ISSN 2180-0480
9 772180 048004

KEMENTERIAN EKONOMI
JABATAN PERANGKAAN MALAYSIA

AES
STATISTIK EKONOMI TAHUNAN
Annual Economic Statistics
2022

PERBELANJAAN PERLINDUNGAN ALAM SEKITAR
Environmental Protection Expenditure

JABATAN PERANGKAAN MALAYSIA
DEPARTMENT OF STATISTICS MALAYSIA

KEMENTERIAN EKONOMI
JABATAN PERANGKAAN MALAYSIA

SURVEY EKONOMI TAHUNAN
ANNUAL ECONOMIC SURVEY
2022

PERBELANJAAN PERLINDUNGAN ALAM SEKITAR
ENVIRONMENTAL PROTECTION EXPENDITURE

Pemakluman

Jabatan Perangkaan Malaysia (DOSM) akan menjalankan Banci Ekonomi pada tahun 2023. DOSM amat menghargai kerjasama daripada responden untuk memberikan maklumat kepada DOSM serta menjayakan banci ini. Sila layari www.dosm.gov.my untuk maklumat lanjut.

DOSM telah melancarkan OpenDOSM NextGen sebagai platform yang menyediakan katalog data dan visualisasi bagi memudahkan pengguna menganalisis pelbagai jenis data. OpenDOSM NextGen ialah medium perkongsian data sumber terbuka dan boleh diakses melalui portal https://open.dosm.gov.my.

Dimaklumkan bahawa Kerajaan Malaysia telah mengisytiharkan Hari Statistik Negara (MyStats Day) pada 20 Oktober setiap tahun. Tema sambutan MyStats Day adalah *"Connecting the World with Data We Can Trust".*

Announcement

The Department of Statistics Malaysia (DOSM) will conduct the Economic Census in 2023. DOSM greatly appreciates the cooperation from respondents to provide information with DOSM and make this census a success. Please visit www.dosm.gov.my for more information.

DOSM has launched OpenDOSM NextGen as a platform that provides a catalogue of data and visualisation that facilitates users in analysing various types of data. OpenDOSM NextGen is an open source data sharing medium and accessible through https://open.dosm.gov.my portal.

Please be informed that the Government of Malaysia has declared National Statistics Day (MyStats Day) on October 20 each year. MyStats Day theme is "Connecting the World with Data We Can Trust".

JABATAN PERANGKAAN MALAYSIA
DEPARTMENT OF STATISTICS MALAYSIA

Diterbitkan dan dicetak oleh / *Published and printed by*:
Jabatan Perangkaan Malaysia
Department of Statistics Malaysia
Blok C6, Kompleks C,
Pusat Pentadbiran Kerajaan Persekutuan
62514 Putrajaya,
MALAYSIA

Tel	:	03-8885 7000
Faks	:	03-8888 9248
Portal	:	https://www.dosm.gov.my
Facebook / Twitter / Instagram / YouTube	:	StatsMalaysia
Emel / *Email*	:	info@dosm.gov.my (pertanyaan umum/ *general enquiries*) data@dosm.gov.my (pertanyaan & permintaan data/ *data request & enquiries)*

Harga / *Price* : RM15.00

Diterbitkan pada Jun 2023 / *Published in June 2023*

Hakcipta terpelihara / *All rights reserved*.

Tiada bahagian daripada terbitan ini boleh diterbitkan semula, disimpan untuk pengeluaran atau ditukar dalam apa-apa bentuk atau alat apa jua pun kecuali setelah mendapat kebenaran daripada Jabatan Perangkaan Malaysia. Pengguna yang mengeluarkan sebarang maklumat dari terbitan ini sama ada yang asal atau diolah semula hendaklah meletakkan kenyataan berikut:

"Sumber: Jabatan Perangkaan Malaysia"

No part of this publication may be reproduced or distributed in any form or by any means or stored in data base without the prior written permission from Department of Statistics Malaysia. Users reproducing content of this publication with or without adaptation should quote the following:

"Source: Department of Statistics Malaysia"

ISSN 2180-0480

Kata Pengantar

Penerbitan Perbelanjaan Perlindungan Alam Sekitar 2022 membentangkan statistik perbelanjaan perlindungan alam sekitar bagi tahun rujukan 2021 yang merupakan hasil daripada Survei Ekonomi Tahunan (AES) 2022. Sektor yang diliputi adalah Pertanian; Perlombongan & pengkuarian; Pembuatan; Pembinaan dan Perkhidmatan. Konsep dan definisi yang digunakan dalam survei ini adalah berdasarkan *Environmental Expenditure Statistics: Industry Data Collection Handbook 2005* oleh *Eurostats, Classification of Environmental Protection Activities and Expenditure (CEPA) 2000* dari *Statistical Office of the European Communities* dan *Glossary of Statistical Terms* oleh *Organisation for Economic Co-operation and Development (OECD).*

Statistik yang dilaporkan dalam penerbitan ini meliputi perbelanjaan modal dan operasi bagi pengurusan pencemaran, pengurusan sisa, penilaian dan caj alam sekitar, perlindungan hidupan liar & habitat serta perbelanjaan lain untuk perlindungan alam sekitar. Statistik ini digunakan sebagai sumber rujukan oleh agensi kerajaan, ahli ekonomi, ahli akademik, pihak swasta dan individu.

Penerbitan ini merangkumi tiga bahagian utama. Bahagian pertama memaparkan penemuan utama dan ringkasan penemuan perbelanjaan perlindungan alam sekitar. Jadual perangkaan terperinci dipaparkan di bahagian kedua, manakala bahagian ketiga pula menerangkan aspek teknikal antaranya skop dan liputan, konsep dan definisi serta pemboleh ubah utama yang digunakan bagi memudahkan pengguna memahami statistik yang diterbitkan.

Jabatan Perangkaan Malaysia merakamkan setinggi-tinggi penghargaan atas kerjasama dan sumbangan yang diberikan oleh semua pihak dalam menjayakan survei ini. Setiap maklum balas dan cadangan untuk penambahbaikan penerbitan ini pada masa akan datang amatlah dihargai.

DATO' SRI DR. MOHD UZIR MAHIDIN
Ketua Perangkawan Malaysia

Jun 2023

Preface

The publication of Environmental Protection Expenditure 2022 presents statistics on the environmental protection expenditure for the reference year 2021 as an outcome from Annual Economic Survey (AES) 2022. Sectors covered comprised of Agriculture; Mining & quarrying; Manufacturing; Construction and Services. Concepts and definitions used in this survey are based on Environmental Expenditure Statistics: Industry Data Collection Handbook 2005 by Eurostats, Classification of Environmental Protection Activities and Expenditure (CEPA) 2000 by Statistical Office of the European Communities and Glossary of Statistical Terms by Organisation for Economic Co-operation and Development (OECD).

Statistics reported in this publication includes capital and operating expenditure for pollution management, waste management, environmental assessment and charges, protection of wildlife & habitat and other environmental protection expenditure. These statistics are useful as a source of reference by government agencies, economists, academicians, private sectors and individuals.

This publication consists of three parts. The first part presents the main findings & summary of findings on environmental protection expenditure. The detail statistical tables are shown in the second part, meanwhile the third part describes technical aspects such as scope and coverage, concepts and definitions as well as the key variables used to assist users to understand the published statistics.

Department of Statistics Malaysia gratefully acknowledges the co-operation and contribution rendered by all parties in making this publication a success. Every feedback and suggestion towards improving future publication is highly appreciated.

DATO' SRI DR. MOHD UZIR MAHIDIN
Chief Statistician Malaysia

June 2023

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

SENARAI JADUAL

LIST OF TABLES

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

PENEMUAN UTAMA & RINGKASAN PENEMUAN

MAIN FINDINGS & SUMMARY OF FINDINGS

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

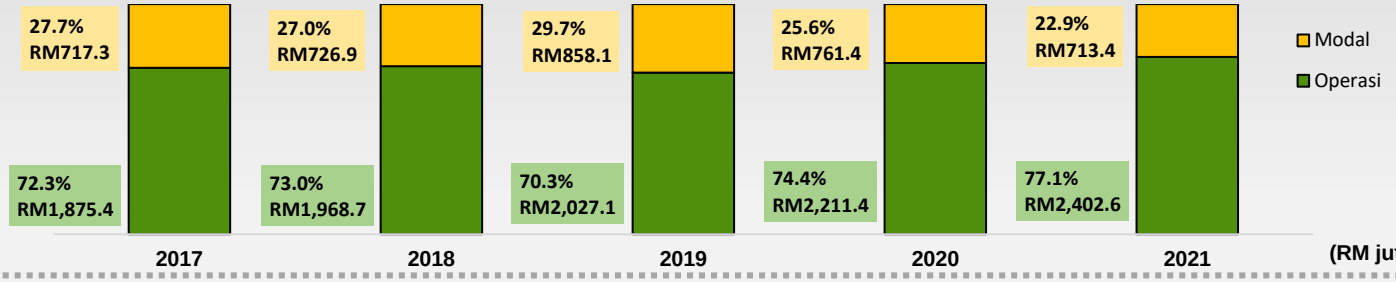
KEMENTERIAN EKONOMI
JABATAN PERANGKAAN MALAYSIA

BANCI EKONOMI 2023
DATA PEMANGKIN EKONOMI NEGARA

StatsMalaysia
www.dosm.gov.my

MALAYSIA MADANI

Perbelanjaan Perlindungan Alam Sekitar bagi 2021 Meningkat 4.8% kepada RM3.1b



RM2.9b dibelanjakan dalam sektor Pembuatan & Perkhidmatan

Pembuatan
▲4.4%
2021: 2,486.8
2020: 2,382.4

Perkhidmatan
▲5.4%
2021: 386.4
2020: 366.7

Perlombongan & pengkuarian
▲10.4%
2021: 110.8
2020: 100.4

Pembinaan
▼4.1%
2021: 84.7
2020: 88.4

Pertanian
▲34.9%
2021: 47.1
2020: 34.9

(RM juta)

Pengurusan pencemaran & pengurusan sisa menyumbang 96.7% kepada jumlah perbelanjaan

Pengurusan pencemaran
2021: 2,210.2
2020: 2,103.7
▲5.1%

Pengurusan sisa
2021: 803.7
2020: 766.8
▲4.8%

Penilaian & caj alam sekitar
2021: 70.6 | 2020: 67.2 ▲5.1%

Perbelanjaan lain untuk perlindungan alam sekitar
2021: 19.3 | 2020: 17.2 ▲12.3%

Perlindungan hidupan liar & habitat
2021: 12.2 | 2020: 18.0 ▼32.3%

(RM juta)

5 negeri menyumbang perbelanjaan tertinggi dengan 67.4%

Johor
2021: 862.4
2020: 808.8
▲6.6%

Selangor
2021: 557.5
2020: 530.4
▲5.1%

Sarawak
2021: 239.4
2020: 235.6
▲1.6%

W.P. Kuala Lumpur
2021: 221.0
2020: 224.0
▼1.3%

Terengganu
2021: 220.2
2020: 236.4
▼6.9%

(RM juta)

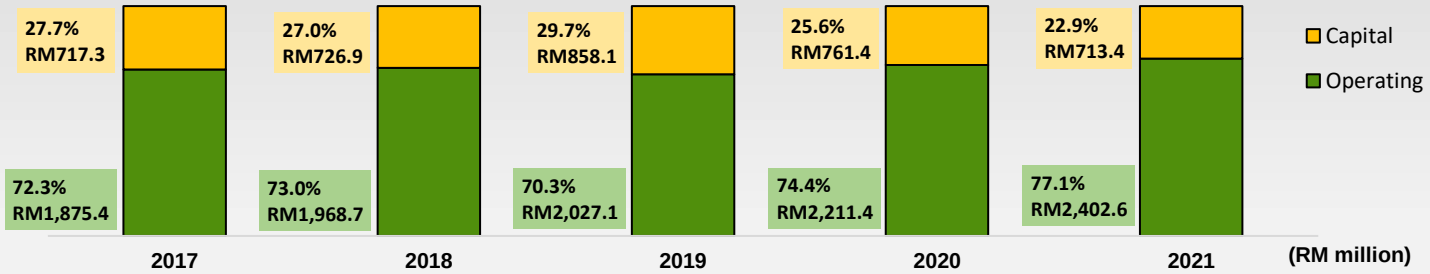
Sumber: Survei Ekonomi Tahunan 2022 - Perbelanjaan Perlindungan Alam Sekitar, Jabatan Perangkaan Malaysia (DOSM)

MINISTRY OF ECONOMY
DEPARTMENT OF STATISTICS MALAYSIA

StatsMalaysia
www.dosm.gov.my

MALAYSIA MADANI

Environmental Protection Expenditure 2021 Grew by 4.8% to RM3.1b



RM2.9b spent by Manufacturing & Services sectors

Manufacturing
▲4.4%
2021: 2,486.8
2020: 2,382.4

Services
▲5.4%
2021: 386.4
2020: 366.7

Mining & quarrying
▲10.4%
2021: 110.8
2020: 100.4

Construction
▼4.1%
2021: 84.7
2020: 88.4

Agriculture
▲34.9%
2021: 47.1
2020: 34.9

(RM million)

Pollution management & waste management constituted 96.7% from total expenses

Pollution management
2021: 2,210.2
2020: 2,103.7
▲5.1%

Waste management
2021: 803.7
2020: 766.8
▲4.8%

Environmental assessment & charges
2021: 70.6 | 2020: 67.2 ▲5.1%

Other environmental protection expenditure
2021: 19.3 | 2020: 17.2 ▲12.3%

Protection of wildlife & habitat
2021: 12.2 | 2020: 18.0 ▼32.3%

(RM million)

5 states with the highest expenses have a combined share of 67.4%

Johor
2021: 862.4
2020: 808.8
▲ 6.6%

Selangor
2021: 557.5
2020: 530.4
▲ 5.1%

Sarawak
2021: 239.4
2020: 235.6
▲ 1.6%

W.P. Kuala Lumpur
2021: 221.0
2020: 224.0
▼ 1.3%

Terengganu
2021: 220.2
2020: 236.4
▼ 6.9%

(RM million)

Source: Annual Economic Survey 2022 – Environmental Protection Expenditure, Department of Statistics Malaysia (DOSM)

1. PENGENALAN

Penerbitan Perbelanjaan Perlindungan Alam Sekitar 2022 adalah hasil daripada Survei Ekonomi Tahunan (AES) 2022. Penerbitan ini membentangkan statistik perbelanjaan perlindungan alam sekitar bagi tahun rujukan 2021. Sektor yang diliputi dalam survei ini ialah:

a. Pertanian;
b. Perlombongan & pengkuarian;
c. Pembuatan;
d. Pembinaan; dan
e. Perkhidmatan.

