permits, licences and consents in time; and asset integrity.

Capability & Activity Analysis

Figure 26 demonstrates the average capability level of suppliers by Removal activity. With an average supplier capability level of 3.00; Module Separation, Removal – Reverse Engineering and Removal – Piece Small are the joint strongest activities of supply. At the other end of the spectrum, Sea Bed Clean-up is the weakest supply activity with a capability of 2.38.

The mean supply capability is 2.83, with 57% of supplier capabilities at level 2 and 43% at level 3.

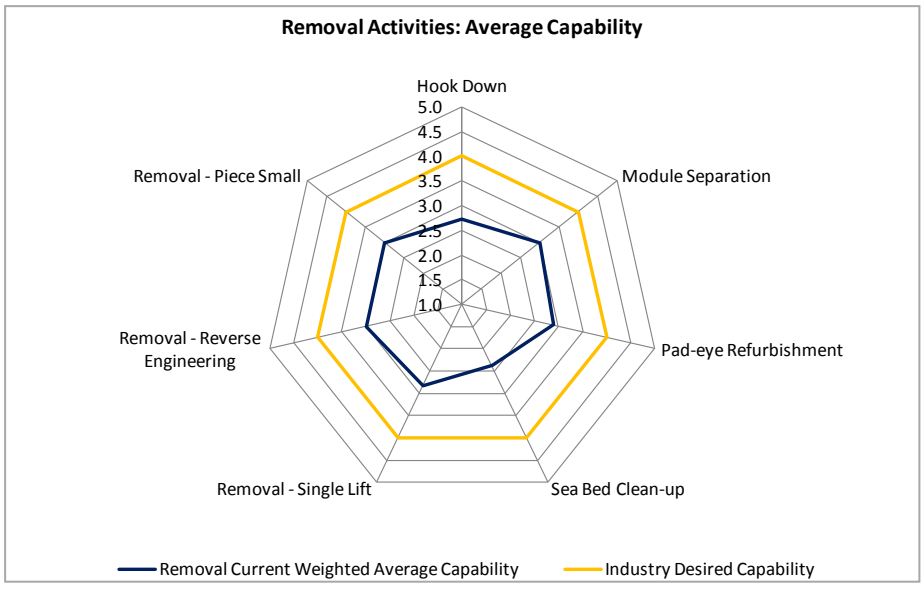


Figure 26

Figure 27 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights; Sea Bed Clean-up is the activity that requires the most development, with a 1.62 gap between current and desired capability.

The average deviation of Removal activities' supply capabilities from the desired industry level is 1.17 which means the phase requires a collective improvement of 41% to reach that benchmark.

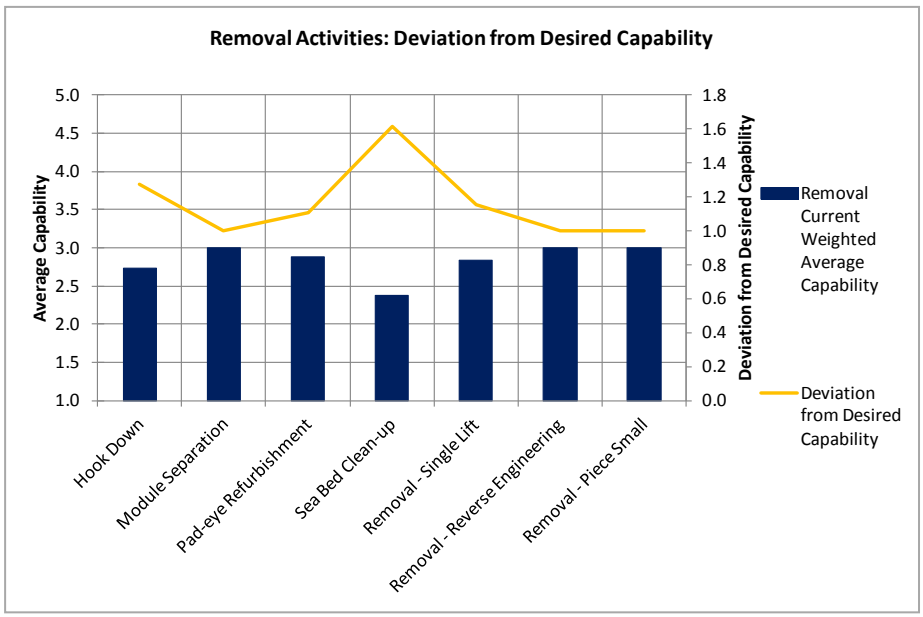


Figure 27

Figure 28 demonstrates the proportion of suppliers by capability level for each activity. The graphic demonstrates varying proportions of suppliers in different capability levels across the phase, hence not showing a strong Removal trend. One recurring pattern is the minimal presence of suppliers with level 5 capability, with only 8% of the total suppliers classifying their capability as level 5.

Most noticeable is the low supply capacity for these Removal services, with an average of only 28% of the total supply market servicing this phase and, for areas such as Pad-eye Refurbishment, just 22%.

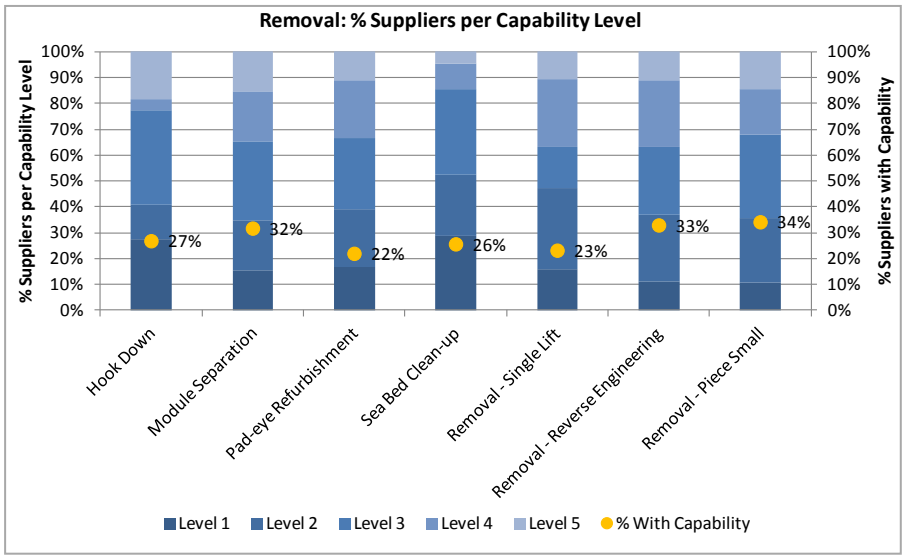
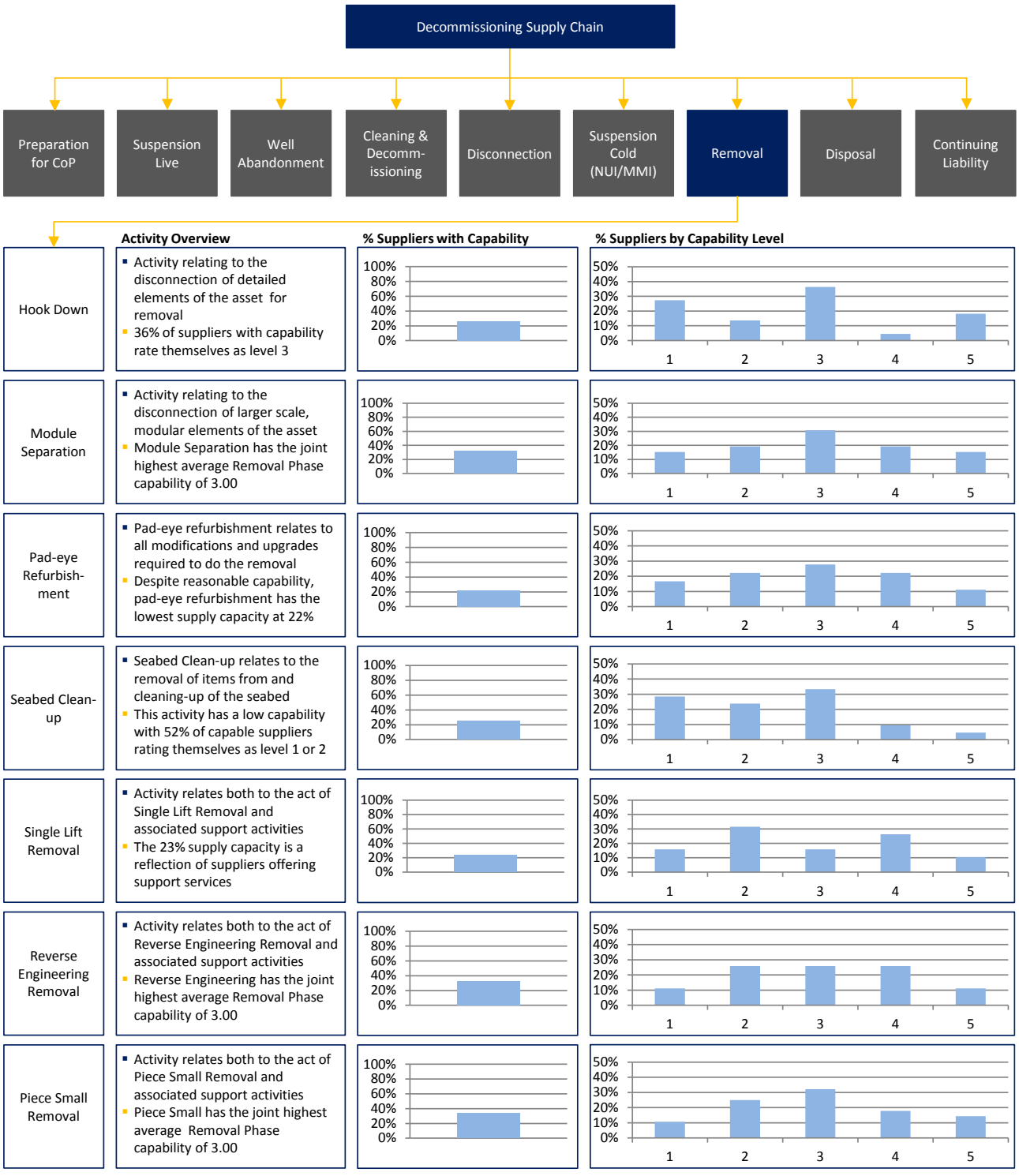


Figure 28

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Project management and support	The UKCS has strong project management and support knowledge, capabilities and capacity
Heavy lift mature	Heavy lift, while reasonably immature in the Removal space, is a mature capability for other sectors such as offshore development
Heavy lift removal has some experience	Although still embryonic as a Removal method, there is some experience in heavy lift which can be leveraged going forward. Every project so far has shown improvement on the last, owing to these lessons learned
Lower heavy lift categories	There is strong supply capacity and capability in heavy lift vessels with lifting capacities of up to 500 tonnes
Heavy lift relationship	The relationship with heavy lift fleet providers is generally strong, proving good access to vessels (when capacity allows)
Challenge/concept mentality	The strong concept/challenge mentality means that there is already strength and experience in the 'Appraise' and 'Define' stages of forthcoming decommissioning projects. The 'select' and 'execute' elements are, however, still in their infancy
Knowledge sharing and learning	There is a strong commitment to learn and improve, as well as a culture of knowledge sharing on areas such as lift strategies and contracting models. This commitment and culture is being fuelled by the work of organisations that offer support to the industry, such as Decom North Sea
Contracting models tested	Contracting models have already been tried and tested. Studies have also been carried out to assess the suitability of different contracting approaches. Consequently, there is a wealth of information and guidance available, especially in organisations such as Decom North Sea
Analysis capability	Strong engineering capability exists for structural analysis required for topside and jacket removal
Warranty provision	The UKCS has strong knowledge, capabilities and capacity in the provision of marine warranties
Marine mammal knowledge	Expertise has been developed in marine mammal science and monitoring, helping to reduce the environmental impact of removal
Open attitude to collaboration and innovation	The decommissioning supplier and operator community is open not only to knowledge sharing and discussion, but also to ideas around working together and providing innovative collaborative alliances
Other industries	Other industries have shown a willingness to involve themselves, sharing knowledge and offering to collaborate

Weakness	Description
Heavy lift over 500 tonnes	There is little heavy lift provision over 500 tonnes, causing supply chain bottlenecks, delays and escalating costs. This is exacerbated by the demand for heavy lift capability from other oil & gas and renewables development projects. Of note, is that there are no heavy lift vessels of this capacity in the UKCS (they have to be mobilised from other regions)

Weakness	Description
Over-engineering	Over-engineering is endemic of the entire decommissioning process. Removal strategies and considerations, in particular, tend to be overcomplicated in approach and fail to leverage pre-packaged services in favour of bespoke solutions
Un-integrated approach	The lack of integration, both between different phases of decommissioning and between suppliers and operators, prevents effective sequencing, capture of synergies and overall cost and time efficiency
Contractual models	Contractual models in the UK are much more restrictive compared to the practices in Norway and the Netherlands, preventing innovation and collaboration in approaches
Insufficient/inconsistent demand	The demand for services is either not great enough or not consistent enough both to justify capability investment and to guarantee the work needed for innovative and collaborative approaches
Restrictive stagegating	The stagegated approach to contracting reduces innovation, as the end point is fixed and the scope of work is locked down too early. This locks contractors out of work after the 'select' phase. Contractors also have restricted entry as the decommissioning contracting packages are not aligned with the phases of the decommissioning lifecycle (to which the contractors have aligned themselves)
Derogation knowledge	There is poor knowledge around the requirements for derogation cases
Platform documentation	There is poor documentation on platforms, particularly topside integrity models and platform modification documents
Subsea lifting tools	Subsea lifting tools are still limited in capability and capacity
Jacket removal	There is currently limited experience in jacket removal, making it an area of low capability. This low capability is exacerbated by the fact that older jackets were not designed to be removed and there is still no optimally designed lift vessel designed for jacket removal

Opportunity	Description
Develop piece small	Opinion varies on the benefits of piece small removal but, if developed further, it could become a more viable option
Better link Removal and Disposal	Removal and Disposal activities could be better integrated by involving the Disposal contractor earlier on in the planning and execution of the process. This would mean working backwards from a desired project end point and planning from there. This could allow for more efficient waste management; better quantification of what needs to be disposed offshore and onshore; clearer definition of what 'known condition' it needs to be in; quicker routes to revenue streams through scrap and re-use and better all-round planning and synergy
Re-use and scrap remuneration	Re-use and scrap values could be used more as forms of supplier remuneration for Removal services. This could financially benefit both suppliers and operators

