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EXAMINING THE REGULATIONS GOVERNING OFFSHORE DECOMMISSIONING IN FIVE COUNTRIES ADVANTAGES AND DISADVANTAGES

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Abstract
In the decades ahead, the decommissioning of offshore structures worldwide will remain a persistent issue, as numerous structures will surpass their expiration or become unproductive when reservoirs are no longer utilized. This article analyzes the global offshore decommissioning legal framework and summarizes the rules in countries recognized for their expertise in decommissioning, specifically the UK, Norway, and the USA. The oil-producing nations of Malaysia and Thailand in Southeast Asia are examined to uncover potential deficiencies in decommissioning legislation for countries at the nascent decommissioning stage. The distinctions were recognized regarding decommissioning preparation, technical execution of decommissioning, supplementary environmental standards, and the financial security framework. In conclusion, most legislation about the technical sector is analogous throughout all examined countries. Significant distinctions exist between two primary philosophies of the framework: a prescriptive regime and a goal-setting regime. Other decommissioning facets garner heightened scrutiny, including the elucidation of in situ decommissioning, residual liabilities, the optimization of financial considerations associated with decommissioning, and the transfer of waste from offshore to onshore. The deficiencies in the current framework can be addressed by adopting an evidence-based approach in its development.
Keywords: Decommissioning regulations, Offshore, Abandonment, Removal

INTRODUCTION

The term 'decommissioning' lacks a clear definition in international and various national legislations and may encompass terms such as 'abandonment,' 'disposal,' and 'removal,' which represent potential processes involved in decommissioning. While the phrase "abandonment program" is used in the Petroleum Act, the more widely used term is "decommissioning program," according to the UK Petroleum Act (1998) and the 2011 Decommissioning Guidelines (Department for Business Energy and Industrial Strategy UK, 2011).

According to the majority of the legal requirements examined in this paper (Department for Business Energy and Industrial Strategy UK, 2011; Government of USA, 2014a; Petroleum Institute of Thailand (2008); Petroleum Safety Authority (Norway), 2015a; PETRONAS, 2008) and current decommissioning practices (Techera & Chandler, 2015), decommissioning appears to be the last stage of an industrial facility's life cycle. It involves closing an industrial facility using methods that balance the delicate boundaries of minimizing financial costs, losses to human life and well-being, and environmental costs.

This report refers explicitly to offshore production facilities as industrial facilities. Offshore facilities consist of a substructure affixed to the seabed, a network of conduits, and a topside structure above the seabed (Techera & Chandler, 2015). The decommissioning process involves the plugging and abandonment of wells, the partial or complete removal of the platform and its associated facilities, and the clearance of any above-midline structures or equipment from the seafloor.

Numerous offshore installations are on the brink of obsolescence in the global context. In the North Sea, there are 1,357 offshore installations, 726 subsea steel installations, and permanent steel installations (OSPAR Commission, 2013), of which 20% exceed 30 years of age (OSPAR Commission, 2013). According to Lyons (2012), there are currently 444 offshore installations in Southeast Asian waters, including the South China Sea and the Gulf of Thailand, that have been in operation for 20 to 30 years, and another 389 that have outlived the expected 30-year service life of such installations and are still in use. Many people are anticipated to initiate decommissioning in the coming years. Both international and domestic laws constrain decommissioning restrictions. Numerous decommissioning alternatives exist, including whole or partial removal, structural severance possibilities, and the retention of shell mounds and drill cuttings; nonetheless, there appears to be a lack of clarity and conflicting philosophies in various international rules. A review of five case studies on local and global maritime legal requirements underscores the feasibility of decommissioning options in the respective countries, including waste management and environmental monitoring mandates for rigs-to-reefs projects.

LITERATURE REVIEW

Scope of paper

Initially, this paper identifies international regulations that are pertinent to decommissioning. Subsequently, to comprehend the decommissioning processes in countries proficient in these activities, a brief examination of the domestic rules of Norway, the UK, and the USA is conducted; further details can be found in another conference paper summarized by the authors regarding these three nations (Fam et al., 2017). Some aspects of the international requirements are anticipated to be included in this domestic legislation. Countries such as Malaysia and Thailand are increasingly developing their decommissioning rules within the offshore business, making them relevant case studies. In Southeast Asia, only Malaysia and Thailand have accessible resources for decommissioning legislation or recommendations, therefore emphasizing these two nations. Recently established rules may present an intriguing or more comprehensive solution to the issues prevalent in all decommissioning activities.