2. PRESTASI KESELURUHAN

Perbelanjaan perlindungan alam sekitar mencatatkan 4.8 peratus kadar pertumbuhan tahunan dengan nilai RM3,115.9 juta. Perbelanjaan operasi kekal sebagai penyumbang utama iaitu 77.1 peratus dengan kadar pertumbuhan tahunan positif 8.6 peratus kepada RM2,402.6 juta. Sebaliknya, perbelanjaan modal menyumbang sebanyak 22.9 peratus menyusut 6.3 peratus kepada RM713.4 juta.

Paparan 1: Jumlah perbelanjaan perlindungan alam sekitar, 2020 dan 2021

	OPERASI (RM JUTA)	MODAL (RM JUTA)	JUMLAH (RM JUTA)
2021	2,402.6	713.4	3,115.9
2020	2,211.4	761.4	2,972.8
KADAR PERTUMBUHAN TAHUNAN (%)	8.6	-6.3	4.8

3. PERBELANJAAN PERLINDUNGAN ALAM SEKITAR MENGIKUT JENIS PERBELANJAAN

Perbelanjaan pengurusan pencemaran dan pengurusan sisa kekal sebagai perbelanjaan utama yang dibuat oleh industri di Malaysia dengan sumbangan 96.7 peratus daripada keseluruhan perbelanjaan perlindungan alam sekitar. Perbelanjaan pengurusan pencemaran berjumlah RM2,210.2 juta atau sumbangan sebanyak 70.9 peratus manakala perbelanjaan pengurusan sisa pula direkodkan sebanyak RM803.7 juta atau sumbangan 25.8 peratus. Tiga lagi perbelanjaan yang dibuat bagi tujuan perlindungan alam sekitar adalah perbelanjaan penilaian dan caj alam sekitar (RM70.6 juta; 2.3%), perbelanjaan lain untuk perlindungan alam sekitar (RM19.3 juta; 0.6%) dan perbelanjaan perlindungan hidupan liar & habitat (RM12.2 juta; 0.4%).

Paparan 2: Perbelanjaan perlindungan alam sekitar mengikut jenis perbelanjaan, 2021

Pengurusan pencemaran	Pengurusan sisa	Penilaian dan caj alam sekitar	Perbelanjaan lain untuk perlindungan alam sekitar	Perlindungan hidupan liar & habitat
RM2,210.2 juta	RM803.7 juta	RM70.6 juta	RM19.3 juta	RM12.2 juta
M: 27.8% O: 72.2%	M: 9.4% O: 90.6%	M: 27.8% O: 72.2%	M: 8.0% O: 92.0%	M: 32.9% O: 67.1%

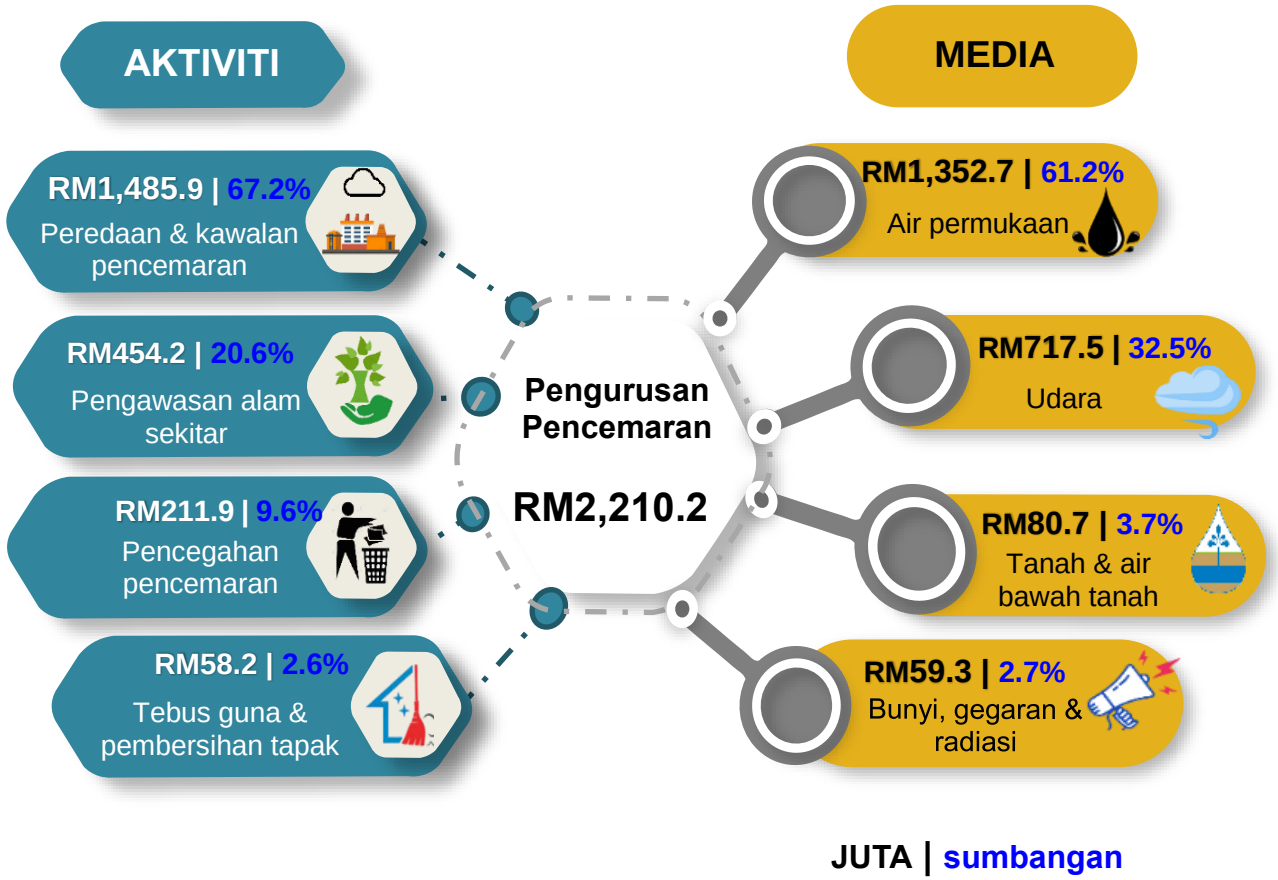
Jumlah: RM3,115.9 juta

M: Perbelanjaan modal
O: Perbelanjaan operasi

Perbelanjaan pengurusan pencemaran boleh dikategorikan mengikut jenis aktiviti dan media. Bagi jenis aktiviti, peredaan & kawalan pencemaran merupakan penyumbang utama sebanyak 67.2 peratus (RM1,485.9 juta). Ini diikuti aktiviti pengawasan alam sekitar dan pencegahan pencemaran dengan sumbangan masing-masing 20.6 peratus (RM454.2 juta) dan 9.6 peratus (RM211.9 juta).

Manakala, perbelanjaan pengurusan pencemaran mengikut media pula sebanyak 61.2 peratus dibelanjakan bagi air permukaan iaitu RM1,352.7 juta dan 32.5 peratus dibelanjakan bagi udara (RM717.5 juta). Perbelanjaan selebihnya adalah bagi media tanah & air bawah tanah serta bunyi, gegaran & radiasi masing-masing sebanyak RM80.7 juta (3.7%) dan RM59.3 juta (2.7%).

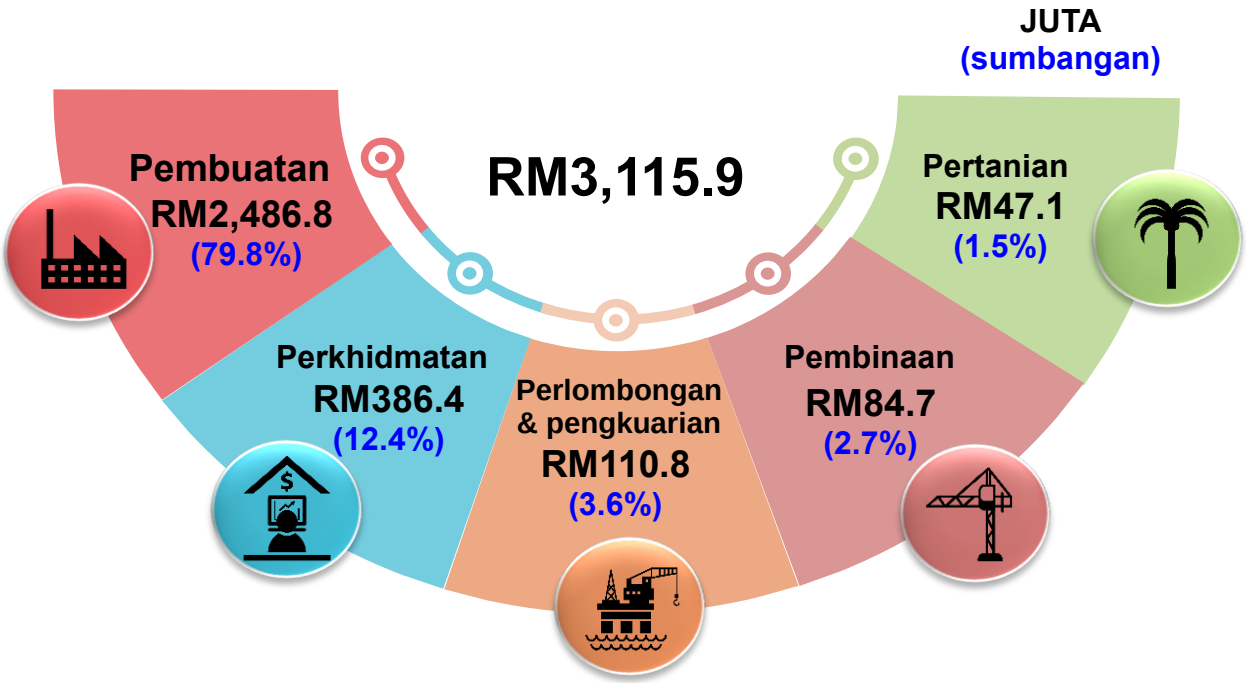
Paparan 3: Perbelanjaan pengurusan pencemaran mengikut aktiviti dan media, 2021



4. PERBELANJAAN PERLINDUNGAN ALAM SEKITAR MENGIKUT SEKTOR

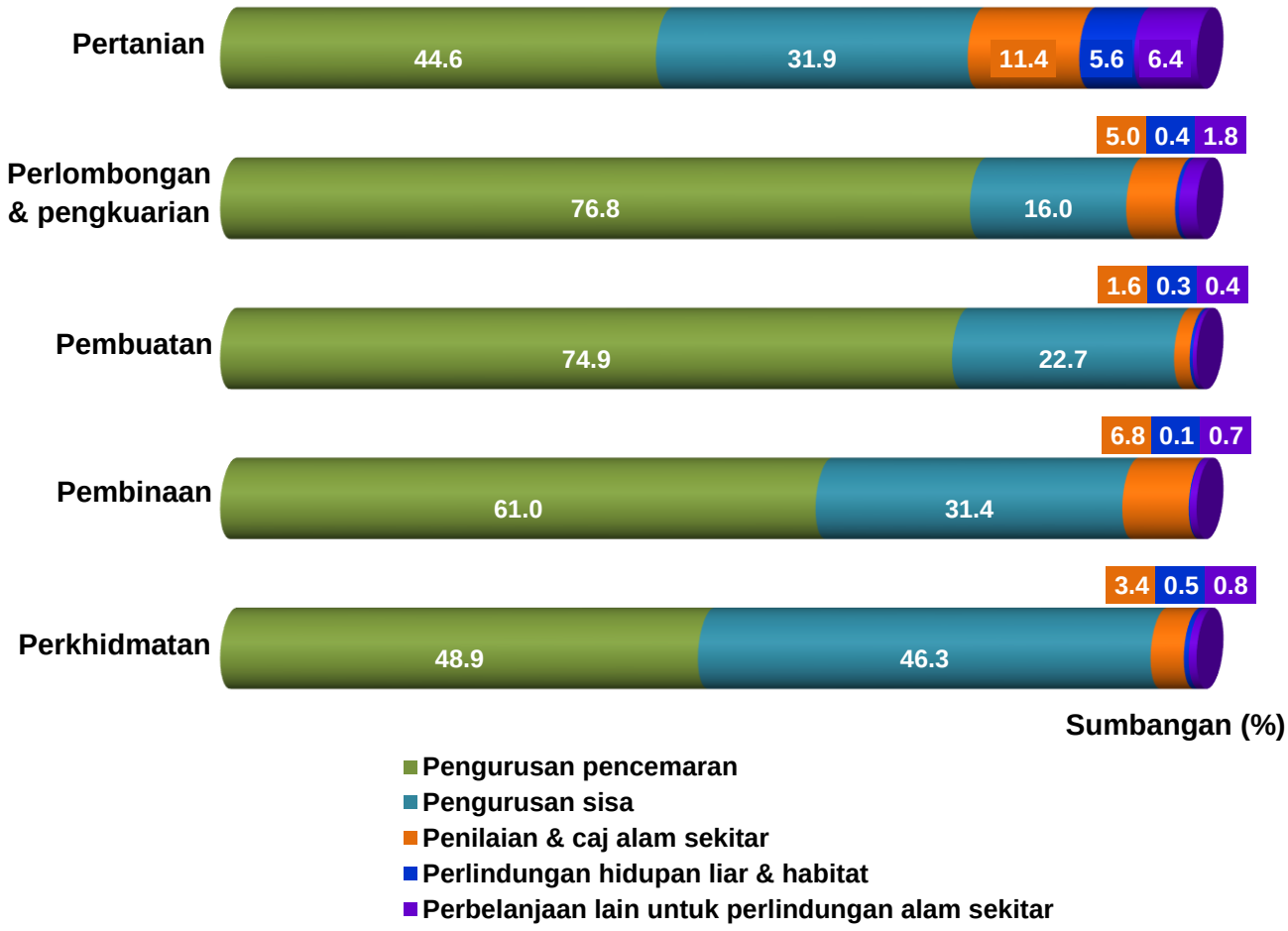
Sektor Pembuatan menyumbang sebahagian besar perbelanjaan perlindungan alam sekitar yang dibuat pada tahun 2021 dengan nilai perbelanjaan sebanyak RM2,486.8 juta atau sumbangan 79.8 peratus diikuti oleh sektor Perkhidmatan dengan RM386.4 juta atau 12.4 peratus. Di samping itu, sektor Perlombongan & pengkuarian, Pembinaan dan Pertanian pula masing-masing menyumbang sebanyak 3.6 peratus (RM110.8 juta), 2.7 peratus (RM84.7 juta) dan 1.5 peratus (RM47.1 juta).