Opportunity	Description
Innovative removal methods	There is debate and differing opinion over the pros and cons of the three major removal methods: single lift, reverse engineering and piece small. An innovative approach could provide a universally accepted solution for which the pros outweigh the cons
Campaign approach	Given the scarce supply of heavy lift vessels with top lifting capacity, a more opportunistic campaign approach might be able to provide a solution beneficial to both suppliers and operators
Better understand removal considerations	Research to better understand and quantify removal considerations would be beneficial to suppliers and operators. For example, data and benchmarks to properly do a cost/benefit analysis of piece small versus single lift removal
Reactive contracting	Contracting models should be more evolutionary and react to lessons learned from past projects. This will reduce risks and increase value in contracting going forward
Improve documentation	Platform documentation should be improved in order to aid and optimise removal. Particularly, platform integrity data needs to be documented when a platform changes ownership to ensure this data is not lost
Leave structures in place	Pending regulatory approval, there is the possibility of leaving structures in place for other purposes. Examples of this are the 'rigs to reefs' scheme in the Gulf of Mexico or the proposal to use redundant platforms in the offshore wind industry. This would save operator and tax payer money as well as being a positive HSE and regulatory option
Leverage lower lift strength	Since heavy lift capability up to 500 tonnes is strong, the use of these vessels for Removal purposes should be maximised, either single lift on smaller structures and pipelines (which account for an estimated 85%[15] of the structures in the UKCS) or collaboratively on medium/larger structures. This would free up more capacity for the larger heavy lift vessels and maximise revenue streams for the smaller lift suppliers

Threat	Description
Leaving structures in place	The mooted possibilities of leaving structures in place for purposes such as wind energy would create less demand for Removal services, removing the revenue stream for that supply pool
Safety concerns	The separation of modules is a safety threat due to the 'unknowns'
Snagging	Hidden snagging issues can be a major HSE threat if not carefully managed
Demand from other sectors	Demand from other industries and sectors, such as oil & gas capital projects and offshore renewables, will create security of supply issues and drive up costs for Removal
Siloed phases	Suppliers and operators could miss opportunities by being overly siloed by the phases of the decommissioning lifecycle. Phase gating may prevent an end-to-end approach and hinder collaboration

[15] Operator estimates

Threat	Description
OSPAR changes	Forthcoming changes to OSPAR regulations may leave contractors unsure of how to operate, especially with regard to derogation
Lack of re-use culture	The lack of re-use culture, if continued, will erode potential value to operators, suppliers and potential buyers
Overvaluing offshore experience	The sector may be missing out on key supply capability and capacity by not giving opportunities to contractors without offshore experience. This is particularly true of demolition contractors with the potential to provide piece small services offshore
Inaction	There is currently a lot of discussion around the topic of Removal but very little action. There is a risk that, if this goes on, suppliers will lose interest and the supply market will lose what embryonic capability and capacity it currently has

Summary

Removal is the most publicised and most discussed area of the decommissioning supply chain. Strengths do exist in project management capabilities, in the lower lift categories and even in heavy lift (although capacity is low).

The opportunity is there for an innovative solution to prevent the heavy lift supply chain bottleneck, be it through investment, technological innovation or novel contracting models. However, the fact remains that an estimated 85%[16] of the structures in the UKCS are small structures and pipelines that will not require the major heavy lift vessels, reducing the potential negative impact of low heavy lift capacity.

Recommendations

Recommendation	Description
Develop innovative approach	There is debate and differing opinion over the pros and cons of the three major removal methods: single lift, reverse engineering and piece small. An innovative approach could provide a universally accepted solution for which the pros outweigh the cons
Create Disposal linkages	Removal and Disposal activities could be better integrated by involving the Disposal contractor earlier on in the planning and execution of the process. This would mean working backwards from a desired project end point and planning from there. This could allow for more efficient waste management; better quantification of what needs to be disposed offshore and onshore; clearer definition of what 'known condition' it needs to be in; quicker routes to revenue streams through scrap and re-use; and better all-round planning and synergy

[16] Operator estimates

3.8 Disposal

The Disposal phase involves the options after the asset has been removed and brought onshore: re-use, recycling or disposal. Disposal covers the handling of the asset, waste management, deconstruction and the final asset options. The Decommissioning Work Breakdown Structure lists the following activities as part of the Disposal phase:

- Offloading
- Cleaning & Handling Hazardous Materials
- Deconstruction
- Recycling & Disposal
- Possible Re-use

The Disposal phase varies in length depending on what final option is selected and where the asset is disposed. There is growing consensus that Disposal contractors should be brought into the project earlier to ensure the management of waste streams, to properly define what needs to be disposed of offshore versus onshore and to bring in potential revenue streams (scrap, re-use) earlier in the process. This would mean an extension of Disposal contractor scope and involvement in the decommissioning process.

The key risks for Disposal are bureaucracy and cross border legislation; ownership risk of waste materials; poor cleaning on previous phases; and heavy lift availability for offloading.

Capability & Activity Analysis

Figure 29 demonstrates the weighted average capability level of suppliers by Disposal activity. The activity with the strongest supply capability is Recycling & Disposal with 3.43 while, at 2.89, Offloading is the weakest.

83% of Disposal activities have an average capability level of 3 or above and the average capability for the phase is 3.16, making it the joint second strongest across the decommissioning supply chain.

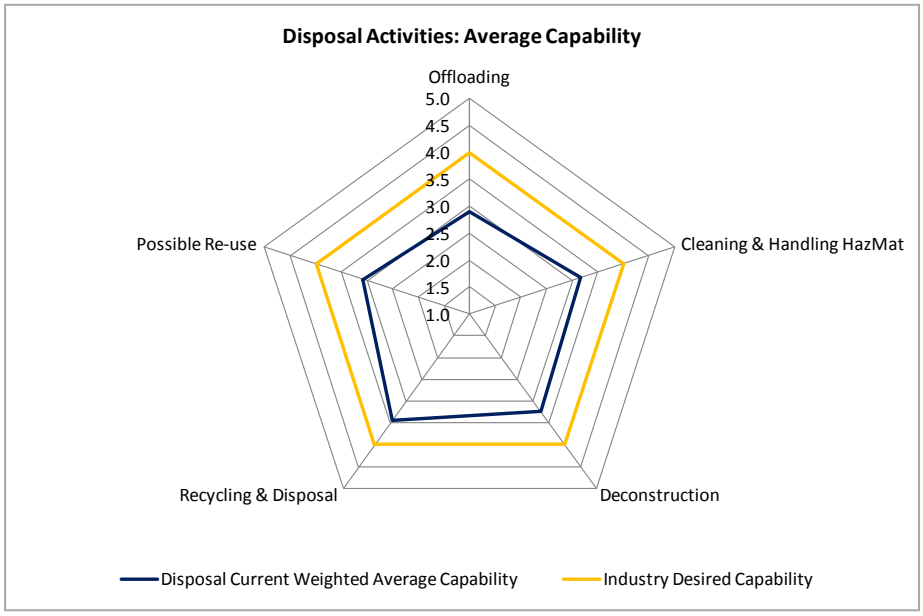


Figure 29

Figure 30 demonstrates the deviation between average supplier capability and the industry desired capability per activity. As the yellow line highlights, Offloading is the activity that requires the most development, with a 1.11 gap between current and desired capability.

The average deviation of Disposal activities' supply capabilities from the desired industry level is 0.84, meaning the phase requires a collective 27% improvement to reach that benchmark.

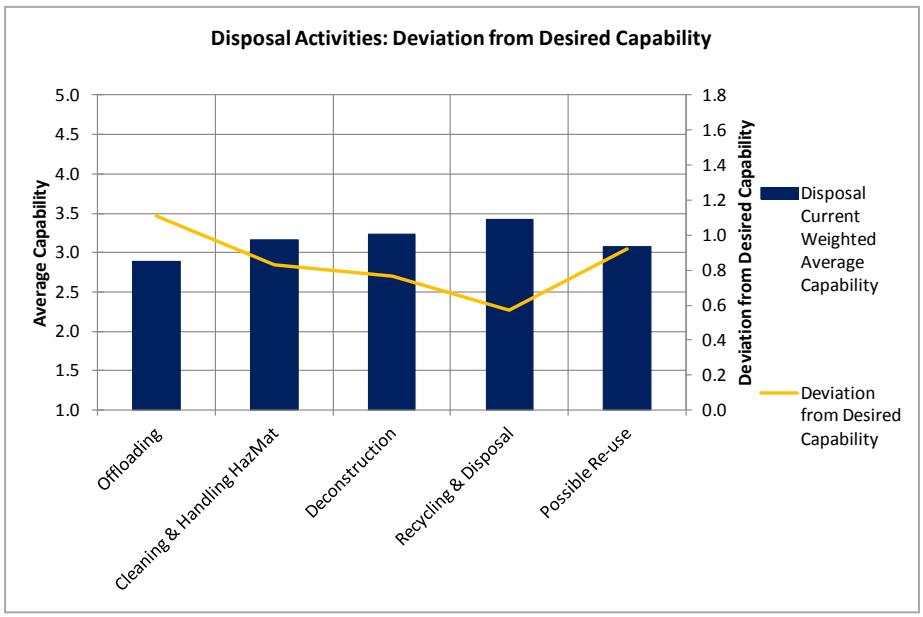


Figure 30

Figure 31 demonstrates the proportion of suppliers by capability level for each activity. As has been the trend for phases with stronger supply capability, suppliers have rated themselves most prevalently as level 3 across the supply chain, with an average 36% of suppliers at that level. It is also noticeable that there are, on average, a higher percentage of level 5 (20%) than level 1 (11%) rated suppliers across the phase activities.

As one of the stronger phases, Disposal also has comparatively high supply capacity, with an average of 41% of the supply market offering some Disposal activities.

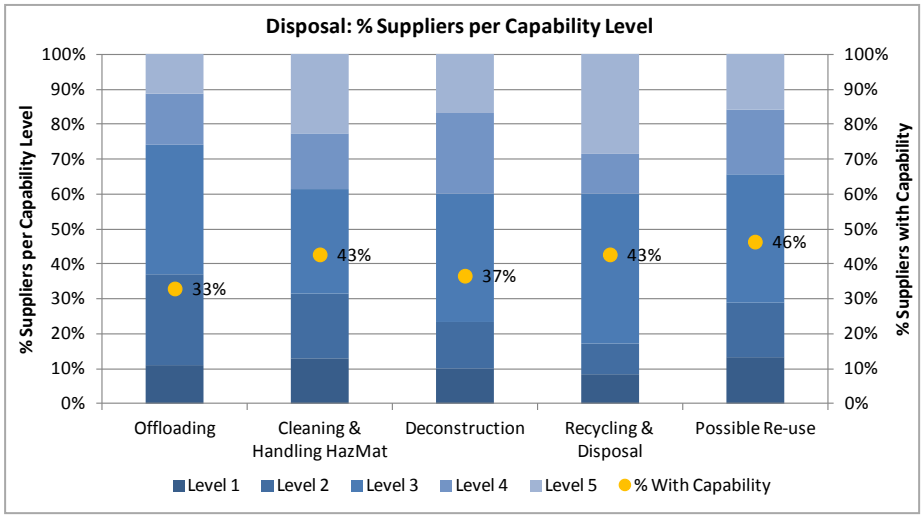
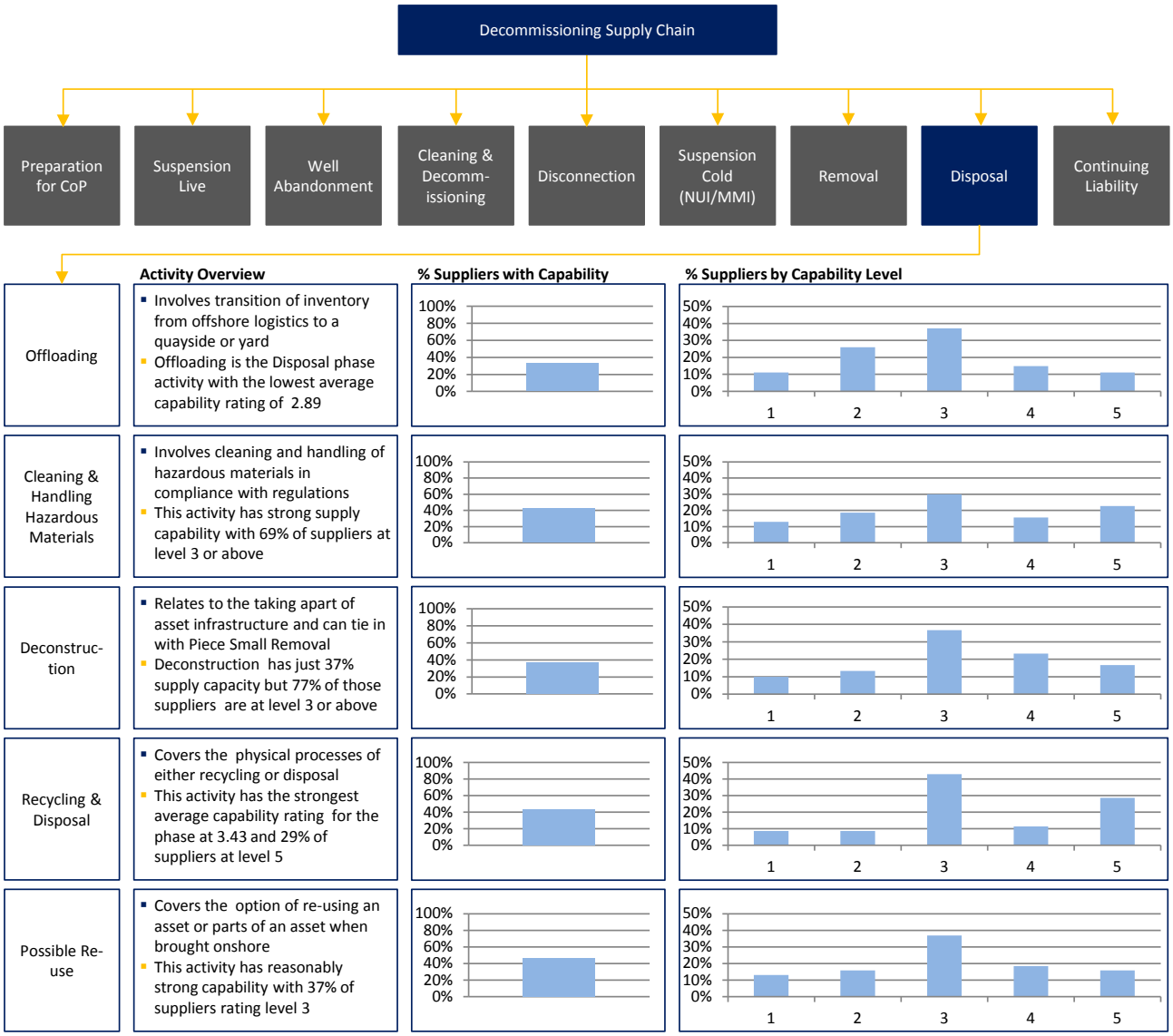