Decommissioning procedures

Decommissioning is typically a process that involves the cessation of operations, the closure of wells, decontamination, the securing of the platform, and the removal, disposal, or relocation of

facilities in accordance with international and national legislation. A standard decommissioning approach for a prevalent type of offshore construction, specifically a jacket structure, is examined (Osmudsen & Tveteras, 2003; see Fig. 2).

The initial phase entails strategizing for decommissioning, usually beginning 2–3 years prior to the cessation of production. The planning process entails a comprehensive documentation assessment, including equipment leases, production sales agreements, drilling records, and maintenance and inspection logs.

Field inspections of equipment, including wellheads and platform structural conditions, are conducted to facilitate precise technical assessments about the disassembly and removal of structural modules in segments. The third stage involves developing permits and filing the decommissioning plan, which succinctly compiles the work completed in the initial step together with the suggested future measures.

Physical decommissioning work, including plugging and abandonment of the well, is initiated in the third phase. Wells will be sealed with cement or alternative substances, and the wellheads will be cut and extracted. The fourth phase involves the elimination of the conductors. Abrasive cutting techniques are generally employed to sever the conductors, which are then surfaced and cut into smaller, more manageable pieces for transportation onshore. Once the conductors are disconnected and extracted or removed from beneath the mud line using a casing jack. The fifth step involves the preparation of the platform. It necessitates decontaminating the topside (the production area) and disconnecting piping, electrical, and instrumentation connections between production modules.

Subsequently, portions of the platform will be designated for installing new pad eyes and lift supports to facilitate sectional removal. Inspection beneath the waterline will be conducted by divers or remotely operated vehicles (ROVs) to delineate the areas of the jacket designated for removal. The sixth phase is pipeline decommissioning, entailing the flushing and cleaning of the pipelines. The pipeline will be cut above the riser bend, and the remaining sections will be sealed with plugs. Pipelines may remain or be removed based on the approved proposal. Like the conductors, the pipes will be segmented into smaller portions to facilitate onshore transit. At this juncture, the processing equipment and pipelines are dispatched to shore for three potential alternatives: refurbishment and reuse, sale as scrap, or disposal in a landfill (Kaiser & Pulsipher, 2005).

RESULTS AND DISCUSSION

Decommissioning framework in areas with an established history of decommissioning

Decommissioning is more established in the North Sea and the Gulf of Mexico than in other regions. Norway and the United Kingdom are the principal nations in the North Sea, whereas the United States oversees the offshore operations in the Gulf of Mexico.

The technical requirements in the North Sea and Gulf of Mexico regions are generally analogous. They encompass aspects such as the depth for structure removal, in situ pipeline decommissioning (in the US and UK), waste management and accountability related to waste shipment, and the application of options analysis methodology to evaluate the optimal decommissioning approach for a specific area.

The legal framework encompasses two primary approaches: a prescriptive approach and a goal-setting approach. The prescriptive approach entails the regulator establishing mandatory requirements for the operator. In contrast, the goal-setting approach permits the operator to formulate their objectives within legal constraints and demonstrate to the regulator that they are fulfilling them. It is evident regarding safety standards and the necessary depth for removing sub-sea constructions. In the USA, it is mandated at 15 feet beneath the seabed; however, the operator determines it in the UK and Norway.

Regarding the financial framework, the UK and the USA possess a bond or financial security structure predicated on varying risk assessments of a company's profile to guarantee that funds are allocated for the decommissioning operation. The UK framework is notably more robust, as the recently amended Energy Act (2016) established the Oil & Gas Authority (UK) as an independent regulator endowed with enhanced powers, including access to company meetings, data acquisition, and the imposition of sanctions (Department for Business Energy and Industrial Strategy UK, 2011). It enables proactive intervention at the preliminary stages of potential issues, allowing for data collection and attendance at company meetings to address the 'what if' scenarios regarding operators' compliance with decommissioning milestones.