Paparan 4: Perbelanjaan perlindungan alam sekitar mengikut sektor, 2021



Secara umumnya, corak perbelanjaan sektor Pembuatan, Perlombongan & pengkuarian dan Pembinaan lebih tertumpu kepada perbelanjaan pengurusan pencemaran dengan sumbangan melebihi 60 peratus. Manakala, corak perbelanjaan bagi sektor Perkhidmatan pula adalah seimbang antara pengurusan pencemaran dan pengurusan sisa dengan masing-masing menyumbangkan 48.9 peratus dan 46.3 peratus. Sektor Pertanian juga didominasi oleh perbelanjaan pengurusan pencemaran dan pengurusan sisa. Namun, perbelanjaan penilaian & caj alam sekitar dan perlindungan hidupan liar & habitat adalah lebih ketara dalam sektor Pertanian berbanding sektor lain dengan sumbangan kedua-duanya adalah 17.0 peratus.

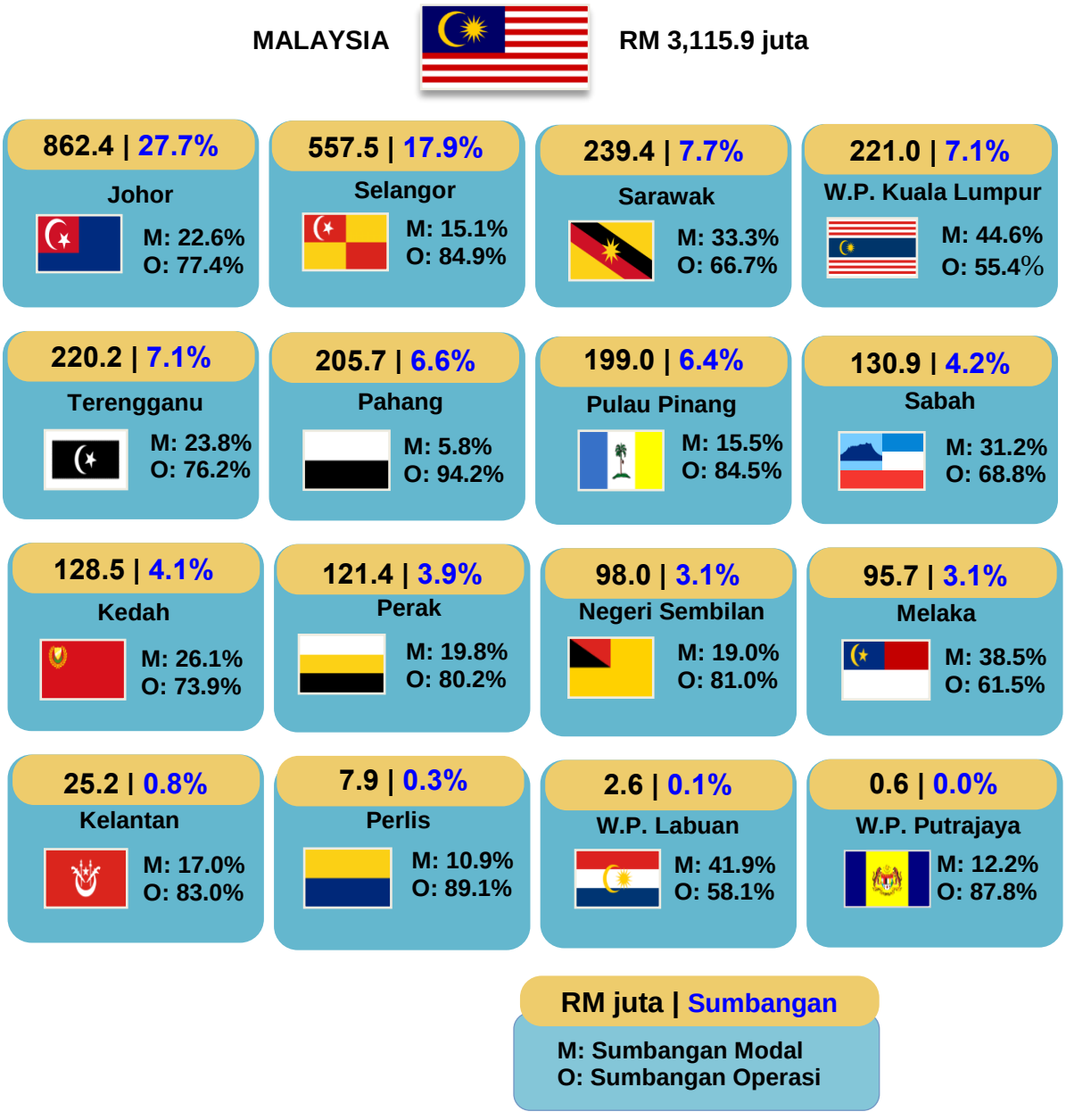
Carta 1: Jenis perbelanjaan perlindungan alam sekitar mengikut sektor, 2021



5. PERBELANJAAN PERLINDUNGAN ALAM SEKITAR MENGIKUT NEGERI

Perbelanjaan perlindungan alam sekitar mengikut negeri didominasi oleh Johor dengan RM862.4 juta atau sumbangan sebanyak 27.7 peratus. Ini diikuti oleh Selangor dengan RM557.5 juta (17.9%), Sarawak RM239.4 juta (7.7%), W.P. Kuala Lumpur RM221.0 juta (7.1%) dan Terengganu RM220.2 juta (7.1%). Lima negeri ini menyumbang kepada 67.4 peratus daripada keseluruhan perbelanjaan yang direkodkan pada 2021.

Paparan 5: Perbelanjaan perlindungan alam sekitar dan peratus sumbangan mengikut negeri, 2021



KAEDAH BIOLOGI UNTUK PENCEGAHAN DAN KAWALAN PENCEMARAN DALAM SEKTOR PERTANIAN

Fuziah Md. Amin, Syed Ibrahim Mohd Jamaluddin, Nazira Abdullah,
Mahadi Mohd Nor, Nurul Asmahusna Asari,
Bahagian Perangkaan Pertanian dan Alam Sekitar

Pendahuluan

Kelestarian alam sekitar adalah merujuk kepada interaksi bertanggungjawab dengan alam sekitar untuk mengelakkan pengurangan sumber semula jadi serta menjamin kualiti persekitaran yang lebih baik untuk jangka masa yang panjang. Menurut *United States Environmental Protection Agency (U.S. EPA),* usaha untuk mencapai kelestarian adalah mengenai mewujudkan dan mengekalkan keadaan di mana manusia dan alam semula jadi boleh wujud dalam keharmonian yang produktif untuk menyokong generasi sekarang dan akan datang[1]. Selain itu, *UN World Commission on Environment and Development (WCED)* menjelaskan pembangunan lestari sebagai pembangunan yang memenuhi keperluan masa kini tanpa menjejaskan keupayaan generasi akan datang untuk memenuhi keperluan mereka sendiri[2]. Proses urbanisasi, perindustrian baharu dan amalan pertanian moden yang tidak diuruskan secara mampan boleh menyebabkan pencemaran sumber air, udara dan tanah. Sumber semula jadi yang dieksploitasi secara berlebihan serta dicemari bahan kimia beracun akan menyukarkan kelangsungan hidup generasi akan datang.

Pertanian Mampan

Pertanian mampan merujuk kepada aktiviti pertanian yang dilaksanakan dengan cara melindungi alam sekitar, membantu dan memperluas sumber semula jadi, dan memanfaatkan sumber tidak boleh diperbaharui dengan sebaiknya[3]. *Food and Agriculture Organization of the United Nations* (FAO) menggariskan lima prinsip utama kelestarian untuk makanan dan pertanian, iaitu meningkatkan produktiviti, pekerjaan dan penambahan nilai dalam sistem makanan; melindungi dan meningkatkan sumber semula jadi; meningkatkan taraf hidup dan menggalakkan pertumbuhan ekonomi yang inklusif; meningkatkan daya tahan manusia, komuniti, dan ekosistem; dan menyesuaikan pentadbiran dengan cabaran baharu[4]. Wawasan pertanian mampan di Malaysia adalah selaras dengan matlamat pembangunan mampan

[1] https://www.epa.gov/sustainability/learn-about-sustainability#what
[2] https://www.sustain.ucla.edu/what-is-sustainability/
[3] https://www.nal.usda.gov/farms-and-agricultural-production-systems/sustainable-agriculture
[4]https://www.fao.org/sustainability/background/en/#:~:text=FAO's%20vision%20for%20sustainable%20food,well%20as%20future%20human%20needs.

negara untuk meningkatkan status pendapatan kumpulan sasar seperti petani, penternak, nelayan dan usahawan asas tani[5]. Transformasi sektor pertanian turut ditonjolkan dalam Dasar Agromakanan Negara (DAN 2.0) 2021-2023 yang digubal dengan objektif untuk memastikan bekalan makanan, meningkatkan daya saing dan kemampanan industri agromakanan, dan meningkatkan tahap pendapatan kumpulan sasaran[6].

Kaedah biologi dalam aktiviti pertanian

Kawalan biologi merujuk kepada kaedah pengurusan populasi perosak tanpa menggunakan racun serangga atau bahan kimia. Keberkesanan kaedah biologi dalam mencegah pencemaran telah banyak dikaji dan dianggap sebagai salah satu pendekatan lestari dalam pengurusan sumber asli. Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI) menerangkan lima jenis kaedah kawalan biologi dalam mengawal perosak dan penyakit di sawah padi iaitu parasitoid, pemangsa, entomopatogen, mikrob antagonis, dan ekstrak tumbuhan. Kaedah-kaedah ini merujuk kepada penggunaan musuh semula jadi yang berperanan dalam mengawal populasi perosak dan penyakit agar tidak meyebabkan kerugian ekonomi. Kaedah kawalan biologi boleh dilaksanakan melalui beberapa pendekatan iaitu kawalan biologi klasik, penambahan populasi, kaedah pelepasan secara bertanggungjawab, kaedah pelepasan secara besar-besaran atau pemuliharaan[7].

Universiti Sains Malaysia (USM) dengan kerjasama Yayasan Pemuliharaan Hijau Minyak Sawit Malaysia (MPOGCF) baru-baru ini melancarkan program Inisiatif Burung Pungguk Jelapang untuk Pekebun Kecil Kelapa Sawit (BOSI) bagi membantu mereka mengawal tikus perosak di ladang mereka. Usaha ini merupakan inisiatif hijau yang bertujuan untuk meminimumkan penggunaan racun serangga yang mempunyai kesan buruk terhadap alam sekitar dan boleh membahayakan haiwan lain yang memakan tikus beracun. Kaedah menggunakan burung pungguk atau burung hantu untuk mengawal populasi tikus telah diamalkan secara meluas dalam ladang kelapa sawit berskala besar yang dimiliki oleh pertubuhan, namun amalan pertanian baik ini belum diperluaskan kepada petani berskala kecil. Oleh itu, kerjasama ini dijangka akan dapat membantu petani berskala kecil dalam menggunakan kaedah ini kerana ia lebih selamat untuk manusia dan alam sekitar, di samping mengurangkan penggunaan racun tikus[8].