Figure 31

This section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Proven capability	The Disposal market's capability and regulatory framework is proven by successful past projects
Competition	There is a competitive supplier pool which drives improvement and flexibility to changing markets
Quayside capacity	There are available quayside spaces for work, preventing supply chain bottlenecks
Facility experience	There is legacy experience with regard to facilities
Proximity to fields	The proximity of Disposal yards to fields reduces mobilisation costs and associated risks
Stakeholder responsibility	Stakeholders are typically responsible and compliant in their duty of care to disposal and environmental issues
Mature infrastructure	There is already mature infrastructure to deal with Disposal challenges
Piece Small	Capability to deal with piece small removal is advanced
Good reputation	Being a mature area, there are already reputable yards and established relationships in the recycling and Disposal supplier pools
Hazardous materials capability	Suppliers are well established at dealing with hazardous materials

Weakness	Description
Deep-water facilities	There is limited availability of very deep-water facilities in the UKCS
Remote steel plants	Yards are generally remote from steel processing plants, increasing logistics costs
Bureaucracy	Disposal, re-cycling and re-use are all hindered by red tape which causes delays and increases costs, especially with regard to international movements of inventory and waste materials. One operator even opted to do their Disposal at a yard 500 miles further away from their field due to the issues of permitting at the nearer yard
Unproven ROI	ROI is unproven from decommissioning disposal activities at this stage and there is therefore no great incentive for yards to invest in capabilities and get more involved
Hazardous materials disposal	There are limited facilities that are permitted and capable to deal with hazardous waste streams (NORM, LSA, Mercury), causing supply chain bottlenecks

Opportunity	Description
Smooth demand	Smoothing demand for Disposal services would allow for better sequencing of modules and guarantee work. This would require better linkage between operators, project managers, removal contractors and the yards. Alternatively, inshore grounding and winching onto a facility could be used to wet store an asset requiring Disposal and therefore smooth out peaks and troughs in yards
Create Demolition and Disposal linkages	Disposal yards could strengthen the capabilities of demolition contractors if a better linkage were in place

Opportunity	Description
Better link Removal and Disposal	Removal and Disposal activities could be better integrated by involving the Disposal contractor earlier on in the planning and execution of the process. This would mean working backwards from a desired project end point and planning from there. This could allow for more efficient waste management; better quantification of what needs to be disposed offshore and onshore; clearer definition of what 'known condition' it needs to be in; quicker routes to revenue streams through scrap and re-use and better all-round planning and synergy
Better share the work	More facilities can service topsides than jackets – if the bigger yards were to focus on the jackets and let the smaller ones do the modular work, there would be an opportunity for greater uptake across the market and bigger market-wide revenues
Salvage and nuclear learnings	The Disposal supply pool could benefit from learning from the salvage market, which traditionally offers a much faster service and has a different mindset to oil & gas. There may even be opportunities to collaborate with salvage suppliers in terms of planning and execution (although there are HSE regulatory blockers). The nuclear industry also presents learning opportunities, especially with regard to waste characterisation and handling
Develop re-use market	The re-use market could be further developed, including the entry of new suppliers or the setup of schemes such as the Decom North Sea valve re-use pilot scheme, to make it a more common activity. Re-use targets could be put in place to ensure that value is not leaked
Re-cycling targets	Re-cycling and re-use targets should be in place to reduce waste to landfill

Threat	Description
International competitors	UKCS suppliers may not be awarded UKCS Disposal work due to the strength of Norwegian and Dutch Disposal yards that have deeper waters and capabilities to do cutting inshore
Scrap price fluctuations	A drop in scrap prices would harm the profitability both of individual contracts and of the industry as a whole, threatening suppliers in this space
Regulatory changes	Anticipated changes to the SEPA environmental regulations could present challenges to Disposal contractors
Anticipated resource shortage	Analysis from Norway showed that, by 2020, demand for Disposal services in the Norwegian Continental Shelf (NCS) will have quadrupled from now and will outstrip supply[17]. If there are similar increases in demand in the UKCS, plus extra demand coming from Norway, there will be a huge Disposal supply shortage across the North Sea
Local stakeholder perception	If not managed correctly, there is a risk of upsetting local stakeholders and authorities when handling waste. In extreme circumstances, this can be a blocker to project delivery

[17] Anecdotal from Supply Chain Workshop

Threat	Description
Closure of disposal routes	The closure of disposal routes for hazardous materials such as NORM, LSA and Mercury would cause environmental and security of supply issues

Summary

Disposal is considered by many industry stakeholders as the offering with the strongest capabilities across the decommissioning supply chain. It is an area of proven capability and experience. There are, however, some concerns around Disposal yard capacities, should demand increase, as well as the lack of deep-water facilities in the UKCS.

There is also a popular theory that Disposal contractors should be involved earlier in the decommissioning process to ensure the management of waste streams, to properly define what needs to be disposed of offshore versus onshore and to bring in potential revenue streams (scrap, re-use) earlier in the process.

With several yards under development and possible opportunities for Disposal contractors to become involved in earlier stages of the decommissioning process, there is the potential for strong activity growth and expansion for Disposal suppliers.

Recommendations

Recommendation	Description
Bring Disposal contractors into the decommissioning process earlier	Operators and Tier 1's should bring in Disposal contractors earlier in an advisory or waste project management capacity. This would allow more efficient end to end waste management; better quantification of what needs to be disposed offshore and onshore; clearer definition of what 'known condition' it needs to be in; quicker routes to revenue streams through scrap and re-use and better all-round planning and synergy
Optimise yard demand	More facilities can do topsides than jackets – if the bigger yards were to focus on the jackets and the smaller ones focus on the modular work, there would be larger Disposal capacity across the market at any given time, more yards would be working and collective market revenues would be greater
Research and leverage learnings and synergies from salvage and nuclear	The Disposal supply pool could benefit from learning from the salvage market, which traditionally offers a much faster service and has a different mindset to oil & gas. There may even be opportunities to collaborate with salvage suppliers in terms of planning and execution (although there are HSE regulatory blockers). The nuclear industry also presents learning opportunities, especially with regard to waste characterisation and handling

3.9 Continuing Liability

The Continuing Liability phase involves the monitoring activities required to maintain that a decommissioned field is safe and compliant to regulations. After developing an asset, an operator is liable in perpetuity for that site and therefore, even after decommissioning, the subsea area and any remaining structures must be periodically monitored (and intervention made if required). The Decommissioning Work Breakdown Structure lists the following activities as part of the Continuing Liability phase:

- Monitoring Programme – Remaining Structures
- Monitoring Programme – Subsea

Continuing Liability, by its very nature, is a permanent phase after decommissioning. However, the level of rigour applied to monitoring activities will depend on the environmental history of the site, the specific requirements or requests from DECC and the standard practice of the operator.

The key risks for the Continuing Liability phase are meeting regulatory requirements; potential effects on users of the sea (such as vessels and trawling nets); changes to the OSPAR requirements (retrospective removal); allocation of liability amongst JV partners; well integrity; and reputational damage.

Capability & Activity Analysis

Figure 32 demonstrates the average supplier capability levels for the two activities of the Continuing Liability phase, as well as their deviation from industry desired capability. The supplier capabilities for Structural Monitoring and Subsea Monitoring are similar and fairly low at 2.52 and 2.56 respectively. As a consequence there is an average supplier capability of 2.54, the lowest of all the phases.

With Structural Monitoring deviating from the industry desired capability by 1.48 and Subsea Monitoring by 1.44, the activities require a significant average improvement of 62% in order to meet that benchmark.

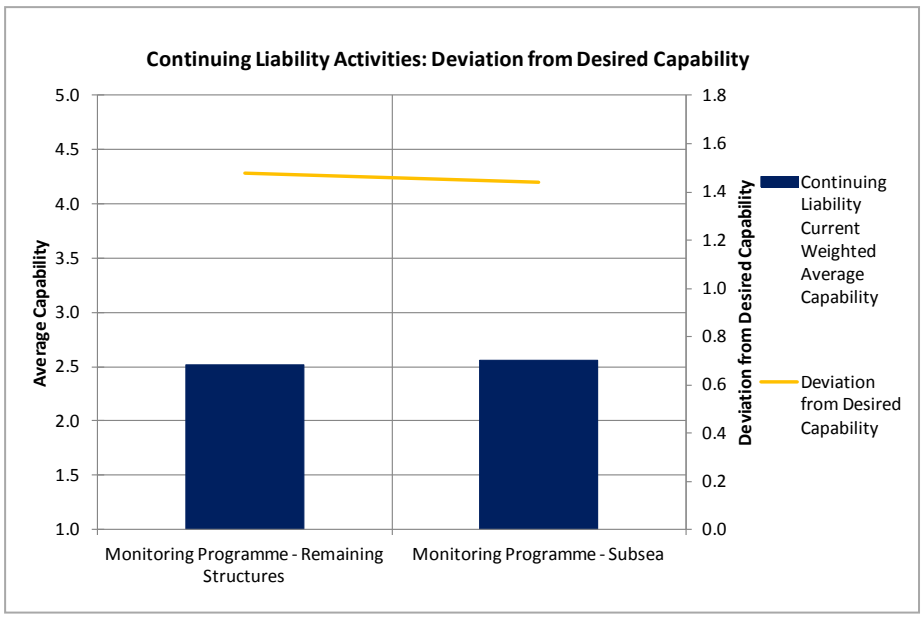


Figure 32

Figure 33 demonstrates the proportion of suppliers by capability level for each activity. Both activities have a very similar capability level profile with levels 1-3 accounting for 82% of all suppliers active in the phase.

Both activities also have the same capacity of supply, with 30% of the total supply market stating that they have some capability in this space.

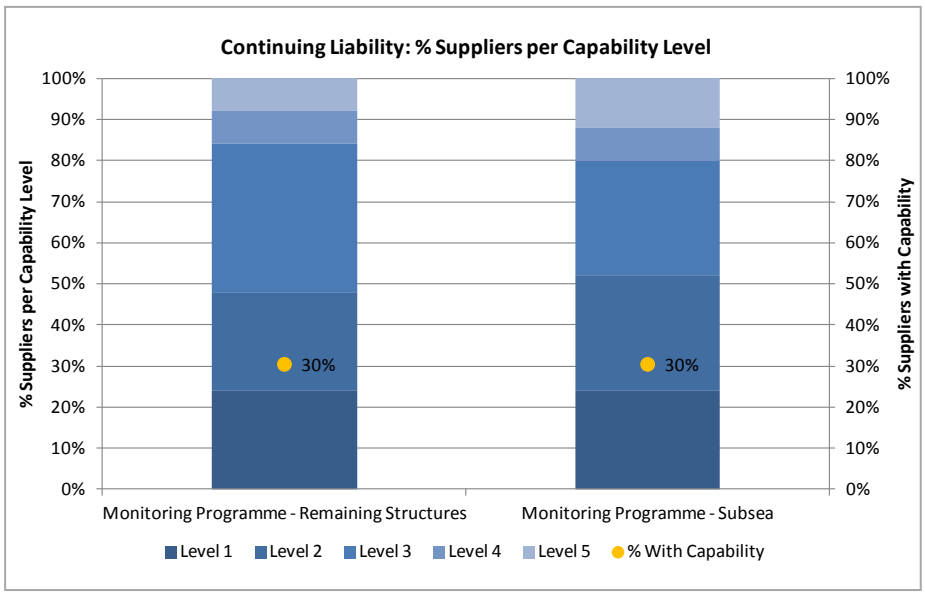
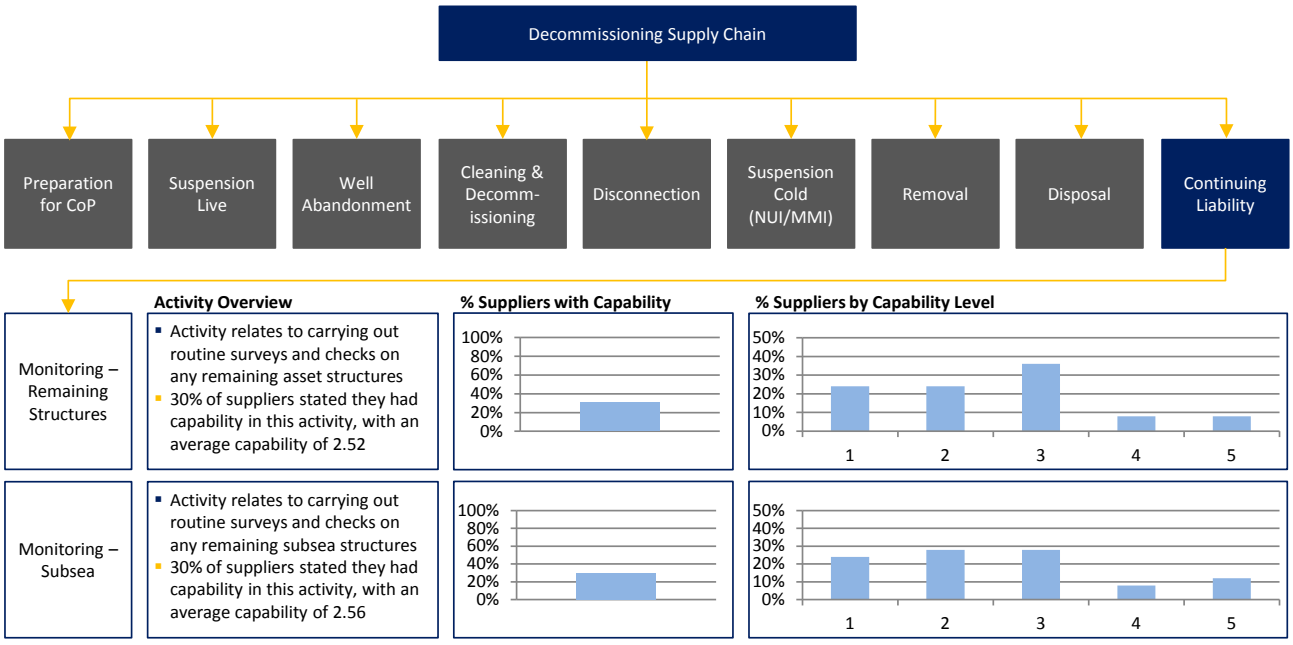