The United States exhibits greater openness regarding the legal and technological environment for re-utilizing offshore infrastructure. The states' geographic location may enhance fisheries production through rigs-to-reef operations, indicating that the reef-to-rigs program provides income in additional capacities beyond its function in the offshore business. The US reef-to-rigs system additionally accounts for financing the management of the reefs by offsetting decommissioning expenses incurred by the facility owner when shifting the structure to a rigs-to-reef site. Norway, the UK, and thirteen other nations in the North Sea ratified the OSPAR convention and must adhere to OSPAR decision 98/3. The OSPAR final standards, influenced by the Brent Spar dispute, banned non-virgin materials as permissible for reef construction, prohibiting rigs' use in the North Sea (Jørgensen, 2012). This region may benefit from legislative enhancements incorporating a case-by-case assessment of a structure's appropriateness for rigs-to-reef initiatives.

Regarding health and safety and overall operating safety, Norway and the UK adopt a goal-setting approach, but the US employs a more prescriptive method, mandating a uniform set of rules that operators. The goal-setting strategy entails the operator formulating their targets and presenting a rationale to the regulator that they are effectively managing safety.

Legal constraints inherently define the parameters of the relevant safety cases. There are minor distinctions between the systems in Norway and the UK; in the former, it is referred to as Acknowledgement of Compliance, whilst in the latter, it is termed a Safety Case. Such goal-setting systems are effective only when the pertinent statutory requirements are sufficiently robust in general and technical management.

The flexibility of a goal-setting system enables exemptions to be granted, provided that remedial measures are identified or justified in order to demonstrate compliance with the overall safety objectives.

The concept of "as low as reasonably practicable" (ALARP) is a crucial component of the goal-setting framework. It aims to quantify the extent to which significant hazards can be managed and risks mitigated before expenses become disproportionate to the benefits achieved. It is significant because the responsibility now rests with the operator to guarantee safety instead of relying on a prescriptive system where a checklist of completed safety items may provide a misleading sense of security regarding the efficacy of a safety management system. Furthermore, each platform is distinct and administered uniquely; hence, the goal-setting framework may be more extensive. It is particularly relevant when shifting from routine hydrocarbon production tasks to novel decommissioning procedures, such as plugging, while operating with limited access to various plant sections as it is demolished incrementally.

Comparative assessment is another distinctive aspect of the United Kingdom's approach, as it is frequently employed to determine the optimal course of action for the extent of decommissioning and to substantiate derogation cases. Comparative evaluations are extensively utilized in decommissioning pipelines to determine optimal choices, including societal, technical, economic, human safety, and environmental concerns. In situ decommissioning methods frequently encompass provisions for long-term monitoring or prospective removal strategies when technology permits (Oil & Gas UK, 2015).

Norway and the UK possess a robust framework for managing residual risk, particularly with pipelines and related structures. Although regulations in all countries permit three removal options—monitoring (decommissioned in place), reuse, or deferral—only Norway possesses a framework and financial resources to manage pipeline removal costs under the Removal Grants Act (Stortinget (Norwegian Government), 2000). This act provides direct grants to subsidize a portion of the State's disposal costs and was utilized in 2000 to remove segments of disused pipelines decommissioned before 2000 to mitigate entanglement risks. Pipelines decommissioned in situ in the UK will require an appropriate monitoring program, the expenses of which will be the operator's responsibility and must be approved by BEIS in collaboration with other governmental agencies.

The general legal framework in Asia Pacific

A relevant regional reference for decommissioning in the Asia Pacific is a guideline authored by ASCOPE, the council representing the petroleum sectors of ASEAN member countries. The alternatives encompass categories of decommissioning and disposal, decommissioning planning, impact assessment, environmental impact assessment, and residual liability. In addition to international legislation, various instruments may influence decommissioning actions in the Asia Pacific, including national laws, decommissioning clauses in production agreements, and industrial or operator guidelines.