[5] Rahman, R.A. (2021) Green nanotechnology for sustainable agriculture in Malaysia, FFTC Agricultural Policy Platform (FFTC-AP). Available at: https://ap.fftc.org.tw/article/2833 (Accessed: 15 June 2023).
[6] https://www.fama.gov.my/documents/20143/64638/Pendahuluan.pdf/115d5802-ee67-4c5e-9e08-9eed710a6624
[7] Amzah, B., Misman, S. N., Mohamad, M., & Vun, C. T. Pengurusan bersepadu perosak, penyakit dan rumpai dalam pengeluaran mampan tanaman padi.
[8] https://www.mpogcf.org/mpogcf-dan-usm-bekerjasama-bina-sarang-burung-pungguk-jelapang-untuk-pekebun-pekebun-kecil-kelapa-sawit/

MARDI dengan kerjasama Jabatan Pertanian (DOA) juga telah berjaya menghasilkan pakej agen kawalan biologi yang berkesan mengawal serangan serangga perosak terutama sayuran tanah tinggi. Teknologi berkonsepkan ekologi yang dibangunkan ini adalah asas pengurusan perosak bersepadu yang bukan saja selamat kepada pengguna, tetapi juga bermanfaat untuk memulihara kestabilan ekosistem di Cameron Highlands. Projek ini menggunakan dua parasitoid sebagai ejen kawalan biologi iaitu *Diadegma Semiclausum* dan *Cotesia Vestali* yang telah terbukti berkesan mengawal serangan serangga perosak utama tanaman krusifer terutama sayuran kubis. Analisis ekonomi mendapati bahawa teknologi ini mampu menjimatkan kos racun kawalan perosak sehingga RM2,000 setiap musim[9].

Selain itu, Kementerian Sains, Teknologi dan Inovasi (MOSTI) juga telah melancarkan Program Bioremediasi Keluarga Malaysia di Pusat Perkhidmatan Pertanian Bersepadu, Pertubuhan Peladang Kawasan Muar Selatan, Johor. Program ini merupakan sebuah program latihan dan pemindahan teknologi kaedah penternakan larva lalat jenis *Black Soldier Fly* (BSF) secara teori dan praktikal oleh saintis tempatan kepada masyarakat. Proses bioremediasi merupakan kaedah pengurusan sisa yang selamat, mesra alam dan lestari menggunakan larva BSF untuk proses pengkomposan sisa domestik dan agro industri menjadi makanan haiwan ternakan serta baja organik yang berkualiti. Penghasilan input pertanian ini mampu mengurangkan beban dan kos para penternak dan petani, di samping dapat mengurangkan masalah pengurusan sisa domestik dan sisa pertanian di kawasan sekitar[10].

Fitoremediasi sebagai pembasmi bahan pencemar

Selain daripada kaedah kawalan biologi dalam pencegahan pencemaran akibat penggunaan racun perosak, kaedah fitoremediasi juga boleh diaplikasikan sebagai alternatif untuk menyingkirkan bahan pencemar menggunakan tumbuhan semula jadi. Fitoremediasi merujuk kepada rawatan pencemaran atau sisa, seperti tanah atau air bawah tanah tercemar, dengan menggunakan tumbuhan hijau yang membasmi, menguraikan, atau menstabilkan bahan pencemar seperti logam beracun[11]. Salah satu contoh penggunaan fitoremediasi yang

[9] https://blogmardi.wordpress.com/2019/06/22/agen-kawalan-biologi/
[10] https://www.mosti.gov.my/en/berita/program-bioremediasi-keluarga-malaysia-mengurangkan-beban-dan-kos-penternak-2/
[11] Merriam-Webster. (n.d.). Phytoremediation. In Merriam-Webster.com dictionary. Retrieved June 16, 2023, from https://www.merriam-webster.com/dictionary/phytoremediation

telah dilaksanakan ialah penggunaan bunga matahari untuk pemulihan tanah yang tercemar selepas letupan loji nuklear di Chernobyl, Rusia[12].

Aktiviti akuakultur seperti penternakan ikan keli lazimnya akan menghasilkan sisa pencemar. Beberapa kajian telah dilaksanakan di Malaysia bagi melihat keberkesanan pengunaan kaedah fitoremediasi dalam merawat air sisa akuakultur. Salah satu daripadanya ialah kajian di kolam penternakan ikan keli di Sungai Udang, Nibong Tebal yang menggunakan *s. Molesta* dan *s. Polyrhiza* sebagai agen fitoremediasi. Hasil kajian ini menunjukkan agen ini mampu menyingkirkan nutrien dalam air sisa ladang ikan berbanding kaedah pertukaran ion yang lazimnya memerlukan kos yang tinggi[13]. Selain itu, kajian menggunakan tumbuhan akuatik *Azolla Pinnata* sebagai agen untuk merawat sisa kolam ikan keli juga menunjukkan penurunan nilai ammonia dan fosfat di dalam air sisa[14]. Kajian fitoremediasi lain menggunakan *Jatropha Curcas*, *Acacia Mangium* dan *Hopea Odorata* juga turut mendapati bahawa tumbuhan ini mempunyai potensi untuk menyerap kuprum (*Copper*) daripada tanah yang telah tercemar dengan enap cemar kumbahan[15]. Kesimpulannya, setiap agen fitoremediasi memiliki kemampuan tersendiri dalam merawat bahan pencemar.

Cabaran dalam pelaksanaan kawalan biologi

Walaupun kawalan biologi dapat menyelamatkan alam sekitar, cabaran dalam mengamalkan kaedah ini dalam kalangan pengusaha pertanian sentiasa terbuka untuk perbincangan. Satu contoh kaedah biologi dalam konteks pertanian adalah *Integrated Pest Management* (IPM) yang merupakan satu pendekatan holistik dalam pengurusan perosak merangkumi pelbagai kaedah, termasuk kawalan biologi, kultur, fizikal, dan kimia[16]. Walaupun IPM memberi tumpuan utama kepada pengurusan perosak dalam persekitaran pertanian, ia secara tidak langsung dapat menyumbang kepada pencegahan pencemaran dengan meminimumkan penggunaan racun serangga dan mempromosikan amalan lestari. Pendekatan ini telah menjadi solusi yang lazim bagi perlindungan tanaman dan telah mendapat pengiktirafan dan sokongan global daripada saintis, pembuat dasar, dan organisasi

[12]https://nature.berkeley.edu/blackmanlab/Blackman_Lab/Lab_News/Entries/2013/2/18_Bloom_of_the_Week_Phytoremediation_with_Sunflower.html#:~:text=Sunflower%20was%20most%20notably%20used,after%20the%20recent%20nuclear%20meltdown.
[13]Ng, Y. S., Samsudin, N. I. S., & Chan, D. J. C. (2017, June). Phytoremediation capabilities of Spirodela polyrhiza and Salvinia molesta in fish farm wastewater: A preliminary study. In IOP Conference Series: Materials Science and Engineering (Vol. 206, No. 1, p. 012084). IOP Publishing.
[14]Farah, D. A., Azhar, A. H., Marlia, M. H., & Nor, A. R. (2019). Phytoremediation capability by Azolla pinnata in aquaculture wastewater treatment. *Sains Malaysiana*, *48*(2), 281-289.
[15]Maryam, G., Majid, N. M., Islam, M. M., Ahmed, O. H., & Abdu, A. (2015). Phytoremediation of copper-contaminated sewage sludge by tropical plants. *Journal of Tropical Forest Science*, 535-547.
[16]Grafton-Cardwell, E., Daane, K. M., & Bentley, W. J. (2013). Integrated Pest Management. UC Agriculture and Natural Resources, Publication 3518. Retrieved from https://anrcatalog.ucanr.edu/Details.aspx?itemNo=3518

pembangunan antarabangsa[17]. Walaupun mempunyai prinsip dan teori yang kukuh, IPM tetap menghadapi kadar penggunaan yang rendah dalam kalangan negara membangun seperti yang ditunjukkan dalam kajian yang melibatkan pengamal IPM dan dari 96 negara yang menyatakan halangan utama yang dihadapi ialah "kekurangan latihan dan sokongan teknikal kepada para petani"[18].

Jabatan Perangkaan Malaysia (DOSM) melaksanakan Survei Perbelanjaan Perlindungan Alam Sekitar secara tahunan untuk mengumpulkan maklumat perbelanjaan pertubuhan khusus bagi tujuan perlindungan alam sekitar. Survei ini meliputi lima jenis perbelanjaan iaitu pengurusan pencemaran, pengurusan sisa, penilaian dan caj alam sekitar, perlindungan hidupan liar dan habitat serta perbelanjaan lain untuk perlindungan alam sekitar di mana perbelanjaan yang terlibat dalam kaedah kawalan biologi akan direkodkan dalam perbelanjaan pengurusan pencemaran. Antara maklum balas kawalan biologi yang diterima melalui survei ini adalah perbelanjaan untuk membeli burung hantu yang dilaporkan oleh pemilik ladang kelapa sawit dalam usaha untuk menghalang serangan tikus di ladang mereka.

Kesimpulan

Kesimpulannya, kaedah kawalan dan pencegahan pencemaran menggunakan pendekatan biologi secara teorinya mampu mengatasi isu pencemaran dengan meminimumkan penggunaan racun serangga perosak dan bahan kimia yang bukan sahaja bersifat mencemarkan, malah akan memusnahkan bakteria yang berfaedah. Bukan itu sahaja, hasil pengeluaran daripada sistem pertanian yang mengamalkan kaedah kawalan biologi juga boleh menjamin kesihatan manusia dan haiwan peliharaan. Walau bagaimanapun, salah satu kelemahan kawalan biologi adalah ia memerlukan masa yang lebih lama untuk menurunkan populasi serangga perosak berbanding dengan penggunaan racun perosak kerana organisma parasit boleh mengambil beberapa hari untuk dihapuskan[19]. Bagi meluaskan aplikasi kawalan biologi di dalam landskap pertanian di Malaysia, kerjasama daripada semua pihak berkepentingan adalah sangat diperlukan terutamanya daripada aspek memupuk kesedaran dalam kalangan pemain industri dan pengusaha pertanian, serta peranan penggubal dasar dalam menggalakkan penggunaan teknologi dan kaedah

[17]Thomas, M. B. (1999). Ecological approaches and the development of "truly integrated" pest management. Proceedings of the National Academy of Sciences, 96(11), 5944-5951.
[18]Parsa, S., Morse, S., Bonifacio, A., Chancellor, T. C., Condori, B., Crespo-Pérez, V., ... & Dangles, O. (2014). Obstacles to integrated pest management adoption in developing countries. Proceedings of the National Academy of Sciences, 111(10), 3889-3894.
[19] Bale, J. S., Van Lenteren, J. C., & Bigler, F. (2008). Biological control and sustainable food production. Philosophical Transactions of the Royal Society B: Biological Sciences, 363(1492), 761-776.

pengeluaran yang menyokong agenda kelestarian seperti mana yang disarankan dalam Matlamat Pembangunan Mampan (SDG).

PENAFIAN

Pandangan yang dinyatakan adalah pandangan penulis dan tidak mewakili pandangan DOSM.

PENGHARGAAN

Penulis merakamkan ucapan terima kasih kepada YBrs. Puan Hajah Nazaria Baharudin, Cik Suhaily Safie, Puan Siti Fairuz Mohd Zukri dan ahli Mesyuarat Jawatankuasa Penerbitan (Program Sosial & Pembangunan Teknikal) atas sumbangan dalam penyediaan artikel ini.

1. INTRODUCTION

The publication of Environmental Protection Expenditure 2022 is an outcome from the Annual Economic Survey (AES) 2022. This publication presents statistics on the environmental protection expenditure for the reference year 2021. The sectors covered in this survey are:

a. *Agriculture;*
b. *Mining & quarrying;*
c. *Manufacturing;*
d. *Construction; and*
e. *Services.*

2. OVERALL PERFORMANCE

Environmental protection expenditure recorded a 4.8 per cent annual growth reaching a value of RM3,115.9 million. The operating expenditure remained as the main contributor with 77.1 per cent share and recorded a positive growth of 8.6 per cent to RM2,402.6 million. On the other hand, capital expenditure represented 22.9 per cent, declined by 6.3 per cent to RM713.4 million.

Exhibit 1: Environmental protection expenditure, 2020 and 2021

	OPERATING (RM MILLION)	CAPITAL (RM MILLION)	TOTAL (RM MILLION)
2021	2,402.6	713.4	3,115.9
2020	2,211.4	761.4	2,972.8
ANNUAL GROWTH RATE (%)	8.6	-6.3	4.8

3. ENVIRONMENTAL PROTECTION EXPENDITURE BY TYPE OF EXPENDITURE

Pollution management and waste management expenditure remained as the major expenditure incurred by Malaysian industries which collectively accounted for 96.7 per cent of the total environmental protection expenditure. Pollution management expenditure amounted to RM2,210.2 million, representing 70.9 per cent of the total, while waste management expenditure was RM803.7 million or a share of 25.8 per cent. The remaining three categories of expenditure for environmental protection were environmental assessment and charges (RM70.6 million; 2.3%), other environmental protection expenditure (RM19.3 million; 0.6%) and protection of wildlife & habitat (RM12.2 million; 0.4%).