Figure 33

The section shows analysis of supplier capacity and capability by activity:



SWOT Analysis

Strength	Description
Strong survey capability	Suppliers perceive a strong collective capability at surveying and monitoring
Low complexity	The Continuing Liability phase is not considered to be complex
Proven HSE attitude and experience	Suppliers and operators alike in the UKCS have extremely high HSE standards and a proven track record
Low costs	Costs are anticipated to be low for operators during this phase
Marine mammal knowledge	Expertise has been developed in marine mammal science and monitoring, helping to reduce the environmental impact of decommissioning

Weakness	Description
Unprofitable phase	The Continuing Liability phase provides little scope for supplier involvement and revenue generation
Vessel availability	Shortage of LWIVs and remotely operated vessels (ROVs) can create supply chain bottlenecks, long lead times and escalating costs

Opportunity	Description
Continuing Liability service offering	A packaged service for Continuing Liability – perhaps offering monitoring, assessment and logistics – could fill a gap in the current supply provision
Change mindset	Encourage a more focused and entrepreneurial approach to Continuing Liability to ensure operator risks are reduced and supplier profitability increased
Bundle with other phases	Continuing liability service provision could be bundled with other activities in the supply chain such as the surveying activities in the Preparation for CoP phase, monitoring during the Suspension Cold phase or logistics throughout the decommissioning lifecycle
Lock down long term demand	As operators are liable in perpetuity, there is an opportunity for suppliers in the right space to lock down very long term contracts, creating a smooth and longstanding demand pipeline for those involved

Threat	Description
Underestimation of phase complications	There is a mindset, much like for Suspension Cold, that Continuing Liability is a phase that requires little attention and has minimal costs. However complications can arise, for example a percolating well, causing increased complexity and escalating costs
Unhappy stakeholders	There is the risk that stakeholders, such as fishermen and environmental organisations, will be unhappy with the state of the subsea and marine environment. This could cause extra costs and reputational damage
Not meeting regulatory requirements	Operators are liable for a field in perpetuity and if regulatory requirements are not met at any stage, there is the scope for issues down the line

Summary

Continuing Liability is not considered a big opportunity area for suppliers outside of the monitoring space as, in the absence of an issue being found, this is the only required activity.

Continuing Liability is not a phase with high spend over a given short period of time but, as the operator will be liable in perpetuity, this does present some suppliers with the opportunity to lock down smooth and longstanding demand for their services.

Suppliers could also consider innovative service offerings to enter this space.

Recommendations

Recommendation	Description
Develop service offering	Examine the feasibility and benefits of a packaged service for Continuing Liability – perhaps offering monitoring, assessment and logistics – could fill a gap in the current supply provision
Bundle with other phases	Examine the feasibility and benefits of bundling Continuing Liability with other activities in the supply chain such as the surveying activities in the Preparation for CoP phase, monitoring during the Suspension Cold phase or logistics throughout the decommissioning lifecycle

4.0 Recommended Supply Chain Map

The recommended supply chain map was developed using the Decommissioning Work Breakdown Structure and other industry precedents to create a draft structure. This was then further developed using supplier and operator feedback.

The intention was to create a detailed and rationalised supply chain model that realistically reflects the sequencing of activities and represents the potential synergies in a live decommissioning project.

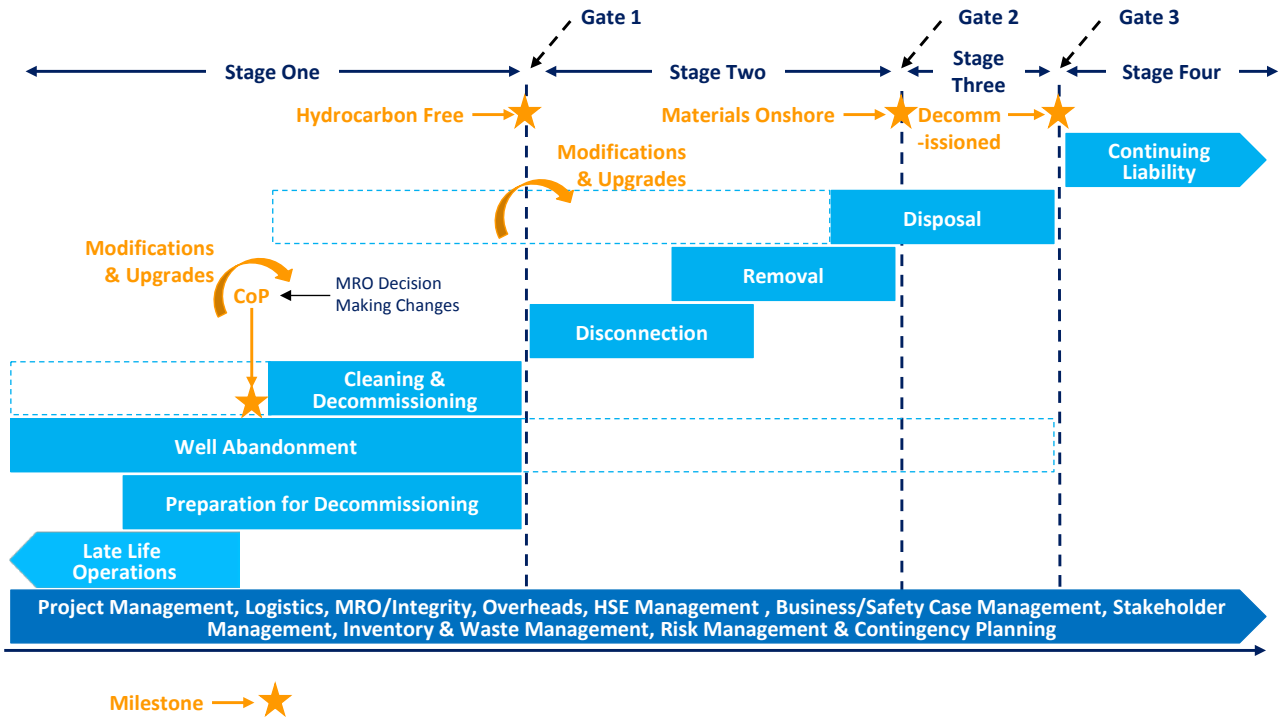
The map consists of three levels:

Level	Definition
Stage	Grouping of phases to represent the synergy of time, activities and suppliers
Phase	Grouping of associated activities by time and objective that constitute one element of the decommissioning supply chain
Activity	A single activity that contributes to the completion of the phase to which it belongs. Activities are found listed in the Activity Map, rather than the Phase Map below
Lifecycle Activity	A single activity that features across multiple phases of the lifecycle

The map covers phases from Late Life Operations through to Continuing liability. Beneath the phase map (and covered later in this chapter) sit the activities per phase, grouped by stage.

Supply Chain Phase Map

Figure 2: Recommended Decommissioning Supply Chain Phase Map



The key developments from previous maps are as follows:

- Creation of proposed 'stages' and 'gates' of time, activity and supply synergy. These demonstrate likely sequencing, remove duplication of activities in overlapping phases and demonstrate collaboration opportunities across phases, for example bundling Removal and Disposal services
- Introduction of phase sequencing
- Dotted line extension of some phases to demonstrate likely variability of execution timing
- Addition of lifecycle activities spanning the full duration of the decommissioning process because many activities are common to multiple or all phases in the lifecycle (see below)

Lifecycle Activities

Project Management	Includes planning, time and cost forecasts, contracting/subcontracting, budget management, business case management, contingency planning
Logistics	Includes offshore and onshore mobilisations, support vessels
MRO/Integrity	Includes maintaining structural integrity to HSE defined standards and to suit decommissioning strategy. Will differ from operational MRO due to different commercial considerations
Overheads	Includes staffing, utilities/power, accommodation
HSE Management	Includes upgrades, provisions, equipment, studies and safety case to meet HSE defined standards
Stakeholder Management	Includes engaging with internal, partner, community and regulatory stakeholders to inform, manage expectations and prevent reputational damage
Inventory Management	Includes directing and tracking movement of material/equipment inventory from operational asset to disposal/reuse/recycling
Waste Management	Includes directing and tracking movement of waste/HAZMAT inventory from operational asset to disposal/reuse/recycling, including characterisation and environmental accounting

NB – "Infrastructure" is taken to mean Topside, Jacket, Subsea and Pipelines

- Addition of a Late Life Operations phase, both because some decommissioning activities were deemed operational and because decommissioning considerations should begin at this stage
- Removal of suspension phases because the activities and spend here are already covered elsewhere
- Addition of upgrade/modification points to prevent need for duplication across phases; for example rig, crane or accommodation upgrades
- Addition of decommissioning milestones for clarity; for example the Hydrocarbon Free milestone which ushers in a new stage of the supply chain, largely requiring different activities, suppliers and infrastructure requirements

The map aims to be more reflective of a live decommissioning project, demonstrating the overlapping nature and varying lengths of the phases. It also aims to add value by identifying synergies and gates within the supply chain of a typical project.

Supply Chain Activity Map

The following tables (starting overleaf) represent the activities per phase of the recommended supply chain map. These activities have been grouped by the stages demonstrated in figure 2 (stages 2 and 3 have been combined for this purpose).

Stage One

Late Life	Preparation for CoP	Well Abandonment	Cleaning & Decommissioning
Perform slot recovery where possible to maximise well and infrastructure usage	Conduct studies to appraise different decommissioning methods and technical options for wells and infrastructure	Specialised logistics - LWIVS, DSVs	Shutdown
Conduct well visits, inspections and logging to determine integrity (e.g. cement evaluation)	Locate, verify and study wells and infrastructure as-built and construction/integrity data/documentation	Reinstate utilities if required	Hydrocarbon freeing and isolation (to required level stipulated in EIA)
Conduct reservoir, wells and infrastructure studies to delay/justify CoP	Conduct surveys, studies and inspections to gather information on wells and infrastructure required to support strategy, plans and approvals. Likely areas to include: history, engineering, design, concepts, cost, HAZMAT, waste, marine, subsea, HSSE	Perform conductor and wellhead removal, transportation and disposal/reuse/recycling (steel)	Depressurisation and draining
Develop decommissioning business case	Prepare and plan impact on hydrocarbon inventory (including alternative fuel sources post CoP)	Plug & abandon wells	Purging and cleaning of process system
Perform early HR/Change Management - organisational restructuring, internal communications	Prepare and plan impact on material and equipment inventories (including assessing weights/volumes and disposal, recycling and reuse options)	Monitor activity	Cleaning & treating pipelines (pigged and flushed)
	Prepare and plan impact on waste and HAZMAT inventories (including assessing weights/volumes and disposal, recycling and reuse options, defining waste route map and performing environmental accounting)		
	Develop Environmental Impact Assessment and define what level of hydrocarbon and waste freeing will be required		
	Develop and maintain safety case from operational through to decommissioned		
	Assess and plan societal impact		
	Map, engage and manage stakeholders		
	Develop CoP transition plan		
	Develop well abandonment plan (including tools, batching, disposal wells, cost estimations, weather, schedule, SIMOPS/contractor interface, management, execution and contingency plans)		
	Develop decommissioning plan (including tools, cost estimations, weather, schedule, SIMOPS/contractor interface, management, execution and contingency plans)		
	Request permits, licenses and plan approvals: internal>partner>stakeholder>regulatory (DECC)		
	Develop resourcing plan (manning, accommodation, power generation, catering, potable water)		
Pan-Stage Activities			

Pan-Stage One Activities:

- Assess and maintain well and infrastructure structural integrity for decommissioning (different decision making to operational MRO)
- Engage and manage stakeholders
- Perform necessary upgrades and modifications to wells and infrastructure (access, rigs, cranes, lifeboats)
- Logistics
- Accommodation and overheads
- Materials and equipment inventory management
- Hydrocarbons inventory management
- Waste inventory management, disposal and accounting, including treatment, transportation and handling of HAZMAT

Stages Two and Three

Disconnection	Removal	Disposal
Closing down of all utility and safety systems after well P&A if applicable	Make safe activities	Offloading
Disconnection of process and utility pipework, cabling crossing module boundaries	Infrastructure assessments and upgrades to ensure structural integrity for lifts	Prepare disposal site
Split modules if applicable	Removal : topside, jacket (as required), pipelines, subsea, caissons	Manage stakeholders such as local councils, press and schools
Engineering up of temporary structures and utilities as required by NUI/MMI	Sea bed and subsea clean-up	Deconstruction as required
Remove small & loose items	Engineer down drill rig and temporary utilities	Re-use, recycling or disposal
		Asbestos and Hazardous Waste Removal
Pan-Stage Activities		

Pan-Stage Two and Three Activities:

- Materials and equipment inventory management
- Waste inventory management, disposal and accounting, including treatment, transportation and handling of HAZMAT
- Assess and maintain infrastructure structural integrity for decommissioning (different decision making to operational MRO)
- Logistics
- Accommodation and overheads

Stage Four

Continuing Liability
Execute post-decommissioning plan agreed with DECC
Establish and carry out monitoring programme for the site(s) and any facilities that remain, including provision, inspection and repairs of nav-aids (buoys and lights) and inspection of any remaining infrastructure and pipelines
Redefine Joint Operating Agreements (if applicable)

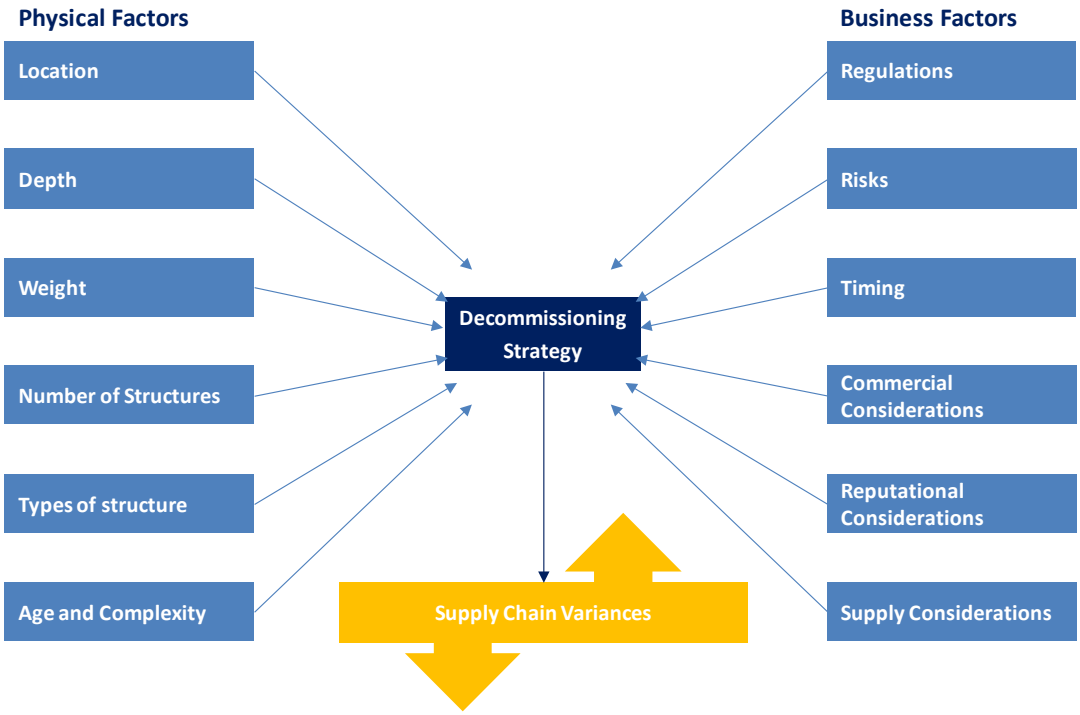
5.0 Supply Chain Variances

Using research gathered in the Supply Chain Mapping Workshop and the Operator Face to Face Meetings, this chapter aims to give an overview of how supply chain phases may vary, both by identifying the factors that impact the supply chain throughout a project and by giving an example of these factors in action.

