Investigating Decommissioning Options Selection: A Survey-Driven Approach.

Emmanuel Eke[1], Ibiye Iyalla[2], Radhakrishna Prabhu[3] and Jesse Andrawus[4]

[1] *School of Engineering, Robert Gordon University Aberdeen, UK – e.eke@rgu.ac.uk*
[2] *School of Engineering, Robert Gordon University Aberdeen, UK*
[3] *School of Engineering, Robert Gordon University Aberdeen, UK*
[4] *AIMRE Consulting Limited.*

I would prefer to give a talk

Offshore decommissioning projects attract little or no return on investment and can result to adverse consequences when carried out sub-optimally, therefore it is pertinent that they are efficiently planned and executed. Several options exist for decommissioning offshore platforms and the selection of the optimal option for a project is a complex decision-making problem involving multiple considerations and trade-offs.

In this work, an MCDA model for options selection is proposed and applied to a case study platform using a survey driven approach and criteria/sub-criteria gathered from an extensive literature review of decommissioning. A hybrid of the Likert Scale and Analytic Hierarchy Process techniques was used for data collection and analysis. Survey participants comprised 78 decommissioning experts from the North Sea, Offshore USA, and other offshore regions. The survey also investigated key considerations for decommissioning and variations in the perspective of individuals across different offshore locations.

Results suggest that partial removal is the preferred decommissioning option, and safety and environmental impact are the most crucial considerations for decommissioning options selection. The identified sub-criteria for environmental impact were ranked by participants in order of importance with about 30 additional sub-criteria suggested for inclusion into the analysis. Also, analysis of survey responses with a weighted geometric mean based on decommissioning experience of respondents indicated that substructure weight, water depth and platform age are the platform features with the highest influence on options selection. These features are thus likely to be suitable for development of parametric models to aid options selection as historical data becomes more available. Lastly, it was observed that stakeholders from the North Sea, compared to people from other regions, were observed to be more averse to leaving the platform in place.

Acknowledgements

The author wishes to acknowledge

- Robert Gordon University, Aberdeen U.K for partially funding this research project and
- Asset Integrity Management & Reliability Engineering (AIMRE) Consulting for their time and technical contribution.

References

Eke, E., Iyalla, I., Andrawus, J. and Prabhu, R. (2020). Optimising Offshore Structures Decommissioning-A Multicriteria Decision Approach. Paper presented at the *SPE Nigeria Annual International Conference and Exhibition*. OnePetro. SPE-207206-MS

Gourvenec, S. (2018). Shaping the offshore decommissioning agenda and next-generation design of offshore infrastructure. *Proceedings of the Institution of Civil Engineers-Smart Infrastructure and Construction*, *171*(2), pp.54-66.

Compiling a Database of Offshore Energy Structures in the North Sea: Past, Present and Future

Martins, MCI[1], Carter, MID[1], Rouse, S[2] and Russell, DJF[1]

[1] *Sea Mammal Research Unit, University of St Andrews– mcim2@st-andrews.ac.uk*
[2] *Marine Scotland Science, Marine Laboratory, 375 Victoria Road, Aberdeen AB24 2TZ, UK*

I would prefer to give a talk

Offshore man-made structures such as oil and gas (O&G) platforms, pipelines and wind energy developments are present globally (Jouffray et al, 2020, McLean, et al, 2022). However, the number, type and age of these structures are changing as the offshore wind energy sector expands whilst O&G structures reach the end of economic viability and are decommissioned and removed (Jouffray et al, 2020, McLean, et al, 2022, Burdon et al, 2018). The North Sea is an area which supports major offshore energy production and consequently is an area for high density of offshore structures (McLean, et al, 2022).

One major challenge when attemping to study man-made structures in the North Sea is the lack of a single database with current and accurate metadata (e.g. installation date, operational status, removal date) and locations. Existing databases are spatially restricted, lack metadata, or contain inconsistencies and conflicting metadata and locations.

Here we aim to develop a comprehensive spatial database of offshore energy infrastructure including O&G platforms, pipelines and wind energy developments (wind farm footprints, wind turbines and associated structures) in the North Sea.

Data were collated from all available disparate sources subject to a quality assurance procedure. The metadata compiled were: type of platform, fixed or floating status, number of legs (where applicable), installation date, date of first oil, operator, operator status, removal date, planned removal date, and absence/presence of platform. Where possible, remaining data gaps or inconsistencies were rectified using individual UK Decommissioning reports or operator and company websites. The locations were compared across data sources and were assumed to be correct if all latitude and longitude values matched.