As the proprietor of mineral resources, the State hires an Independent Oil Company (IOC) as a contractor to provide technical and financial services for the exploration and development of the operations in a Production Agreement. In these agreements, the State is typically represented by the Government or one of its agencies, such as the national oil corporation. The traditional concession or royalty/tax system generally confers exclusive rights to International Oil Companies (IOCs) for the exploration, development, and exportation of petroleum, with the host nation receiving compensation contingent upon production (Bindemann, 1999). The subsequent concession or royalty/tax framework of the 1970s established abbreviated contract durations, a labor duty, a relinquishment provision for the International Oil Companies (IOCs), elevated royalties, and bonus payments for the host nation (Bindemann, 1999). The concession or royalty/tax system consistently depends on a wholly separate and unique framework of national legislation to regulate the decommissioning process. The concession contracts lack any guidance regarding the requirements for completing the decommissioning process. In most ASCOPE member nations, inadequate rules exist to ensure clarity during the decommissioning process. In production-sharing agreements, the State retains ownership of the oil while engaging a foreign business to explore and, upon commercial discovery, develop the resource. The IOC functions at its own risk and cost, receiving a designated portion of production as compensation. The primary distinction from concessions is in the ownership of the mineral resource (Bindemann, 1999). In contrast to concessions, where all crude oil produced is owned by the IOC, under PSAs, ownership resides with the host government, and the portion of output assigned to the IOC can be viewed as remuneration for the risks undertaken and services provided.

Production sharing agreements (PSA) are considered independent regulations in numerous jurisdictions that employ them, particularly in the absence of petroleum legislation governing petroleum operations. Typically, the specific PSA serves as the exclusive reference for initiating and decommissioning petroleum operations; regrettably, previous PSAs included less information regarding abandonment and/or decommissioning (Bindemann, 1999). Risk Service Agreements (RSAs) of certain types are analogous to PSAs. The IOC exclusively assumes the financial risk and participates in exploration and development for a predetermined fixed fee or alternative compensation.

The contract's designation indicates that the IOC provides services and expertise. It possesses no equity stake in the venture. The risk service agreement provides minimal information regarding abandonment and/or decommissioning (Bindemann, 1999). Non-governmental instruments denote

documents such as operator standards, industry body guidelines, the World Bank International Finance Corporation EHS Guidelines, and the Equator Principles, which serve as a credit risk management framework for evaluating and managing environmental and social risks in project finance transactions (ASEAN Council on Petroleum (ASCOPE), 2012).

CONCLUSION

International regulations that are both rigorous and comprehensive dictate the selection of a decommissioning procedure. Nonetheless, substantial discretion remains with national governments. The predominant regulations about the technical portion are analogous; they stipulate that removing things must occur to a safe depth beneath the midline, or, if impractical due to urgent safety issues, an alternate proposal may be permitted. If items may be abandoned, there must be evidence that the abandoned items are stable or possess a leaching rate compliant with regulations or that a continuous post-decommissioning monitoring plan is established to mitigate risks to human health, the environment, or commercial interests to the greatest extent possible. The standards possess specific criteria; nevertheless, they permit the proposal of alternatives in light of other urgent, justifiable problems.

REFERENCES

ASEAN Council on Petroleum (ASCOPE), 2012. International decommissioning laws, regulations, and guidelines referenced in decommissioning. In: The ASEAN Council on Petroleum (Ed.), ASCOPE Decommissioning Guidelines (ADG) for Oil and Gas Facilities. The ASEAN Council on Petroleum, pp. 2031.

Bell, N., Smith, J., (1999). Coral growing on North Sea oil rigs. Nature 482, 601. https://doi.org/10.1038/45127.

Bindemann, K., (1999). Production-sharing Agreements: An Economic Analysis. Oxford Inst. Energy Stud. WPM 25.

Bureau of Safety and Environmental Enforcement (USA), 2016a. Decommissioning FAQ [WWW document]. http://www.bsee.gov/BSEE-Newsroom/Publications-Library/FAQ/Decommissioning/. (Accessed 7 August 2016).

Bureau of Safety and Environmental Enforcement (USA), 2016b. Rigs to reefs [WWW document]. http://www.bsee.gov/About-BSEE/Divisions/ecd/ECD-Rigs-to-Reefs/.(Accessed 7 November 2016).

Celata, M., (2016). Regulatory considerations for ensuring. Decommissioning other lease obligations [WWW document]. http://www.boem.gov/2016-02-04-PLANO-RiskPresentation-Celata/.(Accessed 20 June 2016).

Chaiyasit, N., Kositanont, C., Yeh, S., Gallup, D., Young, L., 2010. Decontamination of mercury-contaminated steel (API 5L-X52) using iodine and iodide Lixiviant. Mod. Appl. Sci. 4, 1220.