Factors Impacting the Supply Chain

Multiple factors will impact the way in which a structure should be decommissioned safely, cost-efficiently and without causing damage to the environment. These factors can be segmented into two distinct categories: physical factors and business factors, as seen in figure 34.

Figure 34: Factors Influencing the Supply chain



The 12 factors in figure 34 commonly influence an asset's decommissioning strategy, therefore impacting the supply chain requirements, timing and expenditure for that project. The key impacts of these factors can be found in the tables below:

Physical Factors

Factor	Description
Location	The location of an asset will dictate how far it is from onshore facilities and ports; what the likely water depth is; what the typical weather conditions are and likely what type of structure is in place.
Depth	The depth of an asset, which is linked to its location, will influence its weight, as well as its decommissioning complexity. This will then drive supply requirements because a deeper asset will require more specialised technology and vessel provision, likely increasing cost and time.
Weight	The weight of an asset is linked to its depth and, in turn, its location. Normally the heavier an asset, the more structural mass that needs to be removed and therefore the longer and more expensive a project will be. Weight is one indicator of structure size and therefore will influence the removal strategy as a very heavy structure may require the highest lifting capacity HLV, whereas it may be most economical to remove a smaller platform piece small. The weight of a structure will also impact its eligibility for derogation.
Number of Structures	The number of structures at an asset will drive project costs and timeframes for the operator and demand for the suppliers. If an asset has multiple structures, a campaign removal approach may be considered. Multiple structures may also be conducive to longer Suspension phases as the operator looks to sequence phases to capture the synergy of multiple structures being decommissioned at once.
Types of Structure	The type of structure being decommissioned will dictate which removal strategy would be most suitable for an asset. For example, a fixed platform will have to be decommissioned (to an extent) *in situ*, whereas a floating platform may be able to be towed for inshore or onshore decommissioning
Age and complexity	The age of a structure can often dictate its condition and best removal strategy. An aging platform may require significant upgrades to perform decommissioning. Similarly, older wells are often found to be in poor condition (with structural integrity issues at 34% in the UKCS[18]) particularly if they have been left dormant for many years, requiring structural intervention and causing project timelines and costs to stretch by up to 1000%[19]. Moreover, older structures were largely not built with Removal in mind and therefore restrict potential Removal strategies. For example, due to the lower lift capacity in the early stages of UKCS development, structures were often composed of multiple modules rather than one homogenous structure. Consequently, these older structures may not be suitable for single lift removal and may be more suited to reverse engineering or piece small.

[18] *Review 268, March 2013*, Society of Petroleum Engineers
[19] Derived from operator inputs

Business Factors

Factor	Description
Regulations	Regulations impact decommissioning strategies through their ability to either enforce or allow practices. In the Gulf of Mexico, the Idle Iron NTL regulation dictates that decommissioning must be completed within certain timeframes after an asset stops producing, in effect stimulating demand. In the UKCS, DECC does not have the same mandate to enforce decommissioning but regulators do have the right to dictate how decommissioning is done and this will affect an operator's supply requirements. For example, OSPAR regulations, such as those governing derogation, may affect supply chain requirements by potentially reducing the level of jacket or sub-structure to be removed and hence the associated volumes of steel or concrete.
Risks	Risks; such as cost, fiscal, time, environmental and reputational; impact the timing of decommissioning projects.
Timing	If there are demands upon the operator to complete a decommissioning project within a given timeframe – perhaps commercial, regulatory or due to their own internal demand profile – this will affect their decommissioning strategy. In this example where speed is paramount, the operator may choose to use a heavy lift supplier for the Removal phase, rather than reverse engineering or piece small, despite the significantly higher day rates. Similarly, if an operator has no time restrictions, and believe it is a viable option, they might choose piece small over the other two Removal options. In this case, the whole Suspension Cold phase may not be needed.
Commercial Considerations	Commercial considerations largely dictate when decommissioning will take place as, when OPEX exceeds production income, an asset has reached its economic limit. More than just timing, commercial considerations could also include how much budget is set aside for decommissioning and therefore dictate what level of service should be procured.
Reputational Considerations	Reputational considerations can influence which decommissioning strategy will be selected
Supply Considerations	The security and perceived quality of supply will influence the choice of decommissioning strategy. For example, if it is known that demand will exceed supply for a given service at a given future date, an operator could choose to expedite the execution of that supply activity, stimulating earlier demand for the supply chain. Similarly, if an operator believes they cannot find sufficient capability in supply for a given activity, they may select an alternative approach to leverage areas where supply is stronger, or may even invest in the supply chain in order to develop that supply capability.

Example: Supply Chain Factors in Action

The impact that these factors may have on the supply chain will differ. In order to further elucidate this, this section describes two hypothetical decommissioning projects and highlights how these factors might impact and vary supply chain requirements.

Asset One: 'Southern Belle'

Southern Belle is a 25-year-old SNS asset consisting of multiple smaller structures, sitting in shallow calm waters close to shore. The structures are of varying age, some requiring decommissioning sooner than others. The asset overall is no longer meeting production targets and OPEX is increasing as the structures age.

The applied factors on Southern Belle are as follows:

Physical Factors	Description	Business Factors	Description
Location	SNS, close to shore	Regulations	Not restrictive
Depth	Shallow	Risks	Financial – medium as OPEX has exceeded production income
Weight	Light	Timing	Reasonably restrictive due to commercial value leakage
Number of Structures	Multiple	Commercial Considerations	Asset no longer economical, budget reasonable
Types of Structure	Small NUI/MMI and pipelines	Reputational Considerations	Low – no previous issues
Age and Complexity	Reasonably old but low complexity	Supply Considerations	Ample supply

As a consequence of these factors, a probable decommissioning strategy for Southern Belle might be a phased campaign approach to both Well Abandonment and Removal, leveraging the staggered but consistent demand from the multiple wells and structures. With multiple small structures and an element of time restriction, single lift would be more practical than reverse engineering or piece small options as low lifting capacity vessels exist in good supply and this would be quicker than the other options. Also, the structures would not be of sufficient size or complexity to demand the other options.

The consequent impacts on the supply chain for Southern Belle might be as follows:

Phase	Supply Variance Description	Time Impact	Spend Impact
Preparation for CoP	Comprehensive preparation would be required to ensure the sequencing of the campaign approach	↑	↑
Suspension Live	With a well sequenced campaign approach, there would not be the requirement for Suspension Live	↓	↓
Well Abandonment	Campaigning should reduce the length of this phase and leveraging demand should cut spend	↓	↓
Cleaning & Decommissioning	The smaller structures would require less cleaning but their high volume would counter that effect	→	→
Disconnection	The choice of single lift removal would reduce the amount of Disconnection activity required	↓	↓
Suspension Cold	With a well sequenced campaign approach, there would not be the requirement for Suspension Cold	↓	↓
Removal	With single lift , the time of Removal should be reduced but day rates will be higher	↓	↑
Disposal	Single lifting structures keeps disposal options open. High volume tempered by small sizes	→	→
Continuing Liability	Fully removing structures lowers liability but large asset area also adds risk	→	→

Asset Two: 'Angel of the North'

Angel of the North is a 30-year-old NNS asset consisting primarily of one large fixed platform, sitting in deep and rough waters at a great distance from shore. Due to the platform's age and size, it consists of many complex modules. The platform is structurally sound but production has dipped significantly and has a high percentage of produced water.

The applied factors on Angel of the North are as follows:

Physical Factors	Description	Business Factors	Description
Location	NNS, far from shore	Regulations	Eligible for derogation
Depth	Deep	Risks	Operational – medium as platform not designed for removal
Weight	Heavy	Timing	Non-restrictive as platform is structurally sound
Number of Structures	Single	Commercial Considerations	Asset no longer economical, budget reasonable
Types of Structure	Fixed Platform	Reputational Considerations	Low – no previous issues
Age and Complexity	Old and high complexity	Supply Considerations	Limited heavy lift for the size of this platform

As a consequence of these factors, a probable decommissioning strategy for Angel of the North would be to perform piece small removal of the topside and to derogate the jacket. Piece small would be more operationally viable than single lift due to the complex and modular nature of the topside, as well as avoiding the high day rates for the largest capacity HLVs that would be required for single lift of this asset. Derogating the jacket would reduce short term operational risk and financial burden but maintain an increased level of risk in perpetuity. It would also be important to ensure the highest capability suppliers when working with an old and complex structure in deep waters.

The consequent impacts on` the supply chain for Angel of the North might be as follows:

Phase	Supply Variance Description	Time Impact	Spend Impact
Preparation for CoP	Extra preparation for derogation case would be tempered by this being a single structure asset	→	→
Suspension Live	Ensuring the highest capability suppliers would likely require waiting for their services	↑	↑
Well Abandonment	Using the highest capability suppliers would be expensive but likely prevent issues and overruns	→	↑
Cleaning & Decommissioning	Rigorous cleaning required for piece small removal will increase time and cost	↑	↑
Disconnection	Extra disconnection for piece small tempered by fewer requirements for derogated jacket	→	→
Suspension Cold	By performing piece small, there should not be a waiting period for removal services	↓	↓
Removal	Piece small will greatly increase Removal time but day rates will be greatly reduced	↑	↓
Disposal	With the topside demolished offshore; scrap, re-use and recycling opportunities are limited	↓	↓
Continuing Liability	By leaving the jacket in place, there is heightened structural liability and potential cost escalations	→	↑

Both these hypothetical examples serve to demonstrate how factors may impact a decommissioning strategy and cause supply chain variances. Even analysis of the factors by stage, as above, will not lead to one consistent approach to decommissioning an asset and one consistent supply chain structure for that project. Opinion on the merits of different approaches varies across the industry and therefore different options will be chosen on different projects, even if the factors are identical.

6.0 Key Themes

Over the course of the research for this study, key themes have been identified across the supply chain. These key themes take the form of challenges and opportunities and can be either unique to a certain phase in the supply chain or span multiple phases. The following sections describe these key themes, examining existing issues, proposing resolutions and analysing potential opportunities.

6.1 Well Abandonment: Plugging the Capability Gap

Although it is often the Removal phase, with its significant engineering challenges and shortage of heavy lift options, that takes the headlines in decommissioning; many within the community identify large scale Well Abandonment activities as presenting the greatest challenges to the industry.

Challenges

Forecasts value Well Abandonment in the UKCS at ~£2 billion over the next 5 years, accounting for 44% of total spend[20], and some operator predictions have put this figure much higher. Meanwhile, the research in this study shows Well Abandonment has:

- The second lowest average supplier capability of all phases in the decommissioning lifecycle, at 2.87
- An average supplier capacity of 37%, nearly a third below Preparation for CoP
- The fourth lowest proportion of suppliers with experience, at 22%

However, before examining the challenges posed by the supply chain, it is important to look at the challenges posed by the wells themselves. According to Douglas-Westwood and Deloitte Petroleum Services[21] in 2010, there were 4,890 wells requiring full decommissioning in the UKCS. However, according to Oil & Gas UK's DEAL website in March 2013, there are 11,461 wells that require or will require decommissioning. The difference between the two figures can be explained to an extent by the three year time gap between the two and also because DEAL includes both original wells and side tracks which use the original top hole. Neither of these figures includes future well developments, meaning the numbers will increase. This lack of clarity on the number of wells requiring decommissioning is a challenge in itself as the industry seeks to plan ahead.

At either end of the spectrum, the challenge of decommissioning at this scale is significant, particularly given the condition of many of these wells is unknown.

Operator experience to date has shown that there is a high degree of complexity when embarking on well decommissioning activity. Non-producing wells are often left unattended for many years and some requiring abandonment are up to 30 years old. As a consequence, operators are finding wells to be in very poor structural condition and this adversely affects project timelines, costs and risks. To contextualise, there have been anecdotal operator reports that as many as one in five of the wells requiring abandonment in the NNS and CNS is in "train wreck" condition. In keeping with that, the Society for Petroleum Engineers recently reported that 34%[22] of wells in the UKCS have structural integrity issues.

[20] 2012 Decommissioning Insight, Oil & Gas UK
[21] The UKCS Offshore Decommissioning Report 2010-2040, Douglas-Westwood
[22] *Review 268, March 2013*, Society of Petroleum Engineers

As mentioned, wells in a poor condition can adversely affect timelines. Operators in the NNS and CNS would normally expect somewhere in the region of 15-20 days to place plugs and cement within the casing[23]. However, data from the Rushmore Reviews shows that operators are typically experiencing abandonment times ranging from 35-40 days[24] if all goes to plan. For those that do not, the timing and cost can increase significantly, with reports of recent experiences where it took over 200 days to plug and abandon a single well. Moreover, the problem is not unique to the NNS and CNS, with another operator setting out to plug and abandon six wells over one summer in the SNS and only managing four, the fourth taking 105 days as complications meant they were not able to remove the wellhead.

For a phase that potentially presents such a high volume of demand and with a significant level of complexity, the Well Abandonment supply market does not appear optimally prepared. As mentioned, the research in this study showed Well Abandonment to have a reasonably low level of suppliers with capability, at 37%, and that those suppliers have a mean capability below the supply chain average at 2.87. Anecdotally, the feedback is that there are a handful of very capable Well Abandonment contractors and many with strength in well services but it is anticipated there will be a shortage of relevant skills and experience if and when the volume of well decommissioning ramps up significantly.