Exhibit 2: Environmental protection expenditure by type of expenditure, 2021

Pollution management	Waste management	Environmental assessment and charges	Other environmental protection expenditure	Protection of wildlife & habitat
RM2,210.2 million	RM803.7 million	RM70.6 million	RM19.3 million	RM12.2 million
C: 27.8% O: 72.2%	C: 9.4% O: 90.6%	C: 23.4% O: 76.6%	C: 8.0% O: 92.0%	C: 32.9% O: 67.1%

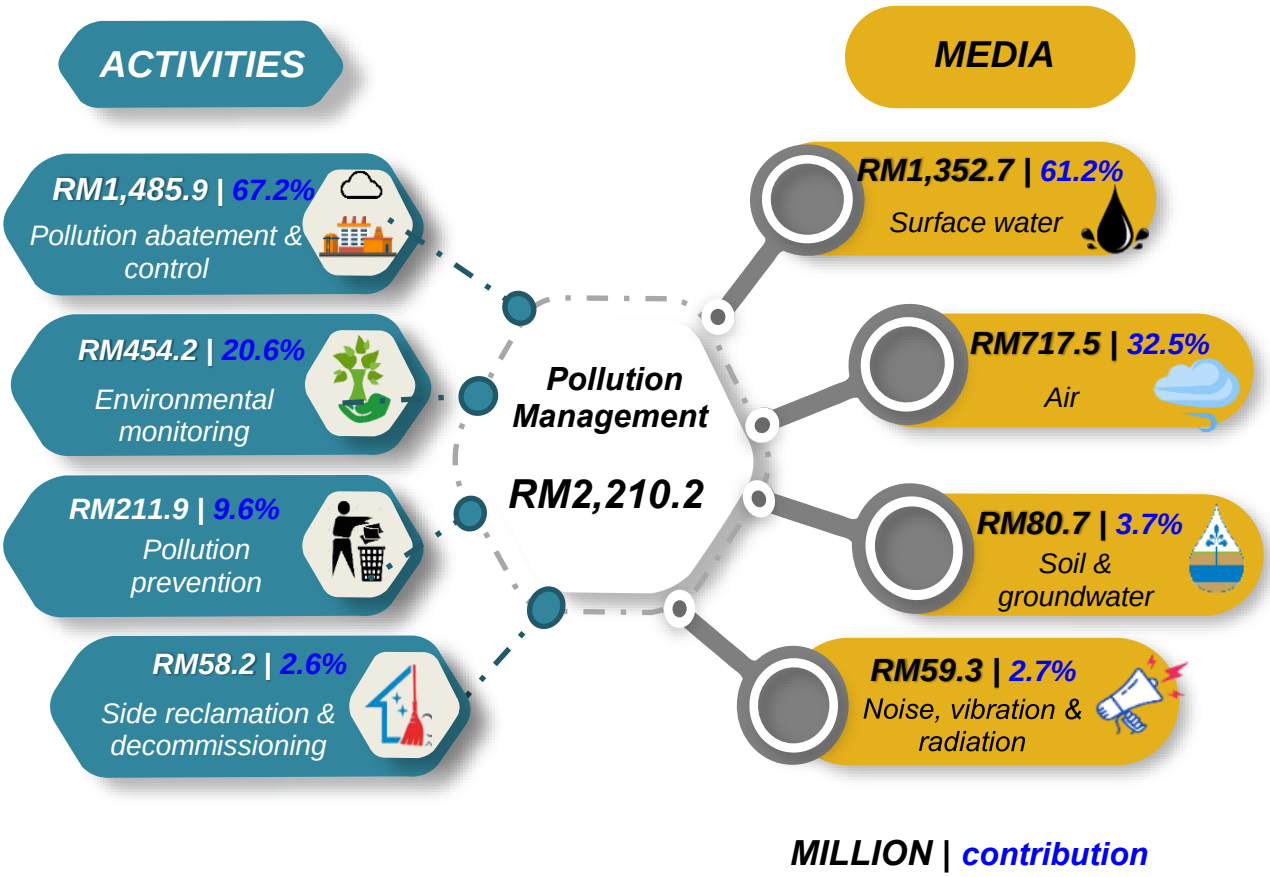
Total : RM3,115.9 million

C: Capital expenditure
O: Operating expenditure

The pollution management expenditure can be categorised by type of activities and media. In terms of type of activities, pollution abatement & control was the main contributor with a share of 67.2 per cent (RM1,485.9 million). This was followed by the environmental monitoring and pollution prevention activities with a share of 20.6 per cent (RM454.2 million) and 9.6 per cent (RM211.9 million) respectively.

Meanwhile, as for pollution management expenditure by media, 61.2 per cent was spent on surface water amounted to RM1,352.7 million and 32.5 per cent (RM717.5 million) on air. The remaining was spent on soil & groundwater as well as noise, vibration & radiation media with RM80.7 million (3.7%) and RM59.3 million (2.7%), respectively.

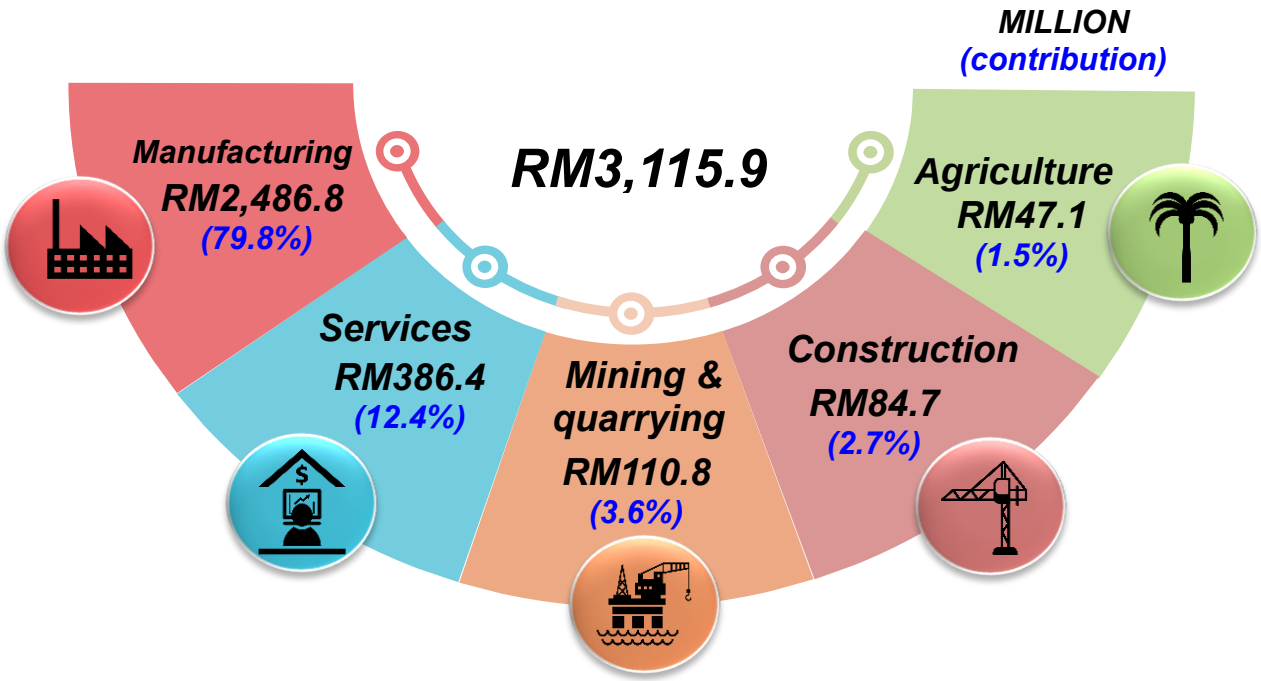
Exhibit 3: Pollution management expenditure by activities and media, 2021



4. ENVIRONMENTAL EXPENDITURE BY SECTOR

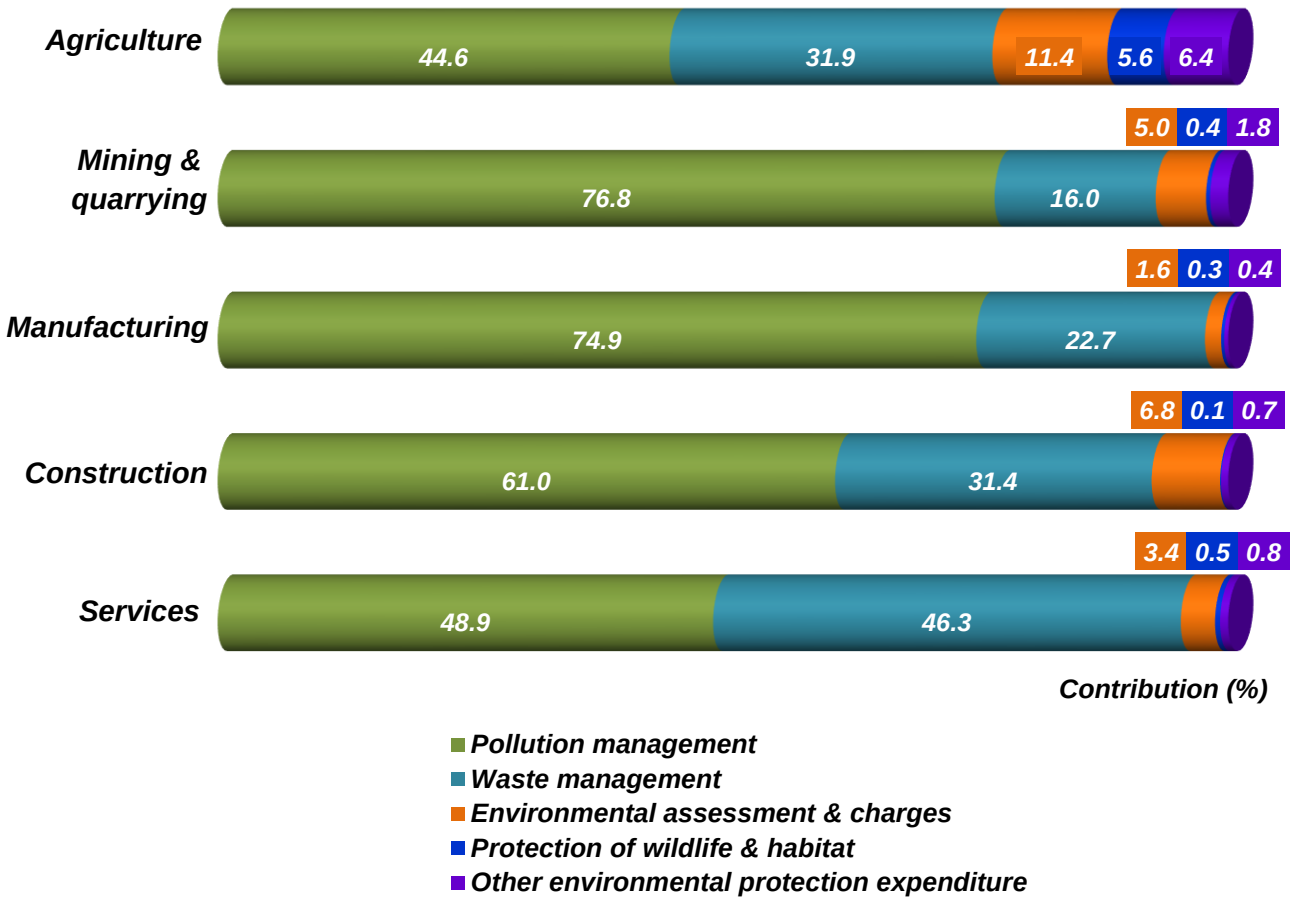
The Manufacturing sector constituted the highest share of environmental protection expenditure in 2021 at 79.8 per cent and amounting to RM2,486.8 million followed by the Services sector with RM386.4 million or 12.4 per cent. In addition, the Mining & quarrying, Construction and Agriculture sectors accounted for 3.6 per cent (RM110.8 million), 2.7 per cent (RM84.7 million) and 1.5 per cent (RM47.1 million), respectively.

Exhibit 4: Environmental protection expenditure by sector, 2021



In general, the spending patterns of the Manufacturing, Mining & quarrying and Construction sectors inclined towards pollution management expenditure with a contribution of more than 60 per cent. Meanwhile, the spending pattern for the Services sector is fairly balanced between pollution management and waste management with a contribution of 48.9 per cent and 46.3 per cent respectively. The Agriculture sector is also dominated by pollution management and waste management expenditure. However, the expenditure on environmental assessments & charges and protection of wildlife & habitat were more significant in the Agriculture sector as compared to other sectors with both expenses contributing 17.0 per cent.