Chandler, J., White, D., Techera, E.J., Gourvenec, S., Draper, S., (2017). Engineering and legal considerations for decommissioning offshore oil and gas infrastructure in Australia. Ocean. Eng. 131, 338–347. https://doi.org/10.1016/j.oceaneng.2016.12.030.

Decomm North Sea, (2017). About us [WWW document]. http://decomnorthsea.com/about-dns/about-us. (Accessed 6 July 2017).

Department for Business Energy and Industrial Strategy UK, 2011. Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998.Offshore Decommissioning, Aberdeen.

Fairfield Fagus Limited, (2017). Osprey field subsea infrastructure comparative assessment [WWW document]. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/668411/Osprey_Final_DP.pdf. (Accessed 3 January 2017).

Fam, M.L., Tan, H.K., Konovessis, D., Ong, L.S., 2017. A review of offshore decommissioning Regulations in three countries - strengths and weaknesses. In: ASME 2017 36th International Conference on Ocean, Offshore and Arctic Engineering, pp. 1–14.

Fowler, A.M., Macreadie, P.I., Jones, D.O.B., Booth, D.J., (2014). A multi-criteria decision approach to decommissioning of offshore oil and gas infrastructure. Ocean Coast.Manag 87, 20–29. https://doi.org/10.1016/j.ocecoaman.2013.10.019.

Gao, Z., (1997). Current international law issues on offshore abandonment, with special reference to the United Kingdom. Ocean. Dev. Int. Law 28, 59–78. https://doi.org/10.1080/00908329709546095

Government of USA, 2014a. Title 40: - Protection of Environment, Part 435- Oil and Gas Extraction Point Source Category, Sub-part a - Offshore Subcategory—the USA.

Government of USA, 2014b. Title 30: Mineral Resources, Part 250- Oil and Gas and Sulfur Operations in the Outer Continental Shelf, Sub-part Q – Decommissioning Activities. The USA.

Hamzah, B.A., (2003). International rules on decommissioning of offshore installations: some observations. Mar. Policy 27, 339348. https://doi.org/10.1016/S0308597X(03)00040-X.

International Maritime Organisation, 2006. Convention on preventing marine pollution by dumping wastes and other matter [WWW document]. http://www.imo.org/en/OurWork/Environment/LCLP/Pages/default.aspx. (Accessed 30 November 2016).

International Maritime Organisation, 1989. Resolution A.672 (16) Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone.

Jørgensen, D., (2012). OSPAR's exclusion of rigs-to-reefs in the North Sea. Ocean Coast. Manag 58, 5761. https://doi.org/10.1016/j.ocecoaman.2011.12.012.

Kaiser, M.J., Pulsipher, A.G., (2005). Rigs-to-Reef programs in the Gulf of Mexico. Ocean.Dev. Int. Law 36, 119134. https://doi.org/10.1080/00908320590943990.

Lyons, Y., (2012). Offshore decommissioning in Southeast Asia and the opportunity [WWW document]. http://cil.nus.edu.sg/wp/wp-content/uploads/2012/06/YounaLyonsHalifax_DecomSEA.pdf.(Accessed 23 June 2016).

Macreadie, P.I., Fowler, A.M., Booth, D.J., (2011). Rigs-to-reefs: will the deep sea benefit from artificial habitat? Front. Ecol. Environ. 9, 455–461. https://doi.org/10.1890/100112.

Ministry of Petroleum and Energy (Norway), 2010. FACTS - the Norwegian petroleum sector 2010 [WWW document]. http://www.npd.no/en/Publications/Facts/Facts2010/.

Norwegian Climate and Pollution Agency, 2011. Decommissioning of offshore installations [WWW Document]. http://www.npd.no/en/Publications/Reports/Decommissioning-of-offshore-installations/.

Oil, Gas, U.K., 2015. Guidelines for Comparative Assessment in Decommissioning Programmes.

Osmudsen, P., Tveteras, R., 2003. Decommissioning of petroleum installations – major policy issues. Energy Policy 31, 1579–1588 doi: Pii S0301-4215(02)00224-0.

OSPAR Commission, 2013. 2013 Update of the Inventory of Oil and Gas Offshore Installations in the OSPAR Maritime Area. Offshore Industry Series.