The primary reason for this is a lack of resources. With patchy demand for Well Abandonment services at present, suppliers are often reluctant to invest in growing and developing their workforces. Consequently, when suppliers are awarded abandonment work, they do not always have suitably qualified and experienced personnel available. This has the potential to jeopardise the success of projects and places additional operational, HSE, time and cost risk on both operators and contractors.

Similarly, even suppliers that do have the experience and capability to deliver high performance Well Abandonment may not use the resources on Well Abandonment projects. This is because the more profitable part of the wells lifecycle is considered to be the drilling and completions activities and, therefore, suppliers and operators can tend to focus their most experienced resources on these operations as a priority. Given some of the challenges identified with Well Abandonment, at times the projects with the greatest technical challenges can have the least experienced resources working them.

Suppliers have also spoken about a ‘resource catch-22’ where those resources that do actually have the skills and experience do not find the abandonment work because the operators, believing sufficient capability does not exist in the supply market, delay doing the work. This forces those resources to get work in other sectors and geographies, meaning the capability is genuinely no longer available in the market and justifying the operator view when they come round to consider abandonment again. The cycle then perpetuates with neither the supplier resources finding the abandonment work nor the operators being able to actually abandon.

The possibility of new entrants to the Well Abandonment supply market is also limited due to the cost of entry, offshore regulatory requirements and, again, the lack of critical mass in the technical resources available.

Some suppliers have also suggested that support for new technology and innovation is not sufficient for them to be able to reach the highest supply capability levels. The role of ITF (Industry Technology

[23] Operator quote
[24] Rushmore Reviews statistics

Facilitator, a not for profit organisation owned by 30 operators and service companies that fosters collaborative technological innovation) is recognised but it was argued that support is often operator centric. Suppliers would like to collaborate with operators in R&D but the commercial demands are often too great and inhibit the possibilities. A recent example concerned a wells service provider being advised by an operator that they would not be interested in getting involved unless the proposed idea could deliver tangible commercial value within 30 months. Since this supplier could not guarantee creating commercially valuable technology within this set time period, the conversations went no further. Consequently, these sorts of demands are likely to inhibit the supply chain from developing potentially game-changing technology.

Proposed Resolutions

The below table discusses some potential proposed resolutions to the key supply issues of the Well Abandonment phase:

Resolution	Description
Change regulation	There are calls to emulate the US and Norway in their regulatory approaches. The US has the 'Idle Iron' mandate that stipulates that any well that has not been used for exploration and production purposes for five years must be abandoned. Norway does not have an enforced timescale for decommissioning currently but it is widely anticipated that updates to the Norsok regulations in July 2013 will enforce the abandonment of a well to two or three years after COP or after it is decided the well will not be used for other purposes. The justification for the UKCS adopting this form of regulation would be that it generates high and constant demand for the supply market, which would encourage skill development and retention as well as extra investment in innovation. It would also prevent wells being left idle for many years, reducing the probability of structural integrity issues. However, industry experts acknowledge that the government would have to foot the tax relief bill for earlier decommissioning activity, and that could act as a deterrent to a motion like this being passed.
Improve R&D support	Other regions have benefitted significantly from a focus on innovation to help fuel R&D activity. This is particularly true of Norway where Statoil has a real emphasis on R&D and is currently pursuing the objective of developing technology to plug and abandon subsea production wells from a LWIV. The operator has a long term horizon for technology development and pursues an ambitious technology agenda. This is supported by many Norwegian state funding initiatives which have helped Norway establish strength in developing oil & gas technology start-ups. Norway is now profiting from this as it is exporting large numbers of LWIVs to Brazil and West Africa. However the same level of government and operator intervention is hard to emulate as, of course, Statoil is state owned and can therefore more easily ensure government policies are converted into action on the ground.

Resolution	Description
Improve resourcing	Resourcing is perhaps the key issue facing Well Abandonment as activity promises to ramp up and many suppliers cite the lack of sufficiently qualified and experienced people as hindering their capability and capacity. Greater focus could be placed on this by both the operator and supply market through: • Creating specific departments and career paths for decommissioning well engineers • Creating a connection with universities to teach this as a specific course and to attract new engineering graduates into the discipline • Encouraging role rotation for well decommissioning engineers, to deepen their experience as part of international secondments during periods of low demand in the UK Talent and resourcing as an issue throughout the lifecycle is covered in section 6.2.
Start earlier	Starting earlier could mean doing logging and surveys or actually starting to plug and abandon wells earlier. Both would bring benefits to both suppliers and operators: stimulating demand for the former and mitigating integrity issues and cost escalations for the latter. Encouraging operators to start earlier would likely either require a regulatory change as described above or a push for a change in common practices by broadcasting the benefits of starting earlier. However, with doubts over whether the government will offer the same tax breaks (decommissioning relief deeds) for abandoning wells before CoP as they will after it, together with considerations of the time value of money, operators may argue that it just does not make commercial sense to start Well Abandonment activities earlier.
Change mindset	There is a perception amongst some in the industry that Well Abandonment is not as lucrative, challenging or glamorous as other wells activities such as explorations and completions. Consequently, it is important that the challenges and complexity of this area are articulated to usher in a new mindset. This would be with the intention of encouraging the industry to invest more in resourcing and technology; presenting the case for operators to consider well integrity and abandonment earlier, stimulating the supply market; and for relevant stakeholders to properly consider the timing and cost of abandonment as forecasting is currently optimistic and inaccurate.

These proposed resolutions have both strengths and shortfalls but, for the industry to overcome the significant challenges ahead, it is essential that options are explored and appropriate actions taken.

6.2 Talent and Resourcing

The resource capability and capacity across the decommissioning supply chain is a subject of much interest for suppliers and operators alike. The supply market can, with the exception of some specific pockets, service the current levels of demand. However, the prospect of surging demand in the UKCS, while presenting abundant opportunities, also raises significant question marks over the supply market's capabilities and capacity. Improving talent and resourcing is key to overcoming the challenges of demand and supply.

Demand Challenges

With £35 billion decommissioning spend forecast in the UKCS between now and 2040[25], it is likely the demands placed on decommissioning suppliers will ramp up hugely, while their ability to attract and retain talent will be key. Moreover the demand on people resources will be greatly exacerbated by the demand from other areas of the energy industry such as oil & gas capital projects, where large development projects such as Clair Ridge and Mariner will contribute to the £44 billion of total UKCS investment currently sanctioned[26]; and renewables and nuclear, which also have large scale investment plans and consequent demand on resources.

Demand for resources could also be heightened by similar activity in other geographies. An example of this is how Norway predicts its demand for Disposal yards will quadruple by 2020[27], outstripping supply and potentially forcing buyers of their services (from offshore decommissioning and elsewhere) to look at other options such as UKCS supply.

If it is acknowledged that capital project spend is interlinked across sectors and countries from a given region, figure 35 provides a significant indication of the demand ahead. The total energy capital project spend for Europe between 2012 and 2035 is estimated at $4,351 billion, the third highest of the world regions listed. This high spend, though varied in sector and activity, will likely place a squeeze on the supply and demand balance in the region over the next few decades, the effect of which could be felt in the UKCS decommissioning industry. This demand could further place pressure on UKCS operators and suppliers to source talent and maintain high levels of human resource.

[25] 2013 Activity Survey, Oil & Gas UK
[26] 2013 Activity Survey, Oil & Gas UK
[27] Anecdotal from Supply Chain Workshop

Figure 35: Cumulative investment in energy-supply infrastructure 2012-2035 (billion in year-2011 dollars)

	Coal	Oil	Gas	Power	Biofuels	Total	Share of GDP
OECD	**204**	**3 341**	**3 720**	**6 787**	**206**	**14 258**	**1.0%**
Americas	79	2 666	2 337	2 852	131	8 065	1.3%
Europe	6	551	924	2 797	73	4 351	0.8%
Pacific	119	124	460	1 138	2	1 842	0.7%
Non-OECD	**963**	**6 641**	**4 854**	**10 080**	**149**	**22 687**	**2.1%**
E. Europe/Eurasia	36	1 239	1 455	1 182	4	3 917	3.5%
Russia	23	745	987	717	-	2 472	3.5%
Developing Asia	844	1 036	1 425	6 768	74	10 147	1.6%
China	634	576	577	3 712	43	5 541	1.3%
India	93	202	199	1 620	19	2 133	2.2%
Middle East	0	1 074	498	577	-	2 149	2.5%
Africa	56	1 604	936	745	1	3 342	4.3%
Latin America	27	1 688	540	808	69	3 132	1.9%
Inter-regional transport	57	259	103	-	22	422	n.a.
World	**1 224**	**10 242**	**8 677**	**16 867**	**357**	**37 366**	**1.5%**

Source: World Energy Outlook 2012, International Energy Agency

Supply Challenges

Contrasting the demand forecast data with the questionnaire supply market data reveals there is a capability gap, demonstrating where talent and resourcing needs to improve. Not one of the activities across the supply chain had an average capability rating at the industry desired level, with suppliers requiring an average improvement of 35% to reach that benchmark. However, this figure has been derived from averages and therefore does not demonstrate that there are still many suppliers operating at level 4 and above.

The average supplier capacity across the supply chain is 38%. Although there is no benchmark to compare this figure to, it seems a high proportion considering it covers nine distinct supply phases. However, this percentage must be tempered by an acknowledgement that, though 38% of the supply market says it has a capability, not all of these supply offerings are as mature as required by the industry and there would likely be less than 38% capacity if going to market today.

In order to improve and expand, suppliers need to be able to bring in talent and develop their resource capability. The first blocker to this is the challenge on ROI given the uncertainty around decommissioning. With many operators delaying decommissioning projects due to risks; fiscal uncertainty; the high oil price; and improved recovery techniques; it is difficult for suppliers to know when there will be demand for their services. This then prevents the suppliers from investing in new resources. Ironically, this lack of capability investment will only serve to further discourage decommissioning; the cycle is therefore self-perpetuating.

Instead, many suppliers are focusing their attentions on positioning themselves for the aforementioned surge in development activities, as these are largely considered more lucrative than decommissioning.

For those suppliers that are trying to develop their workforces, they are reporting that it is hard to attract talent. There are few available resources with decommissioning experience in the UKCS and they may still be unavailable due to the 'resource catch-22' or because they have chosen to work in build areas. In terms of developing new talent, suppliers believe decommissioning is not yet a widely known

area for graduates to get involved in and, for those that do know about it; the perception is that it is not as interesting, lucrative or glamorous as development, thereby discouraging involvement.

Meanwhile, from the perspective of those looking for work, poor scheduling of decommissioning opportunities may discourage many from getting involved. The stop-start nature of project work is often less attractive than the constant income guaranteed by operational activities. There is also generally poor visibility of decommissioning project opportunities for workers, and this stems from the uncertainty of when projects will take place. As a consequence, there could be a continuation of the trend for UKCS workers to migrate to newer petroleum provinces where work is more guaranteed.

Proposed Resolutions

The table below discusses some proposed resolutions to the key talent and resourcing issues:

Resolution	Description
Improve demand visibility	In order for suppliers to make the requisite investment in their resources, they first need to be able to gauge the return from that investment. Better visibility of the demand for their services would allow them to quantify that return and consider the case for investment. There is a perception amongst some suppliers that operators are constrained in the information they can share. In order for there to be better visibility of demand, there needs to be better integrated supply and demand planning. This starts with optimised planning within the operators and then builds out into optimised planning across the operator-supplier interface.
Improve scheduling	Taking the above one step further, if suppliers were better able to know when demand exists for their work, they would be able to better schedule their own demand for resources. Better visibility of work would mitigate the trend for resources to migrate to other sectors and geographies.
Develop awareness and training	Greater emphasis should be placed on decommissioning, at academic, professional and technical levels. If there were better knowledge of decommissioning opportunities for graduates, suppliers would likely see more talent coming through. One observation has been that there are currently no or few decommissioning job titles advertised in the usual channels for graduate job applications. Without the roles being there, graduates are unaware of the opportunities. Other suggestions have included suppliers doing university visits, and even the possibility of developing a skills-based decommissioning MBA or including decommissioning as part of graduate development programmes. Decommissioning training for those already at technical and professional levels would also provide increased talent for the supply market. Ideally, professional training would leverage pre-existing skills and transfer them to the decommissioning space, as explained below.

Resolution	Description
Transfer capabilities	As suggested above, the most efficient way of developing talent for decommissioning would likely be to transfer skills from associated sectors. Three synergy areas have been identified for potential transfer of skills: • Onshore decommissioning → offshore decommissioning • Other industries decommissioning → oil & gas decommissioning • Offshore development → offshore decommissioning By leveraging existing capability, the length, cost and challenge of training will likely be reduced and simplified. However, this would require some change in mindset as there is currently a shared sentiment that the transferability of other areas such as onshore and non-oil & gas to this sector is low and would only present further operational and HSE challenges.

The feasibility and cost/benefits of these proposed resolutions should be explored and considered by operators, suppliers and support organisations around decommissioning. Such discussions could lead to the drafting of a talent and resourcing implementation roadmap for high performance decommissioning.