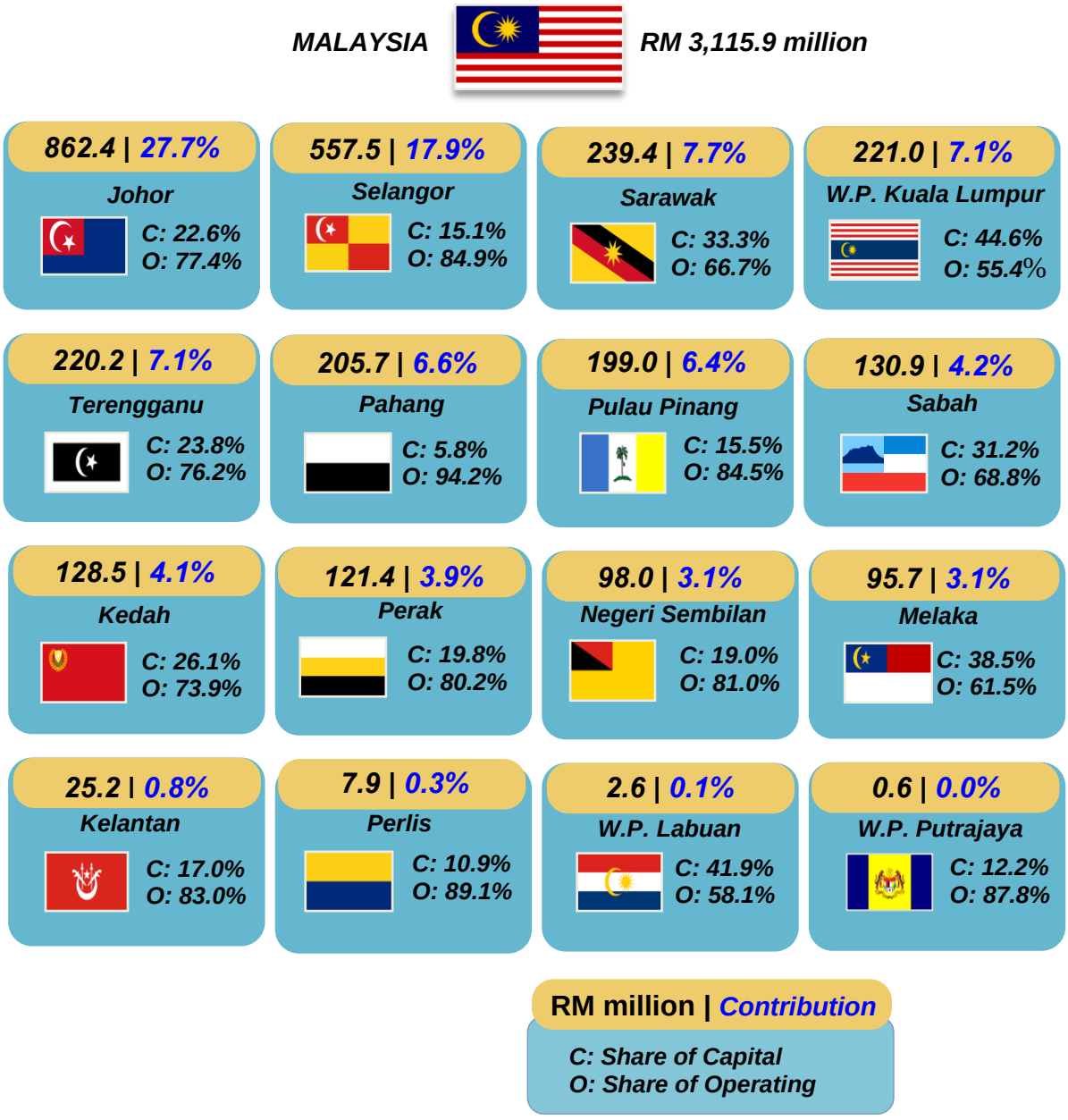
Chart 1: Type of environmental protection expenditure by sector, 2021



5. ENVIRONMENTAL PROTECTION EXPENDITURE BY STATE

Environmental protection expenditure by state was dominated by Johor at RM862.4 million with a contribution of 27.7 per cent. This was followed by Selangor RM557.5 million (17.9%), Sarawak RM239.4 million (7.7%), W.P. Kuala Lumpur RM221.0 million (7.1%) and Terengganu RM220.2 million (7.1%). These five states accounted for 67.4 per cent of the total expenditure in 2021.

Exhibit 5: Environmental protection expenditure and contribution by state, 2021



BIOLOGICAL APPROACHES FOR POLLUTION PREVENTION AND CONTROL IN THE AGRICULTURE SECTOR

Fuziah Md. Amin, Syed Ibrahim Mohd Jamaluddin, Nazira Abdullah,
Mahadi Mohd Nor, Nurul Asmahusna Asari,
Agricultural and Environment Statistics Division

Introduction

Environmental sustainability entails the responsible interaction with the environment with the aim to prevent the depletion of natural resources and to ensure better environment conditions for a long period of time. According to the United States Environmental Protection Agency (U.S. EPA), pursuing sustainability is about creating and maintaining the conditions under which humans and nature can exist in a productive harmony to support present and future generations[1]. Besides, the UN World Commission on Environment and Development (WCED) explains sustainable development as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs[2]. The process of urbanisation, emerging industries and modern agricultural methods which are not implemented in a sustainable manner may contribute to the contamination of water, air and soil resources. The over-exploitation and contamination of natural resources with hazardous substances will pose challenges for the survival of future generations.

Sustainable Agriculture

Sustainable agriculture refers to farming activities that is carried out in such a way to protect the environment, aid and expand natural resources and to make the best use of non-renewable resources[3]. The Food and Agriculture Organization of the United Nations (FAO) underlines five key principles of sustainability for food and agriculture namely increase productivity, employment and value addition in food systems; protect and enhance natural resources; improve livelihoods and foster inclusive economic growth; enhance the resilience of people, communities and ecosystems; and adapt governance to new challenges[4]. Sustainable agriculture vision in Malaysia is in line with the country's sustaibale development goals to uplift income status of target groups such as farmers, livestock breeders, fishermen

[1] *https://www.epa.gov/sustainability/learn-about-sustainability#what*
[2] *https://www.sustain.ucla.edu/what-is-sustainability/*
[3] *https://www.nal.usda.gov/farms-and-agricultural-production-systems/sustainable-agriculture*
[4] *https://www.fao.org/sustainability/background/en/#:~:text=FAO's%20vision%20for%20sustainable%20food,well%20as%20future%20human%20needs.*

and agro-based entrepreneurs[5]. The transformation of agricultural sector is also higlighted in the National Agrofood Policy (NAP 2.0) 2021-2023 that is formulated with the objective of ensuring food supply, enhancing the competitiveness and sustainability of the agrofood industry, and elevating the income level of the target group[6].

Biological methods in agriculture activities

Biological control refers to methods of managing pest populations without the use of insecticides or chemicals. The effectiveness of biological methods in preventing pollution has been widely studied and is considered as one of the sustainable approaches to natural resources management. Malaysian Agricultural Research and Development Institute (MARDI) describes five types of biological control methods in controlling pests and diseases in paddy fields namely parasitoid, predatorship, entomopathogen, antagonistic microorganisms and plant extract.These methods are referring to the use of natural enemies whose role are to control pest population and disease so that they may not cause economic loss. Biological control methods can be implemented through several approaches, namely classical biological control, augmentation, inoculative release method, inundative release method, or conservation[7].

Universiti Sains Malaysia (USM), in collaboration with the Malaysian Palm Oil Green Conservation Foundation (MPOGCF) has recently initiated the Barn Owl initiative program for Palm Oil Smallholders (BOSI) to assist them in rodent control within their fields. This effort represents a green initiative aimed at minimising the use of pesticides, which have adverse effects on the environment and can harm other animals that consume poisoned rodents. The method of using barn owls or owls to regulate rodents populations has been widely practiced in large-scale palm oil plantations owned by companies, but this good agricultural practice has not been extended to small-scale farmers. Therefore, this collaboration is expected to help small-scale farmers in utilizing this method as it is safer for humans and the environment, while also reducing the usage of rat poisons[8].

MARDI in collaboration with the Department of Agriculture (DOA) have also successfully developed a package of biological control agents that effectively combat insect pests particularly in highland vegetables. The developed ecological concept technology

[5] Rahman, R.A. (2021) Green nanotechnology for sustainable agriculture in Malaysia, FFTC Agricultural Policy Platform (FFTC-AP). Available at: https://ap.fftc.org.tw/article/2833 (Accessed: 15 June 2023).
[6] Translated from https://www.fama.gov.my/documents/20143/64638/Pendahuluan.pdf/115d5802-ee67-4c5e-9e08-9eed710a6624
[7] Translated from - Amzah, B., Misman, S. N., Mohamad, M., & Vun, C. T. Pengurusan bersepadu perosak, penyakit dan rumpai dalam pengeluaran mampan tanaman padi.
[8] Translated from https://www.mpogcf.org/mpogcf-dan-usm-bekerjasama-bina-sarang-burung-pungguk-jelapang-untuk-pekebun-pekebun-kecil-kelapa-sawit/

serves as the foundation for integrated pest management, which not only ensures user safety but also contributes to the preservation of ecosystem stability in Cameron Highlands. This project utilises two parasitoids, namely Diadegma Semiclausum and Cotesia Vestalis as biological control agents, demonstrating their efficacy in managing cruciferous plants' primary pest attacks particularly in cabbage vegetables. The economic analysis found that this technology is capable of providing savings in pest control chemical costs amounting to RM2,000 per season[9].

Besides, Ministry of Science, Technology and Innovation (MOSTI) has recently launched the Malaysian Family Bioremediation Program at the Center for Integrated Agricultural Services, Muar Selatan Farmers Association in Johor. This program aims to provide training and technology transfer on Black Soldier Fly (BSF) breeding methods, both in theory and practice, to the local community. The bioremediation process involves the safe, environmentally friendly, and sustainable management of waste by utilising BSF larvae for composting domestic and agro-industrial waste resulting in the production of animal feed and high-quality organic fertiliser. By producing these agricultural inputs, breeders and farmers can alleviate financial burdens and costs while also addressing domestic waste management challenges and reducing agricultural waste in the surrounding area[10].

Phytoremediation for pollutants removals

Other than biological control methods for preventing pollution caused by the use of pesticides, phytoremediation methods can also be employed as an alternative approach to remove pollutants using natural plants. Phytoremediation refers to the treatment of pollutants or waste, for instance, contaminated soil or groundwater by the use of green plants that remove, degrade, or stabilize the undesirable substances such as toxic metals[11]. One notable example of phytoremediation is the use of sunflowers to restore contaminated soil following the nuclear plant explosion in Chernobyl, Russia[12].

Aquaculture activities such as catfish farming usually generate polluting waste. Several studies have been conducted in Malaysia to assess the effectiveness of employing phytoremediation methods for treating aquaculture wastewater. One such study took place in

---

[9] Translated from https://blogmardi.wordpress.com/2019/06/22/agen-kawalan-biologi/

[10] Translated from https://www.mosti.gov.my/en/berita/program-bioremediasi-keluarga-malaysia-mengurangkan-beban-dan-kos-penternak-2/

[11] Merriam-Webster. (n.d.). Phytoremediation. In Merriam-Webster.com dictionary. Retrieved June 16, 2023, from https://www.merriam-webster.com/dictionary/phytoremediation

[12]https://nature.berkeley.edu/blackmanlab/Blackman_Lab/Lab_News/Entries/2013/2/18_Bloom_of_the_Week__Phytoremediation_with_Sunflower.html#:~:text=Sunflower%20was%20most%20notably%20used,after%20the%20recent%20nuclear%20meltdown.

a catfish breeding pond in Sungai Udang, Nibong Tebal, which utilized S. molesta and S. polyrhiza as phytoremediation agents. The findings demonstrated that these agents were capable of effectively reducing nutrient levels in fish farm wastewater as compared to ion exchange methods that often incur high costs[13]. Furthermore, laborotary study employing the aquatic plant, Azolla pinnata as an agent for treating catfish pond waste revealed a decrease in ammonia and phosphate levels in the wastewater[14]. Another study investigating phytoremediation using Jatropha curcas, Acacia mangium, and Hopea odorata found that these plants exhibited potential for absorbing copper from soil contaminated with sewage sludge[15]. In a nutshell, each phytoremediation agent have distictive capabilities in treating pollutants.

Challenges of adopting biological control

Eventhough biological control may save the environment, the challenges in adopting this method among agricultural practinioners are always opened for discussion. An example of biological method in agricultural setting is Integrated Pest Management (IPM), a holistic approach to pest management that incorporates various methods, including biological, cultural, physical, and chemical control measures[16]. While IPM primarily focuses on pest management in agricultural settings, it can indirectly contribute to pollution prevention by minimizing the use of chemical pesticides and promoting sustainable practices. This approach has emerged as the prevailing solution for crops protection and has gained global recognition and support from scientists, policymakers, and international development organizations[17]. Despite its sound principles and theoretical prominence, IPM still faces low adoption rates in developing countries, as highlighted by a survey of IPM practitioners from 96 countries which revealed that the most common obstacle perceived was "insufficient training and technical support to farmers"[18].

The Department of Statistics Malaysia (DOSM) conducted the environmental protection expenditure survey annually to gather information on establishments' expenditures

[13] *Ng, Y. S., Samsudin, N. I. S., & Chan, D. J. C. (2017, June). Phytoremediation capabilities of Spirodela polyrhiza and Salvinia molesta in fish farm wastewater: A preliminary study. In IOP Conference Series: Materials Science and Engineering (Vol. 206, No. 1, p. 012084). IOP Publishing.*

[14] *Farah, D. A., Azhar, A. H., Marlia, M. H., & Nor, A. R. (2019). Phytoremediation capability by Azolla pinnata in aquaculture wastewater treatment. Sains Malaysiana, 48(2), 281-289.*

[15] *Maryam, G., Majid, N. M., Islam, M. M., Ahmed, O. H., & Abdu, A. (2015). Phytoremediation of copper-contaminated sewage sludge by tropical plants. Journal of Tropical Forest Science, 535-547.*

[16] *Grafton-Cardwell, E., Daane, K. M., & Bentley, W. J. (2013). Integrated Pest Management. UC Agriculture and Natural Resources, Publication 3518. Retrieved from https://anrcatalog.ucanr.edu/Details.aspx?itemNo=3518*

[17] *Thomas, M. B. (1999). Ecological approaches and the development of "truly integrated" pest management. Proceedings of the National Academy of Sciences, 96(11), 5944-5951.*

[18] *Parsa, S., Morse, S., Bonifacio, A., Chancellor, T. C., Condori, B., Crespo-Pérez, V., ... & Dangles, O. (2014). Obstacles to integrated pest management adoption in developing countries. Proceedings of the National Academy of Sciences, 111(10), 3889-3894.*

specifically dedicated to environmental protection. The survey covered five categories of expenditure, namely pollution management, waste management, environmental assessment and charges, protection of wildlife and habitat, and other environmental protection expenditure in which the expenses related to biological control methods are recorded under pollution management expenses. One notable response received through this survey was the expenditure made by palm oil plantation owners on purchasing owls as a measure to prevent rodent infestation.