OSPAR Commission, 2009. Assessment of construction or placement of artificial reefs [WWW Document]. http://qsr2010.ospar.org/media/assessments/p00438_Artificial_reefs_assessment.pdf.

OSPAR Commission, 2007. Convention for the Protection of the Marine Environment of the North-East Atlantic, pp. 1–33.

OSPAR Commission, 1998. OSPAR decision 98/3 on the disposal of disused offshore installations [WWW document]. https://www.ospar.org/convention/agreements?q¼Osparþdecisionþ98%2F3&t¼&a¼&s¼.

Petroleum Institute of Thailand, 2008. Draft Thailand Decommissioning Guidelines for Upstream Installations [Www Document]. URL Draft Thail. Decommissioning Guidel. Upstream Installations - Final.

Petroleum Safety Authority (Norway), 2015a. Regulation guidelines for petroleum activities [WWW document]. http://www.psa.no/activities/category404.html#_Toc442268047. (Accessed 7 May 2016).

Petroleum Safety Authority (Norway), 2015b. Handbook for Application for Acknowledgement of Compliance (AoC).

PETRONAS, (2017). Decommissioning safety: Dana and D30 decommissioning project. In: SPE Workshop: Process Safety and Technical Risk Assessment.

PETRONAS, (2008). PETRONAS Procedures and Guidelines for Upstream Activities Revision 2.

Pradnyana, G., (2017). Offshore Platform Decommissioning in Indonesia: Some Issues and Concerns, in: 4th IndoDecomm.

Schroeder, D.M., Love, M.S., 2004. Ecological and political issues surrounding the decommissioning offshore oil facilities in the Southern California Bight. Ocean Coast. Manag 47, 21–48. https://doi.org/10.1016/j.ocecoaman.2004.03.002.

Standards Norway (NORSOK), 2013. D-010: Well Integrity in Drilling and Well Operations Rev 4.

Stortinget (Norwegian Government), 2000. Recommendation of the Energy and Environment Committee on the Disposal of Disused Pipelines and Cables on the Norwegian Continental Shelf. Report No. No. 47 (1999–2000) Disponering Av

Utrangerte Rørledninger Og Kabler På Norsk Kontinentalsokkel. St.Meld. [WWWDocument]. https://www.stortinget.no/no/Saker-og-publikasjoner/Saker/Sak/?p¼20500.

Soomro, Hira, Nooraini Zainuddin, Hanita Daud, Joshua Sunday, Noraini Jamaludin, Abdullah Abdullah, Apriyanto Mulono, and Evizal Abdul Kadir. "3-Point block backward differentiation formula with an off-step point for the solutions of stiff chemical reaction problems." Journal of Mathematical Chemistry 61, no. 1 (2023): 75-97.

Yulianti, Y., Apriyanto, M., Azhar, A., & Fikri, K. N. S. (2023). Implementasi Program Aksi Ketahanan Pangan Di Kabupaten Indragiri Hilir. Selodang Mayang: Jurnal Ilmiah Badan Perencanaan Pembangunan Daerah Kabupaten Indragiri Hilir, 9(1), 16-24.

Apriyanto, M., Azhar, A., Fikri, K. N. S., & Puspitasari, F. (2022). The Legality Of Cultivated Palm Oil, Research On The Readiness Of Small Holder Farmers In Indonesia To Produce Sustainable Palm Oil (ISPO) Is Reviewed. International Journal of Business, Law, and Education, 3(2), 76-81.

Apriyanto, M., Marlina, M., Mardesci, H., & Riono, Y. Forest and Environmental Fires in Sustainable Palm Oil for Independent Smallholders. International Journal of Environmental & Agriculture Research (IJOEAR).

Azhar, A., Fikri, K. N. S., & Apriyanto, M. (2023). Pelestarian Makam Syekh Abdurrahman Siddiq Melalui Pengenalan Hukum Tatanegara Dalam Festival Kampung. Journal of Community Dedication, 3(1), 78-87.

Apriyanto, M., Fitriani, D., Priyanto, T., & Razak, A. (2024). Post-Harvest Agricultural Innovation of Indonesian Horticulture in Suriname. Symbiosis Civicus, 1(2), 51-56.