6.3 Bundling & Supplier Collaboration in Decommissioning Supply Chain Activities

Despite the promise of significant industry spend on decommissioning supply services, with current estimates indicating that ~£1 billion will be spent in the UKCS annually until 2020[28], many suppliers are struggling to enter the market. The following are two contributing factors to that phenomenon:

1. The financial and operational risks associated with decommissioning are discouraging project execution
2. Some suppliers do not have sufficient capability, capacity and experience to service operator demand independently

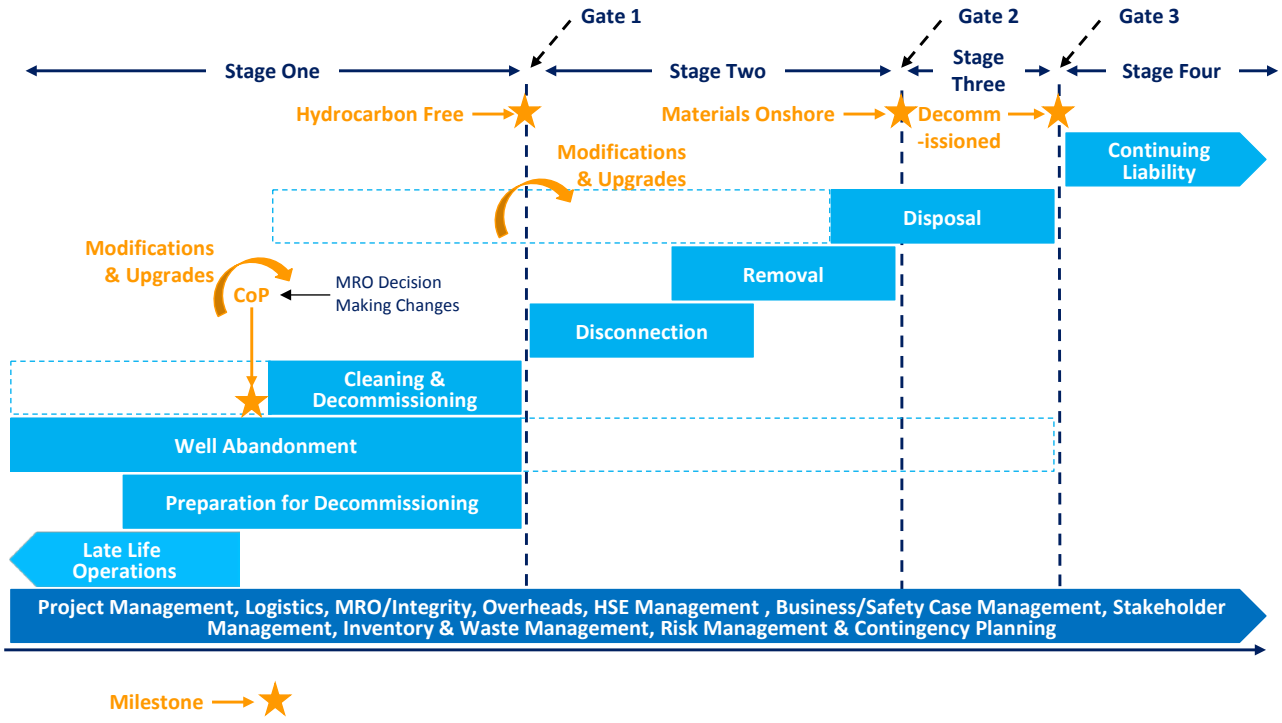
A proposed solution, that would address both these factors, is the more widespread use of bundling.

What is bundling?

Bundling involves packaging together different activities from the supply chain to exploit synergies and benefit both operators and suppliers. It is a practice that is starting to evolve in the decommissioning supply chain, with several joint ventures already appearing, especially in the Disposal phase. However, as the sector matures, it is essential these collaborations continue to be fostered to ensure the maximum value for both suppliers and operators.

There are a number of areas in the decommissioning supply chain of overlapping scope, where there may be commonality in the services required, the suppliers which can perform them and the timing at which they happen, as shown by the stages in figure 2.

Figure 2: Recommended Decommissioning Supply Chain Phase Map



[28] 2013 Activity Survey, Oil & Gas UK

The permutations of how bundling could be carried out across the decommissioning supply chain are many and varied. For example:

- Suppliers could combine their skillsets to offer an enhanced service for just one supply chain activity
- Suppliers could combine their offerings to create a packaged service for a whole phase
- Suppliers could even develop a bundled service offering for multiple phases, with typical multiple phase synergy demonstrated by the stages of figure 2

What would the benefits be?

In whichever way it is manifested, bundling can be of benefit to both operators and suppliers as efficiencies are captured, skills are pooled and more suppliers are involved. This has been demonstrated in other areas of oil & gas operation.

Bundling services, if done correctly, has been proven to reduce the overall cost of operations through achieving synergies in areas such as project management; logistics; inventory and materials management; and HSSE management. Supplier collaboration will pool the skills and experience of multiple suppliers and therefore enhance the capability of the service provided. Collaborating across different skill pools may also act as a catalyst for further innovation as suppliers share techniques, processes and learnings to help further improve their operations.

A further benefit to the operators in bundled services is the ease of doing business. Fewer service providers results in fewer contracts and fewer management responsibilities for the operators. Reducing the cost of decommissioning, encouraging innovation and improving supplier management may make it more profitable and appealing for operators to execute decommissioning projects, increasing activity and generating some momentum in the sector.

Decommissioning projects hold multiple risks: financial, operational, HSE, time and reputational. When going to market, operators will typically look to spread some or all of that risk to the suppliers who will be providing the decommissioning services. This can therefore preclude many smaller niche suppliers, as they do not have big enough balance sheets to underwrite this risk. However, by forming alliances with other suppliers, they will be able to pool that risk and bid for work without jeopardising their business. There would also be more scope for innovative contracting models which might redefine the way risk is handled, an area for which research work has already been carried out.

Bundled services by UK providers may also help ensure a greater proportion of decommissioning work is channelled through UK suppliers. In developing a decommissioning strategy, operators may consider the use of EPCs in order to spread risk, reduce cost and reduce management overheads. However, EPC use, particularly foreign owned and managed EPCs may result in a greater proportion of decommissioning services being awarded to non UK based suppliers. If suppliers make themselves more cost effective and efficient through greater collaboration, the UK supply market can potentially reduce the threat in this area.

Inverse to the type of bundling described above is another collaboration opportunity; the campaign approach. Campaigns are where a supplier or consortium of suppliers will service multiple fields or operators for an activity, phase or stage; rather than multiple suppliers servicing a single field or operator. With an increased volume of work across fewer suppliers, there can be greater economies of scale and increased efficiency. The advantages for suppliers are increased workload and revenue, whilst operators should benefit from cost and time reductions, as well as a greater standardization of service. Campaign approaches have so far been pioneered in the Well Abandonment phase, however activity has been limited and the industry is hoping to significantly extend this approach and its applicability to other phases.

How can bundling be applied to decommissioning?

Figure 36: Typical Decommissioning Stagegate Model

Supplier collaboration, consortia and joint ventures can come together at various phases of the contracting and procurement process and in many forms.

In order for bundling to play any part in a decommissioning project, it is important to understand the process taken by operators in selecting their suppliers. As figure 36 shows, operators will typically follow a stagegate model which dictates when they go to market. If operators are required to tender decommissioning services in the 'Select' phase then it is important that bundling conversations are initiated well before, either in the 'Appraise' stage or, better still, at an earlier stage, when the operator is still defining their decommissioning strategy. Intervention at that early stage will allow greater scope to influence and frame how operators might go to market and to explain the benefits of a bundled model.

Bundling initiatives and conversations could be led by operators, by organisations that support the decommissioning sector (such as Decom North Sea and Oil & Gas UK) or by the suppliers themselves. It is a practice that requires initiative and resourcefulness. Once at the table, the parties then need to agree which bundled services would offer the most synergy, how the arrangement would work and what the commercial terms would be.

6.4 Integrated Demand & Supply Planning

Many factors such as the oil price, regulatory changes, commercial considerations and technological advances are influencing when decommissioning will be carried out. There are also various factors, such as location of asset, type of asset and weight of asset, that influence this. As a consequence the demand profile for different activities in the supply chain is volatile and visibility can be poor.

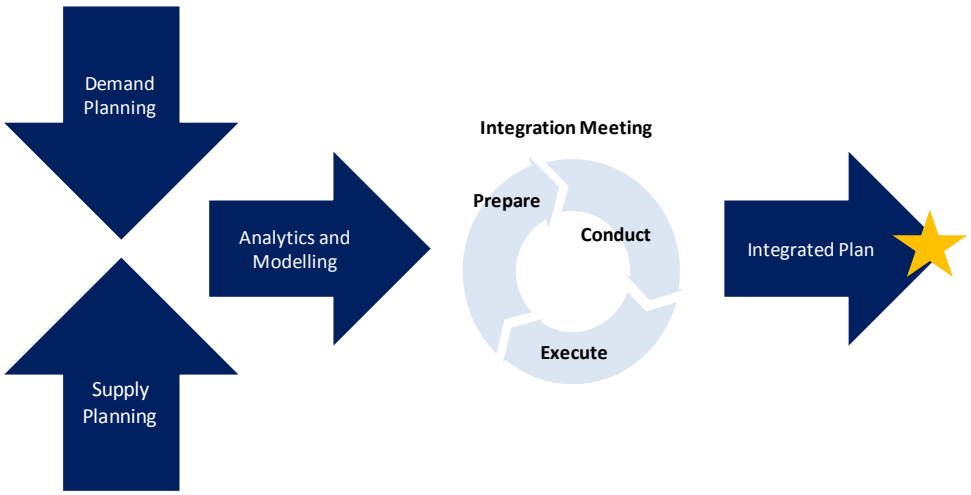
Integrated demand and supply planning would provide better visibility of supply and demand plans, benefiting both operators and suppliers.

What is Integrated Demand & Supply Planning?

Operator excellence in supply chain planning has traditionally been focused on operational demand planning provided by the operations functions, which includes integrated activity planning for wells, production, and projects. This is typically well documented, formulated and communicated within the operator. However, this silo based approach can involve little dialogue, input and interaction with supply planning in the supply chain functions (including supplier management, procurement, inventory management and logistics), which often have a short term view and are notified belatedly of changes to plans, which can result in supply shortages, higher costs and wastage.

The volatile nature of decommissioning activity increases the need to plan – for example if a sudden drop in the oil price fuelled a surge in decommissioning activity, the findings in this study illustrate that the supply market would likely find it difficult to reply to the demand. Optimised integration of supply and demand planning internally and externally could help mitigate this. This can be seen in figure 37.

Figure 37: High Level Integrated Planning Model



This approach would allow companies to unlock value through better sequencing, improved decision support, enhanced organisation effectiveness and increased cost effectiveness.

How would integrated planning work for decommissioning?

Integrated planning for decommissioning would need to start with the operators as that is where demand originates in the market. Operators need to optimally understand their own demand before they can provide visibility of demand to the supply market. If the above model was applied to enhance linkages between the projects, engineering, late life, and supply chain functions, the integrated view of demand and supply would be much improved.

Once plans are clarified, there is scope for better sharing of the pipeline with the supply market which, in turn, would further share supply plans. This could happen in many guises such as meetings, annual 'share-fairs' or an online database (similar to DECCs Pathfinder). This would then allow the supply market to identify demand and invest in its capabilities ahead of time.

It is, of course, worth caveating that confidentiality and uncertainty would still cloud the plan visibility but better integrated planning would certainly allow for better scope of visibility across the decommissioning marketplace.

The level of integrated planning can then be taken one step further to an operational level on decommissioning projects. Operators have acknowledged that, in projects, interface management across all parties is often suboptimal. If plans were better aligned between these groups, they could optimise the use of deck space, beds, logistics services and other support services, potentially reducing the project duration, risks and costs.

If there were a detailed integrated supply and demand planning cycle in place, this would also feed into the operational project plan and provide the benefits of sequencing, synergy and efficiency listed above. This could be done by implementing a three tiered plan view:

1. Strategic View: 18 month horizon
2. Tactical View: 9 month horizon
3. Operational View: 1 month horizon

By providing an operational view, the integrated planning system is able to inform individual project plans as well as high level strategies.

What are the benefits?

Integrated planning brings multiple benefits to suppliers and operators alike, including better sequencing, better decision making, enhanced effectiveness and improved cost efficiency. However, the key benefits for the decommissioning sector are threefold:

1. **Increased visibility of demand**. With optimised planning within operators, there is also scope for better visibility of plans throughout the supply market. This will remove some of the uncertainty in the sector and allow suppliers to invest in their capability which, in turn, will further stimulate demand
2. **Greater scope for synergy**. With an improved strategic and tactical view, there is greater scope for suppliers and operators to identify where synergies lie and look to collaborate through bundling and innovative approaches
3. **Improved operational interface**. With a clear view of supply and demand plans between operators and contractors at the operational level, there can be better sequencing of operational activities on a project, leading to increased efficiency of cost and time, as well as reduced operational issues

6.5 Removing the Decommissioning Mystique: Leveraging Existing Capability

One operator recently remarked that there is too much mystique around the decommissioning challenge that lies ahead. While specific experience in decommissioning is limited and the massive scale of the challenge unquestionable, there is too great a tendency to focus on the headline capability challenges, supply chain bottlenecks and spend forecasts than to recognise that the supply market is relatively well placed already.

Existing Capability

Decommissioning is considered by many as a whole entity and, in that form, it is considered complex, new, risky, expensive and time-consuming. However, when broken down into its constituent parts, decommissioning can be seen for what it really is: multiple services that, in the main, the supply market already provides. Some assert that decommissioning should be considered more as a waste management exercise during the late life period, rather than a unique engineering challenge.

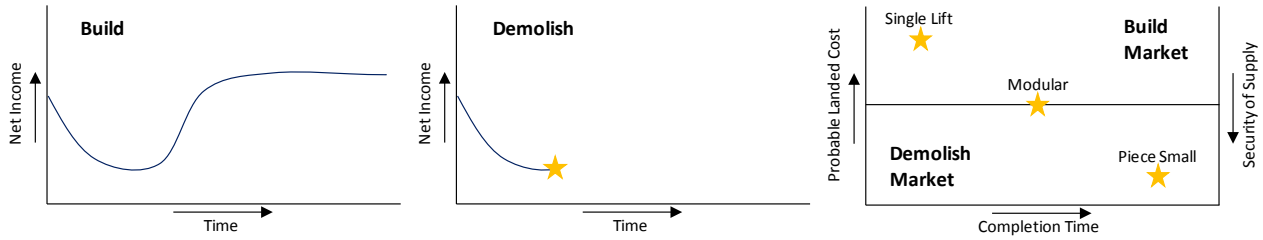
While the notion of labelling decommissioning as waste management could be considered a matter of semantics, its impact on the supply chain could be very tangible. Since waste management; in the many guises of re-use, re-cycling, deconstruction, demolition and disposal; is regarded by suppliers and operators as a more mature area of the supply chain, there are widespread calls to involve these suppliers earlier in the decommissioning process.

Research and analysis in this study has shown that Disposal is the phase with the second highest average supplier capability at 3.16 and second highest level of actual decommissioning experience at 32% of suppliers. It has been suggested that this strength of supply could therefore be leveraged in other phases of the supply chain where the capability is weaker. The prime example is Removal as this has a capability of 2.83, well documented heavy lift supply shortages and synergies of time and activity with the Disposal phase. Disposal contractors could be involved either in a project management capacity, to identify waste streams, to remove excess waste and materials or even to do the removal itself if a piece small removal strategy were being used.

The idea of applying suppliers from one phase to support another phase works well with Disposal but is not restricted to it. The same theory could be applied anywhere where the phases have synergy. Leveraging this existing capability will not only create greater capability in weaker areas of supply but also provide more work for the areas where the supply may outstrip the demand: having an overall balancing effect on supply and demand across the decommissioning market.

A Split Services Market

Figure 38: Split Services Market – Removal and Disposal Example



Leveraging existing capability to optimise the supply and demand balance of the market could be taken further with the notion of a split market place. Continuing with the theme of the Removal and Disposal phases; Removal has scarce supply for heavy lift activity and these suppliers are the same large companies that deal with high profile development projects; while Disposal has abundant smaller suppliers that could support Removal activities and are not tied up with development work.