Conclusion

In conclusion, pollution control and prevention methods by employing a biological approach have the potential to address pollution issues by reducing the reliance on pesticides and chemicals, which not only contribute to pollution but also harmful to beneficial bacteria. Moreover, adopting biological control methods in agricultural systems can ensure the well-being of both humans and animals. However, one of the limitations of biological control is that it is slower to suppress pest populations than most pesticides as parasitised organisms may take several days to die[19]. To promote the widespread adoption of biological control in Malaysia's agricultural landscape, collaboration among all stakeholders is crucial especially in raising awareness among industry players and agricultural operators, as well as the active involvement of policymakers in promoting the use of technologies and production methods that align with the sustainability agenda, such as those recommended in the Sustainable Development Goals (SDGs).

DISCLAIMER

The views expressed in this article are those of the authors and do not represent the views of DOSM.

ACKNOWLEDGEMENT

The author would like to thank YBrs. Puan Hajah Nazaria Baharudin, Cik Suhaily Safie, Puan Siti Fairuz Mohd Zukri and members of the Publication Committee Meeting (Technical Development & Social Programme) for their contribution in preparing this article.

[19] *Bale, J. S., Van Lenteren, J. C., & Bigler, F. (2008). Biological control and sustainable food production. Philosophical Transactions of the Royal Society B: Biological Sciences, 363(1492), 761-776.*

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

JADUAL

TABLES

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

A SIRI MASA PERBELANJAAN PERLINDUNGAN ALAM SEKITAR

TIME SERIES ON ENVIRONMENTAL PROTECTION EXPENDITURE

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

Jadual 1: Perbelanjaan perlindungan alam sekitar mengikut sektor, 2017-2021
Table 1: Environmental protection expenditure by sector, 2017-2021

Sektor *Sector*	2017		2018		2019		2020		2021	
	(RM'000)	%	(RM'000)	%	(RM'000)	%	(RM'000)	%	(RM'000)	%
Jumlah *Total*	**2,592,648**	**100.0**	**2,695,687**	**100.0**	**2,885,259**	**100.0**	**2,972,801**	**100.0**	**3,115,940**	**100.0**
Pertanian *Agriculture*	**45,473**	**1.8**	**45,518**	**1.7**	**32,671**	**1.1**	**34,917**	**1.2**	**47,098**	**1.5**
Perlombongan & pengkuarian *Mining & quarrying*	**313,213**	**12.1**	**305,462**	**11.3**	**96,310**	**3.3**	**100,421**	**3.4**	**110,847**	**3.6**
Pembuatan *Manufacturing*	**1,734,920**	**66.9**	**1,820,762**	**67.5**	**2,181,290**	**75.6**	**2,382,378**	**80.1**	**2,486,838**	**79.8**
Pembinaan *Construction*	**223,992**	**8.6**	**230,037**	**8.5**	**161,183**	**5.6**	**88,366**	**3.0**	**84,717**	**2.7**
Perkhidmatan *Services*	**275,050**	**10.6**	**293,907**	**10.9**	**413,806**	**14.3**	**366,720**	**12.3**	**386,440**	**12.4**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	41,738	1.6	18,287	0.7	24,684	0.9	18,685	0.6	21,138	0.7
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	81,030	3.1	157,620	5.8	184,240	6.4	195,111	6.6	171,628	5.5
Pengangkutan & penyimpanan *Transportation & storage*	77,594	3.0	88,816	3.3	117,238	4.1	88,525	3.0	107,631	3.5
Lain-lain perkhidmatan *Other services*	74,688	2.9	29,184	1.1	87,645	3.0	64,399	2.2	86,043	2.8

Jadual 1.1: Perbelanjaan modal perlindungan alam sekitar mengikut sektor, 2017-2021
Table 1.1: Capital expenditure on environmental protection by sector, 2017-2021

Sektor *Sector*	2017		2018		2019		2020		2021	
	(RM'000)	%	(RM'000)	%	(RM'000)	%	(RM'000)	%	(RM'000)	%
Jumlah *Total*	**717,275**	**100.0**	**726,945**	**100.0**	**858,134**	**100.0**	**761,421**	**100.0**	**713,350**	**100.0**
Pertanian *Agriculture*	**5,122**	**0.7**	**7,790**	**1.1**	**3,794**	**0.4**	**11,428**	**1.5**	**12,892**	**1.8**
Perlombongan & pengkuarian *Mining & quarrying*	**28,814**	**4.0**	**31,023**	**4.3**	**3,554**	**0.4**	**10,902**	**1.4**	**13,351**	**1.9**
Pembuatan *Manufacturing*	**539,690**	**75.2**	**551,430**	**75.9**	**638,683**	**74.4**	**610,804**	**80.2**	**527,997**	**74.0**
Pembinaan *Construction*	**98,605**	**13.7**	**87,621**	**12.1**	**30,301**	**3.5**	**24,374**	**3.2**	**21,058**	**3.0**
Perkhidmatan *Services*	**45,045**	**6.3**	**49,080**	**6.8**	**181,802**	**21.2**	**103,913**	**13.6**	**138,052**	**19.4**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	1,770	0.2	1,597	0.2	5,672	0.7	4,278	0.6	7,627	1.1
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	6,229	0.9	30,473	4.2	62,966	7.3	27,672	3.6	36,860	5.2
Pengangkutan & penyimpanan *Transportation & storage*	31,726	4.4	15,899	2.2	67,090	7.8	50,718	6.7	65,882	9.2
Lain-lain perkhidmatan *Other services*	5,320	0.7	1,111	0.2	46,075	5.4	21,245	2.8	27,683	3.9

Jadual 1.2: Perbelanjaan operasi perlindungan alam sekitar mengikut sektor, 2017-2021
Table 1.2: Operating expenditure on environmental protection by sector, 2017-2021

Sektor *Sector*	2017		2018		2019		2020		2021	
	(RM'000)	%	(RM'000)	%	(RM'000)	%	(RM'000)	%	(RM'000)	%
Jumlah *Total*	**1,875,373**	**100.0**	**1,968,742**	**100.0**	**2,027,125**	**100.0**	**2,211,380**	**100.0**	**2,402,589**	**100.0**
Pertanian *Agriculture*	**40,351**	**2.2**	**37,729**	**1.9**	**28,876**	**1.4**	**23,489**	**1.1**	**34,206**	**1.4**
Perlombongan & pengkuarian *Mining & quarrying*	**284,399**	**15.2**	**274,439**	**13.9**	**92,756**	**4.6**	**89,519**	**4.0**	**97,497**	**4.1**
Pembuatan *Manufacturing*	**1,195,230**	**63.7**	**1,269,332**	**64.5**	**1,542,607**	**76.1**	**1,771,574**	**80.1**	**1,958,840**	**81.5**
Pembinaan *Construction*	**125,388**	**6.7**	**142,416**	**7.2**	**130,882**	**6.5**	**63,992**	**2.9**	**63,658**	**2.6**
Perkhidmatan *Services*	**230,005**	**12.3**	**244,827**	**12.4**	**232,004**	**11.4**	**262,807**	**11.9**	**248,388**	**10.3**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	39,968	2.1	16,690	0.8	19,012	0.9	14,407	0.7	13,512	0.6
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	74,801	4.0	127,147	6.5	121,274	6.0	167,438	7.6	134,767	5.6
Pengangkutan & penyimpanan *Transportation & storage*	45,867	2.4	72,917	3.7	50,148	2.5	37,807	1.7	41,749	1.7
Lain-lain perkhidmatan *Other services*	69,369	3.7	28,073	1.4	41,570	2.1	43,154	2.0	58,359	2.4

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

B

STATISTIK PERBELANJAAN PERLINDUNGAN ALAM SEKITAR MENGIKUT NEGERI

STATISTICS ON ENVIRONMENTAL PROTECTION EXPENDITURE BY STATE

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

Jadual 2: Perbelanjaan perlindungan alam sekitar mengikut negeri dan jenis perbelanjaan, 2021

Table 2: Environmental protection expenditure by state and type of expenditure, 2021

Negeri *State*	**Jumlah** *Total*		**Pengurusan pencemaran** *Pollution management*	**Perlindungan hidupan liar & habitat** *Protection of wildlife & habitat*	**Penilaian dan caj alam sekitar** *Environmental assessment and charges*	**Pengurusan sisa** *Waste management*	**Perbelanjaan lain untuk perlindungan alam sekitar** *Other environmental protection expenditure*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**3,115,940**	**100.0**	**2,210,166**	**12,189**	**70,599**	**803,705**	**19,281**
%	**100.0**		**70.9**	**0.4**	**2.3**	**25.8**	**0.6**
Johor	**862,398**	**27.7**	660,433	4,289	9,754	184,388	3,535
Kedah	**128,481**	**4.1**	90,088	171	1,567	36,049	606
Kelantan	**25,186**	**0.8**	17,233	806	1,234	5,800	112
Melaka	**95,676**	**3.1**	78,090	-	922	16,335	328
Negeri Sembilan	**97,961**	**3.1**	67,819	569	4,536	24,222	815
Pahang	**205,747**	**6.6**	182,567	22	1,603	20,844	711
Pulau Pinang	**198,977**	**6.4**	114,391	12	4,221	78,889	1,465
Perak	**121,367**	**3.9**	85,945	455	2,428	31,288	1,251
Perlis	**7,943**	**0.3**	5,894	-	20	2,025	4
Selangor	**557,525**	**17.9**	363,703	23	7,196	184,977	1,626
Terengganu	**220,152**	**7.1**	184,519	55	2,129	32,338	1,111
Sabah	**130,864**	**4.2**	95,273	3,244	7,781	21,818	2,748
Sarawak	**239,412**	**7.7**	137,636	543	14,045	84,967	2,222
W.P. Kuala Lumpur	**221,029**	**7.1**	125,313	1,999	13,112	77,863	2,742
W.P. Labuan	**2,586**	**0.1**	945	-	-	1,641	-
W.P. Putrajaya	**635**	**0.0**	318	-	50	262	5

Jadual 2.1: Perbelanjaan modal perlindungan alam sekitar mengikut negeri dan jenis perbelanjaan, 2021

Table 2.1: Capital expenditure on environmental protection by state and type of expenditure, 2021

Negeri *State*	**Jumlah** *Total*		**Pengurusan pencemaran** *Pollution management*	**Perlindungan hidupan liar & habitat** *Protection of wildlife & habitat*	**Penilaian dan caj alam sekitar** *Environmental assessment and charges*	**Pengurusan sisa** *Waste management*	**Perbelanjaan lain untuk perlindungan alam sekitar** *Other environmental protection expenditure*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**713,350**	**100.0**	**615,428**	**4,007**	**16,488**	**75,886**	**1,542**
%	**100.0**		**86.3**	**0.6**	**2.3**	**10.6**	**0.2**
Johor	**195,199**	**27.4**	158,045	2,710	3,359	30,916	168
Kedah	**33,555**	**4.7**	28,368	73	93	4,981	40
Kelantan	**4,270**	**0.6**	3,410	276	255	291	38
Melaka	**36,837**	**5.2**	34,175	-	423	2,187	52
Negeri Sembilan	**18,591**	**2.6**	15,773	276	144	2,099	300
Pahang	**12,003**	**1.7**	10,130	11	139	1,472	251
Pulau Pinang	**30,920**	**4.3**	29,587	-	969	334	29
Perak	**24,073**	**3.4**	22,412	182	456	945	77
Perlis	**869**	**0.1**	629	-	20	220	-
Selangor	**84,155**	**11.8**	73,739	-	741	9,491	183
Terengganu	**52,460**	**7.4**	52,321	-	53	60	26
Sabah	**40,830**	**5.7**	35,747	204	1,168	3,444	267
Sarawak	**79,784**	**11.2**	67,489	8	3,765	8,521	1
W.P. Kuala Lumpur	**98,644**	**13.8**	83,364	268	4,896	10,009	107
W.P. Labuan	**1,083**	**0.2**	187	-	-	896	-
W.P. Putrajaya	**78**	**0.0**	50	-	7	18	3

Jadual 2.2: Perbelanjaan operasi perlindungan alam sekitar mengikut negeri dan jenis perbelanjaan, 2021

Table 2.2: Operating expenditure on environmental protection by state and type of expenditure, 2021

Negeri *State*	**Jumlah** *Total*		**Pengurusan pencemaran** *Pollution management*	**Perlindungan hidupan liar & habitat** *Protection of wildlife & habitat*	**Penilaian dan caj alam sekitar** *Environmental assessment and charges*	**Pengurusan sisa** *Waste management*	**Perbelanjaan lain untuk perlindungan alam sekitar** *Other environmental protection expenditure*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**2,402,589**	**100.0**	**1,594,739**	**8,182**	**54,111**	**727,819**	**17,739**
%	**100.0**		**66.4**	**0.3**	**2.3**	**30.3**	**0.7**
Johor	**667,199**	**27.8**	502,388	1,579	6,394	153,471	3,367
Kedah	**94,926**	**4.0**	61,720	98	1,475	31,068	565
Kelantan	**20,916**	**0.9**	13,823	530	980	5,509	74
Melaka	**58,839**	**2.4**	43,915	-	499	14,148	277
Negeri Sembilan	**79,369**	**3.3**	52,045	293	4,392	22,124	515
Pahang	**193,744**	**8.1**	172,437	12	1,464	19,372	460
Pulau Pinang	**168,057**	**7.0**	84,804	12	3,251	78,554	1,436
Perak	**97,295**	**4.0**	63,532	273	1,973	30,343	1,174
Perlis	**7,074**	**0.3**	5,265	-	-	1,805	4
Selangor	**473,370**	**19.7**	289,964	23	6,455	175,486	1,442
Terengganu	**167,692**	**7.0**	132,198	55	2,077	32,277	1,085
Sabah	**90,034**	**3.7**	59,526	3,041	6,612	18,374	2,481
Sarawak	**159,628**	**6.6**	70,147	535	10,280	76,445	2,222
W.P. Kuala Lumpur	**122,386**	**5.1**	41,949	1,731	8,216	67,855	2,635
W.P. Labuan	**1,503**	**0.1**	759	-	-	745	-
W.P. Putrajaya	**558**	**0.0**	268	-	43	244	2