The final shapelayer will facilitate further research on man-made structures in the North Sea for a range of stakeholders ranging from ecologists, engineers, policymakers, industry advisors and even goescientists and geographers. Indeed, it is a fundamental requirement to robustly quantify and predict the impact of North Sea man-made structure on the ecosystrem and its services.

Acknowledgements

We would like to acknowledge SUPER DTP for funding and to thank Lesley Phillips from Marine Scotland Science and Michael Redford from SAMS for their support in data collation.

References

Jouffray, J.B., Blasiak, R., Norström, A.V., Österblom, H. and Nyström, M., 2020. The blue acceleration: the trajectory of human expansion into the ocean. One Earth, 2(1), pp.43-54

McLean, D. L., Ferreira, L. C., Benthuysen, J. A., Miller, K. J., Schläppy, M.-L., Ajemian, M. J., Berry, O., Birchenough, S. N. R., Bond, T., Boschetti, F., Bull, A. S., Claisse, J. T., Condie, S. A., Consoli, P., Coolen, J. W. P., Elliott, M., Fortune, I. S., Fowler, A. M., Gillanders, B. M., … Thums, M. (2022). Influence of offshore oil and gas structures on seascape ecological connectivity. Global Change Biology, 00, 1–22

Burdon, D., Barnard, S., Boyes, S.J. and Elliott, M., 2018. Oil and gas infrastructure decommissioning in marine protected areas: system complexity, analysis and challenges. *Marine Pollution Bulletin*, *135*, pp.739-758.

Decommissioned Oil-Rigs in the Marine Environment: Friend or Foe?

Gareth E Thomas[1], Erin Losty[1], Boyd Mckew[1], Eoin O'Gorman[1], Corinne Whitby[1] and Natalie Hicks[1]

[1] *School of Life Sciences, University of Essex, Wivenhoe Park, Colchester, Essex, CO3 4SQ, UK – gthomab@essex.ac.uk*

I would prefer to give a talk.

The North Sea is home to the largest proportion of offshore oil-rigs in the world, most of which remain *in situ* and unused after ceasing hydrocarbon extraction. There is a wealth of literature suggesting these man-made structures can act as artificial reefs, which may boost macrofaunal diversity. Their impact on microbial ecology, such as bacterial abundance and community structure, is less certain, however, as is the effect of environmental stressors on community similarities with increasing distance from the oil-rigs. In June 2021, we sampled sediments along 3 km bidirectional transects away from two *in situ* decommissioned oil-rigs in the Northern North Sea, UK: namely, Miller and North West Hutton. Here, we present preliminary findings from our study.

Analysis of the environmental chemistry revealed heavy metal concentrations decreased with increasing distance from the oil-rigs. Hydrocarbon concentrations and compositions are still under investigation, though preliminary analysis also suggests significant changes with increasing distance from the oil-rigs. Molecular analysis revealed the abundance of the bacterial 16S rRNA gene decreased with depth at both sites and with distance at North West Hutton. Additionally, there was a decrease in the abundance of the eukaryotic 18S rRNA and the fish 12S rRNA genes with increasing distance at North West Hutton. Bacterial community structure was clearly dissimilar with sediment depth and oil-rig location, as well as with sediments closer to the oil-rigs (50 – 200 m) compared to those further away (400 – 3200 m). The abundance of bacteria capable of utilising hydrocarbons as a source of energy and carbon averaged 2-3% of the community, with only some minor effects with distance from oil-rigs.

Preliminary findings from this study of two decommissioned oil-rigs in the North Sea suggest that there are increased levels of pollution in the surrounding sediments. Future work should assess whether removing these structures could increase levels of pollution, not only locally but over larger distances. Additionally, there is evidence these man-made structures could act as unofficial marine protected areas. Remaining analysis will be completed shortly as we ascertain whether decommissioned oil-rigs act as an adversary or ally to the marine environment.

Acknowledgements

The authors would like to thank Sally Rouse and the crew and staff members onboard the MMS Scotia research vessel who secured the sediment samples used in this study. Additionally, we would like to thank technician John Green of the University of Essex, and Hugh Kinsella, for their assistance in the laboratory. This work was funded under the Functionality and Ecological Connectivity of Man-Made Structures (FuECoMMS) project by the Natural Environment Research Council (NERC) via the Influence of Man-made Structures in the Ecosystem (INSITE) programme (NE/T010800/1).