The argument would be that, since the scarce heavy lift suppliers offer such a unique, expensive and high value offering, and there is stiff competition for them from the development market, their services are more suited to 'build' activities that, as figure 38 shows, will continue to add value over time. Disposal contractors, however, are more numerous, have strong capability and are not largely involved in development activities. Since the latter group presents less cost, it is more suited to 'demolish' activities that, as figure 38 demonstrates, cannot add value beyond the end of the project.

Taking these assertions forward, then, the benefits of a market where the 'build' and 'demolish' activities are separated from one another can be seen. This would allow 'build' suppliers to concentrate on lucrative capital projects and free up more demand for the 'demolish' suppliers, creating more work, more marketplace competition and more developed capabilities. Moreover, as the 'build' suppliers are largely international and the 'demolish' suppliers more local, this would reap benefits on the local supply chain and economy in the UKCS. This would be an advantage to the operators as well, as security of supply would go up and their bargaining power would increase.

In the context of the Disposal and Removal example, then, one would see HLV operators focusing on capital projects and more scope for Disposal services to get involved at an earlier phase in the supply chain, leveraging existing capability. It is a particularly strong example because, while the headlines are concerned with the shortage of HLVs for decommissioning, it should be emphasised that an estimated 85%[29] of the structures requiring removal in the UKCS are the small structures and pipelines that will not require the top categories of heavy lift capability. Hence the capability is already there, with smaller lift vessels and Disposal contractors, to remove the vast majority of the structures. Although this example aligns strongly to piece small removal, a much debated technique, it is a universally applicable notion that could work in several phases of the decommissioning supply chain.

The split service marketplace also does not necessarily require that those suppliers working in the 'build' market exit the 'demolish' market. It does, however, mean that those suppliers could divide their activities so that they have a permanent decommissioning arm with dedicated resources. These arms would then compete in the 'demolish' market without the interference of the companies' 'build' arms.

To conclude, the fact remains that the decommissioning supply chain lacks some of the capability and capacity required to meet estimated future demand. Capability requires a 35% improvement to meet the industry desired level and average capacity across activities is a relatively low 38% of total suppliers. However, a change of mindset to proactively focus more on what current capability can offer, rather than where the gaps exist, would help remove the "decommissioning mystique". By focusing on how capability can be framed and leveraged to optimise the supply and demand balance along the supply chain, the challenge ahead may be much reduced.

[29] Operator Estimates

7.0 Recommendations

Throughout the study, recommendations have been made to address the challenges and harness the opportunities that exist across the supply chain. This chapter brings together these recommendations.

Preparation for CoP

Supplier involvement in the Preparation for CoP phase can be limited as much of the planning and forecasting is done in-house by the operators. Moreover, the suppliers that are contracted for the phase are often the incumbent suppliers that have been servicing the asset during its operational life, hence reducing opportunities for other capable suppliers.

However, the many studies and surveys required by the phase are usually contracted out, allowing further suppliers to get involved. Moreover, if there was a change of mindset to consider Preparation for CoP more as part of an integrated late life period, there would be further scope both for suppliers to get involved and for operators to capture efficiencies in project delivery.

Recommendation	Description
Encourage 'late life' mindset	Examine and articulate the benefits of treating operational end of life and the early decommissioning phases as one continuous, synergised stage
Define late life process	Bring together experts to define a standardised, gated and transparent approach to late life decisions and operations
Encourage a more diverse supply base	Encourage or look to incentivise the usage of diverse suppliers, allowing more to develop requisite knowledge to enter this sub-market and add maturity to it
Develop standardised decommissioning project planning template	Bring together experts to define an optimised and standardised planning template that will allow for better sequencing, longer horizon planning and better integrated activities throughout the entire decommissioning project

Suspension Live

Suspension Live is a phase that is both expensive for operators and not greatly profitable for the supply chain; the majority of spend being on overheads and support services. Supply market possibilities are also hampered by the continued presence of the incumbent suppliers from the asset's operational life. However, if integrated with other phases, Suspension Live could present improved options for suppliers and operators alike.

Recommendation	Description
Integrate with other phases	Integrate this phase with others such as Preparation for CoP, Well Abandonment and Cleaning & Decommissioning to allow suppliers and operators to better plan and sequence activities, as well as capturing supply synergies across the phases

Well Abandonment

Well Abandonment likely presents the greatest tests of all the supply chain phases given the size and complexity of the (known) challenges that lie ahead, as well as the generally low capability and capacity of the supply market.

With strength in the well servicing market, current capabilities could be transferred and tailored to suit abandonment needs. More knowledge sharing, better integrated planning and a focus on resourcing will likely be key to the success of the abandonment supply market.

Recommendation	Description
Plan and execute earlier	Earlier planning allows for more preparation, reduced complexity, less risks and therefore improved performance and heightened cost containment. Executing earlier mitigates integrity and timing issues, therefore containing costs and preventing overruns
Integrate plans	Integrated planning - operators to suppliers, and suppliers to suppliers – allows for better pipeline visibility, smoothes supply and demand, improves sequencing and presents greater opportunities for collaboration. This could be encouraged in pockets or managed across the sector from a central initiative
Broadcast the challenge	A push to broadcast the challenge and complexity of the UKCS Well Abandonment task ahead would stimulate operators to think more about their plans and investment, the government to consider support and regulatory revision and suppliers to further prepare their capability
Talent and resource focus	A co-ordinated drive for increased training and recruitment in the abandonment area, with a focus on transferring skills from similar sectors, would benefit suppliers and operators alike and be an exportable trade in years to come
Integrate with other phases	Since there is a degree of commonality to the activity, timing and supply requirements between this phase and others such as Preparation for CoP, Suspension Live and Cleaning & Decommissioning, the phases could be integrated. This approach would allow suppliers and operators to better plan and sequence activities, as well as capturing supply synergies across the phases

Cleaning & Decommissioning

Cleaning & Decommissioning is an area of proven capability, capacity and experience. The supply market should guard against complacency and continue to look at innovation and improvement opportunities in order to remain competitive and sector-leading.

Recommendation	Description
Analyse cost/benefit of earlier cleaning	Bring together experts to quantify and analyse the costs and benefits of carrying out Cleaning & Decommissioning earlier in the decommissioning lifecycle. Publicise findings and encourage earlier cleaning if it proves beneficial

Recommendation	Description
Analyse cost/benefit of onshore cleaning	Bring together experts to quantify and analyse the costs and benefits of carrying out parts or all of the Cleaning & Decommissioning process onshore. Publicise findings and encourage onshore cleaning if it proves beneficial
Integrate with other phases	Since there is a degree of commonality to the activities, timing and supply requirements between this phase and others such as Preparation for CoP, Well Abandonment and Suspension Live, the phases could be integrated. This approach would allow suppliers and operators to better plan and sequence activities, as well as capturing supply synergies across the phases

Disconnection

Disconnection is another phase with strong supply capability, knowledge and experience. This strength is tempered, however, by the prospect that there would be less significant demand for Disconnection services in the future were single lift to become a more common removal technique. Derogation possibilities also pose a threat to the Disconnection supply market and it must therefore continue to develop and innovate to remain relevant and competitive.

Recommendation	Description
Integrate with other phases	Since there is a degree of overlap to the activities, timing and supply requirements between this phase and others such as Removal and Disposal, the phases could be integrated. This approach would allow suppliers and operators to plan, sequence and synergise across the phases
Learn from other regions	Research and analysis should be carried out to see how lessons can be learned and harnessed from other regions in terms of systems, processes and people
Test place in the market	Disconnection suppliers should consult with operators, removal contractors and regulatory agencies to gauge the likelihood of reduced work stemming from single lift removal and jacket derogation cases in the future. From that, they can gauge probable future demand and set their strategies to match

Suspension Cold

Suspension Cold, being a phase of uncertain length, as well as requiring few services, is not seen as a very profitable opportunity for suppliers or a productive phase for operators. Moreover, the rapid asset deterioration endemic of 'lighthouse mode' makes it a problematic phase. However, packaged service offerings and integrated approaches could help turn the phase into a positive for suppliers and operators.

Recommendation	Description
Packaged offering research	Bring together experts to quantify and analyse the costs and benefits of developing a packaged service offering for Suspension Cold. Publicise

	findings and, if it proves beneficial, encourage both suppliers and operators to consider these options
Integrate with other phases	Since there is some overlap in timing and supply requirements (maintenance, integrity and support) between this phase and others such as Disconnection, Removal and Disposal, the phases could be integrated. This approach would allow suppliers and operators to plan, sequence and synergise across the phases

Removal

Removal is the most publicised and most discussed area of the decommissioning supply chain. Strengths do exist in project management capabilities, in the lower lift categories and even in heavy lift (although capacity is low).

The opportunity is there for an innovative solution to prevent the heavy lift supply chain bottleneck, be it through investment, technological innovation or novel contracting models. However, the fact remains that an estimated 85%[30] of the structures in the UKCS are small structures and pipelines that will not require the major heavy lift vessels, reducing the potential negative impact of low heavy lift capacity.

Recommendation	Description
Develop innovative approach	There is debate and differing opinion over the pros and cons of the three major removal methods: single lift, reverse engineering and piece small. An innovative approach could provide a universally accepted solution for which the pros outweigh the cons
Create Disposal linkages	Removal and Disposal activities could be better integrated by involving the Disposal contractor earlier on in the planning and execution of the process. This would mean working backwards from a desired project end point and planning from there. This could allow for more efficient waste management; better quantification of what needs to be disposed offshore and onshore; clearer definition of what 'known condition' it needs to be in; quicker routes to revenue streams through scrap and re-use; and better all-round planning and synergy

Disposal

Disposal is considered by many industry stakeholders as the offering with the strongest capabilities across the decommissioning supply chain. It is an area of proven capability and experience. There are, however, some concerns around Disposal yard capacities, should demand increase, as well as the lack of deep-water facilities in the UKCS.

There is also a popular theory that Disposal contractors should be involved earlier in the decommissioning process to ensure the management of waste streams, to properly define what needs to be disposed of offshore versus onshore and to bring in potential revenue streams (scrap, re-use) earlier in the process.

[30] Operator estimates

With several yards under development and possible opportunities for Disposal contractors to become involved in earlier stages of the decommissioning process, there is the potential for strong activity growth and expansion for Disposal suppliers.

Recommendation	Description
Bring Disposal contractors into the decommissioning process earlier	Operators and Tier 1's should bring in Disposal contractors earlier in an advisory or waste project management capacity. This would allow more efficient end to end waste management; better quantification of what needs to be disposed offshore and onshore; clearer definition of what 'known condition' it needs to be in; quicker routes to revenue streams through scrap and re-use and better all-round planning and synergy
Optimise yard demand	More facilities can do topsides than jackets – if the bigger yards were to focus on the jackets and the smaller ones focus on the modular work, there would be larger Disposal capacity across the market at any given time, more yards would be working and collective market revenues would be greater
Research and leverage learnings and synergies from salvage and nuclear	The Disposal supply pool could benefit from learning from the salvage market, which traditionally offers a much faster service and has a different mindset to oil & gas. There may even be opportunities to collaborate with salvage suppliers in terms of planning and execution (although there are HSE regulatory blockers). The nuclear industry also presents learning opportunities, especially with regard to waste characterisation and handling

Continuing Liability

Continuing Liability is not considered a big opportunity area for suppliers outside of the monitoring space as, in the absence of an issue being found, this is the only required activity.

Continuing Liability is not a phase with high spend over a given short period of time but, as the operator will be liable in perpetuity, this does present some suppliers with the opportunity to lock down smooth and longstanding demand for their services.

Other suppliers could also consider innovative service offerings to enter this space.

Recommendation	Description
Develop service offering	Examine the feasibility and benefits of a packaged service for Continuing Liability – perhaps offering monitoring, assessment and logistics – could fill a gap in the current supply provision.
Bundle with other phases	Examine the feasibility and benefits of bundling Continuing Liability with other activities in the supply chain such as the surveying activities in the Preparation for CoP phase, monitoring during the Suspension Cold phase or logistics throughout the decommissioning lifecycle

Lifecycle Recommendations

Drawing together all the research and suggestions from the nine phases of the decommissioning process results in multiple lifecycle recommendations. However, by prioritising the challenges and dovetailing the common themes, the following key recommendations have been identified for optimising the decommissioning supply chain:

Recommendation	Description
Integrate planning	Optimise integrated planning within operators and across the operator-supplier interface. Better planning will not only reap benefits such as improved visibility of demand and supply and better sequencing of projects; it will also facilitate other benefits such as increased investment in capabilities and increased scope for collaboration, bundling and phase -integration
Practice collaboration & bundling	Launch further initiatives to encourage collaboration & bundling of supply activities. Increased collaboration & bundling will allow more suppliers to work in decommissioning, alleviate decommissioning risk, foster learning and development, improve the capability of supply and drive cost efficiencies
Plan & execute earlier	In order to encourage the planning & executing of decommissioning earlier, articulate and emphasise its benefits to key industry stakeholders. Earlier activity will reduce the potential for complexity and integrity issues, improve the operational performance of the decommissioning projects and bring forward supplier decommissioning demand and revenues. This, in turn, will reduce financial, time, operational and HSE risks for operators; as well as allowing suppliers to develop their capabilities.
Develop talent & resourcing	Develop talent and ensure proper levels of resourcing to ensure supply can meet forecast demand. This essential measure for ensuring the supply market can service demand could be achieved by improving visibility of resource demand, launching training initiatives to transfer existing skills, engaging more with universities and creating more decommissioning specific work positions
Leverage supply strengths	Encourage the utilisation of strong suppliers in other areas of supply weakness. Leveraging supply strengths will increase the overall capability, capacity and revenue of the supply chain, lessen the likelihood of supply chain bottlenecks and encourage collaboration and skills transfer from one phase to another. This may help usher in a sustained period of increased decommissioning activity

IMPORTANT NOTICE

It must be noted that the results of this research and the analysis found in this study are a product of the aggregated views of those that took part in the supplier questionnaire, supply chain workshop and face to face meetings. The study is limited to the suppliers and operators that took part and does not reflect the capabilities or opinions of all suppliers and operators in the UKCS. This material cannot be considered an exact representation of the supply market but rather an indicative picture of current market trends, movements and sentiments.

It should also be stressed that, as an aggregated opinion of multiple industry stakeholders from supplier and operator organisations, the contents of this document are not the direct opinion of Scottish Enterprise, Decom North Sea or Accenture.