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

C STATISTIK JUMLAH PERBELANJAAN PERLINDUNGAN ALAM SEKITAR

STATISTICS ON TOTAL ENVIRONMENTAL PROTECTION EXPENDITURE

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

Jadual 3: Perbelanjaan perlindungan alam sekitar mengikut sektor dan jenis perbelanjaan, 2021

Table 3: Environmental protection expenditure by sector and type of expenditure, 2021

Sektor *Sector*	**Jumlah** *Total*		**Pengurusan pencemaran** *Pollution management*	**Perlindungan hidupan liar & habitat** *Protection of wildlife & habitat*	**Penilaian dan caj alam sekitar** *Environmental assessment and charges*	**Pengurusan sisa** *Waste management*	**Perbelanjaan lain untuk perlindungan alam sekitar** *Other environmental protection expenditure*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**3,115,940**	**100.0**	**2,210,166**	**12,189**	**70,599**	**803,705**	**19,281**
%	**100.0**		**70.9**	**0.4**	**2.3**	**25.8**	**0.6**
Pertanian *Agriculture*	**47,098**	**1.5**	**21,022**	**2,651**	**5,374**	**15,046**	**3,006**
Perlombongan & pengkuarian *Mining & quarrying*	**110,847**	**3.6**	**85,181**	**457**	**5,490**	**17,724**	**1,995**
Pembuatan *Manufacturing*	**2,486,838**	**79.8**	**1,863,312**	**6,929**	**40,718**	**565,348**	**10,532**
Pembinaan *Construction*	**84,717**	**2.7**	**51,639**	**105**	**5,730**	**26,641**	**602**
Perkhidmatan *Services*	**386,440**	**12.4**	**189,012**	**2,048**	**13,287**	**178,946**	**3,147**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	21,138	0.7	16,973	1,781	310	2,033	41
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	171,628	5.5	52,175	5	3,326	115,206	916
Pengangkutan & penyimpanan *Transportation & storage*	107,631	3.5	88,407	9	3,590	14,619	1,006
Lain-lain perkhidmatan *Other services*	86,043	2.8	31,457	252	6,062	47,088	1,184

Jadual 3.1: Perbelanjaan modal perlindungan alam sekitar mengikut sektor dan jenis perbelanjaan, 2021

Table 3.1: Capital expenditure on environmental protection by sector and type of expenditure, 2021

Sektor *Sector*	**Jumlah** *Total*		**Pengurusan pencemaran** *Pollution management*	**Perlindungan hidupan liar & habitat** *Protection of wildlife & habitat*	**Penilaian dan caj alam sekitar** *Environmental assessment and charges*	**Pengurusan sisa** *Waste management*	**Perbelanjaan lain untuk perlindungan alam sekitar** *Other environmental protection expenditure*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**713,350**	**100.0**	**615,428**	**4,007**	**16,488**	**75,886**	**1,542**
%	**100.0**		**86.3**	**0.6**	**2.3**	**10.6**	**0.2**
Pertanian *Agriculture*	**12,892**	**1.8**	**7,759**	**527**	**789**	**3,590**	**227**
Perlombongan & pengkuarian *Mining & quarrying*	**13,351**	**1.9**	**7,276**	**293**	**3,715**	**2,054**	**13**
Pembuatan *Manufacturing*	**527,997**	**74.0**	**474,501**	**2,889**	**5,901**	**43,565**	**1,142**
Pembinaan *Construction*	**21,058**	**3.0**	**13,670**	**-**	**1,284**	**5,992**	**113**
Perkhidmatan *Services*	**138,052**	**19.4**	**112,222**	**299**	**4,798**	**20,686**	**48**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	7,627	1.1	7,148	252	-	226	-
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	36,860	5.2	24,359	-	2	12,495	4
Pengangkutan & penyimpanan *Transportation & storage*	65,882	9.2	65,604	-	24	234	20
Lain-lain perkhidmatan *Other services*	27,683	3.9	15,111	47	4,772	7,730	23

Jadual 3.2: Perbelanjaan operasi perlindungan alam sekitar mengikut sektor dan jenis perbelanjaan, 2021
Table 3.2: Operating expenditure on environmental protection by sector and type of expenditure, 2021

Sektor *Sector*	**Jumlah** *Total*		**Pengurusan pencemaran** *Pollution management*	**Perlindungan hidupan liar & habitat** *Protection of wildlife & habitat*	**Penilaian dan caj alam sekitar** *Environmental assessment and charges*	**Pengurusan sisa** *Waste management*	**Perbelanjaan lain untuk perlindungan alam sekitar** *Other environmental protection expenditure*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**2,402,589**	**100.0**	**1,594,739**	**8,182**	**54,111**	**727,819**	**17,739**
%	**100.0**		**66.4**	**0.3**	**2.3**	**30.3**	**0.7**
Pertanian *Agriculture*	**34,206**	**1.4**	**13,263**	**2,124**	**4,584**	**11,456**	**2,780**
Perlombongan & pengkuarian *Mining & quarrying*	**97,497**	**4.1**	**77,905**	**164**	**1,775**	**15,671**	**1,982**
Pembuatan *Manufacturing*	**1,958,840**	**81.5**	**1,388,811**	**4,040**	**34,817**	**521,783**	**9,390**
Pembinaan *Construction*	**63,658**	**2.6**	**37,969**	**105**	**4,446**	**20,649**	**489**
Perkhidmatan *Services*	**248,388**	**10.3**	**76,791**	**1,749**	**8,489**	**158,260**	**3,099**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	13,512	0.6	9,825	1,529	310	1,806	41
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	134,767	5.6	27,816	5	3,324	102,711	912
Pengangkutan & penyimpanan *Transportation & storage*	41,749	1.7	22,803	9	3,566	14,385	986
Lain-lain perkhidmatan *Other services*	58,359	2.4	16,347	206	1,290	39,357	1,160

Jadual 4: Perbelanjaan perlindungan alam sekitar mengikut sektor dan pecahan perbelanjaan, 2021

Table 4: Environmental protection expenditure by sector and share of expenditure, 2021

Sektor *Sector*	**Pecahan perbelanjaan** *Share of expenditure*			**Jumlah** *Total*	
		(RM'000)	**%**	**(RM'000)**	**%**
Jumlah *Total*	**Modal**/*Capital*	**713,350**	**22.9**	**3,115,940**	**100.0**
	Operasi/*Operating*	**2,402,589**	**77.1**		
Pertanian *Agriculture*	**Modal**/*Capital*	**12,892**	**27.4**	**47,098**	**1.5**
	Operasi/*Operating*	**34,206**	**72.6**		
Perlombongan & pengkuarian *Mining & quarrying*	**Modal**/*Capital*	**13,351**	**12.0**	**110,847**	**3.6**
	Operasi/*Operating*	**97,497**	**88.0**		
Pembuatan *Manufacturing*	**Modal**/*Capital*	**527,997**	**21.2**	**2,486,838**	**79.8**
	Operasi/*Operating*	**1,958,840**	**78.8**		
Pembinaan *Construction*	**Modal**/*Capital*	**21,058**	**24.9**	**84,717**	**2.7**
	Operasi/*Operating*	**63,658**	**75.1**		
Perkhidmatan *Services*	**Modal**/*Capital*	**138,052**	**35.7**	**386,440**	**12.4**
	Operasi/*Operating*	**248,388**	**64.3**		
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	**Modal**/*Capital*	7,627	36.1	21,138	0.7
	Operasi/*Operating*	13,512	63.9		
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	**Modal**/*Capital*	36,860	21.5	171,628	5.5
	Operasi/*Operating*	134,767	78.5		
Pengangkutan & penyimpanan *Transportation & storage*	**Modal**/*Capital*	65,882	61.2	107,631	3.5
	Operasi/*Operating*	41,749	38.8		
Lain-lain perkhidmatan *Other services*	**Modal**/*Capital*	27,683	32.2	86,043	2.8
	Operasi/*Operating*	58,359	67.8		

D

STATISTIK PERBELANJAAN UNTUK PENGURUSAN PENCEMARAN

STATISTICS ON EXPENDITURE FOR POLLUTION MANAGEMENT

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

Jadual 5: Perbelanjaan untuk pengurusan pencemaran mengikut sektor dan aktiviti, 2021

Table 5: Expenditure for pollution management by sector and activity, 2021

Sektor *Sector*	**Jumlah** *Total*		**Pengawasan alam sekitar** *Environmental monitoring*	**Tebus guna & pembersihan tapak** *Site reclamation & decommissioning*	**Peredaan & kawalan pencemaran** *Pollution abatement & control*	**Pencegahan pencemaran** *Pollution prevention*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**2,210,166**	**100.0**	**454,204**	**58,210**	**1,485,860**	**211,892**
%	**100.0**		**20.6**	**2.6**	**67.2**	**9.6**
Pertanian *Agriculture*	**21,022**	**1.0**	**10,130**	**3,915**	**3,736**	**3,240**
Perlombongan & pengkuarian *Mining & quarrying*	**85,181**	**3.9**	**32,214**	**824**	**35,837**	**16,307**
Pembuatan *Manufacturing*	**1,863,312**	**84.3**	**304,836**	**50,281**	**1,357,005**	**151,191**
Pembinaan *Construction*	**51,639**	**2.3**	**24,389**	**2,094**	**15,596**	**9,561**
Perkhidmatan *Services*	**189,012**	**8.6**	**82,635**	**1,097**	**73,686**	**31,594**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	16,973	0.8	7,383	-	4,362	5,228
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	52,175	2.4	38,917	576	9,708	2,973
Pengangkutan & penyimpanan *Transportation & storage*	88,407	4.0	16,147	78	53,522	18,660
Lain-lain perkhidmatan *Other services*	31,457	1.4	20,187	443	6,095	4,732

Jadual 5.1: Perbelanjaan modal untuk pengurusan pencemaran mengikut sektor dan aktiviti, 2021
Table 5.1: Capital expenditure for pollution management by sector and activity, 2021

Sektor *Sector*	**Jumlah** *Total*		**Pengawasan alam sekitar** *Environmental monitoring*	**Tebus guna & pembersihan tapak** *Site reclamation & decommissioning*	**Peredaan & kawalan pencemaran** *Pollution abatement & control*	**Pencegahan pencemaran** *Pollution prevention*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**615,428**	**100.0**	**132,567**	**27,396**	**363,461**	**92,004**
%	**100.0**		**21.5**	**4.5**	**59.1**	**14.9**
Pertanian *Agriculture*	**7,759**	**1.3**	**3,040**	**2,043**	**632**	**2,044**
Perlombongan & pengkuarian *Mining & quarrying*	**7,276**	**1.2**	**3,111**	**-**	**2,615**	**1,550**
Pembuatan *Manufacturing*	**474,501**	**77.1**	**81,184**	**24,718**	**303,191**	**65,408**
Pembinaan *Construction*	**13,670**	**2.2**	**5,572**	**507**	**5,059**	**2,532**
Perkhidmatan *Services*	**112,222**	**18.2**	**39,659**	**128**	**51,964**	**20,471**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	7,148	1.2	4,430	-	1,968	751
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	24,359	4.0	23,500	73	718	68
Pengangkutan & penyimpanan *Transportation & storage*	65,604	10.7	344	40	46,819	18,401
Lain-lain perkhidmatan *Other services*	15,111	2.5	11,385	15	2,460	1,251

Jadual 5.2: Perbelanjaan operasi untuk pengurusan pencemaran mengikut sektor dan aktiviti, 2021

Table 5.2: Operating expenditure for pollution management by sector and activity, 2021

Sektor *Sector*	**Jumlah** *Total*		**Pengawasan alam sekitar** *Environmental monitoring*	**Tebus guna & pembersihan tapak** *Site reclamation & decommissioning*	**Peredaan & kawalan pencemaran** *Pollution abatement & control*	**Pencegahan pencemaran** *Pollution prevention*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**1,594,739**	**100.0**	**321,637**	**30,814**	**1,122,399**	**119,887**
%	**100.0**		**20.2**	**1.9**	**70.4**	**7.5**
Pertanian *Agriculture*	**13,263**	**0.8**	**7,090**	**1,872**	**3,105**	**1,196**
Perlombongan & pengkuarian *Mining & quarrying*	**77,905**	**4.9**	**29,103**	**824**	**33,222**	**14,757**
Pembuatan *Manufacturing*	**1,388,811**	**87.1**	**223,652**	**25,562**	**1,053,814**	**85,783**
Pembinaan *Construction*	**37,969**	**2.4**	**18,817**	**1,587**	**10,537**	**7,029**
Perkhidmatan *Services*	**76,791**	**4.8**	**42,976**	**969**	**21,722**	**11,123**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	9,825	0.6	2,953	-	2,394	4,478
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	27,816	1.7	15,417	503	8,990	2,905
Pengangkutan & penyimpanan *Transportation & storage*	22,803	1.4	15,803	38	6,703	259
Lain-lain perkhidmatan *Other services*	16,347	1.0	8,802	428	3,635	3,481

Jadual 6: Perbelanjaan untuk pengurusan pencemaran mengikut sektor dan jenis media, 2021
Table 6: Expenditure for pollution management by sector and type of media, 2021

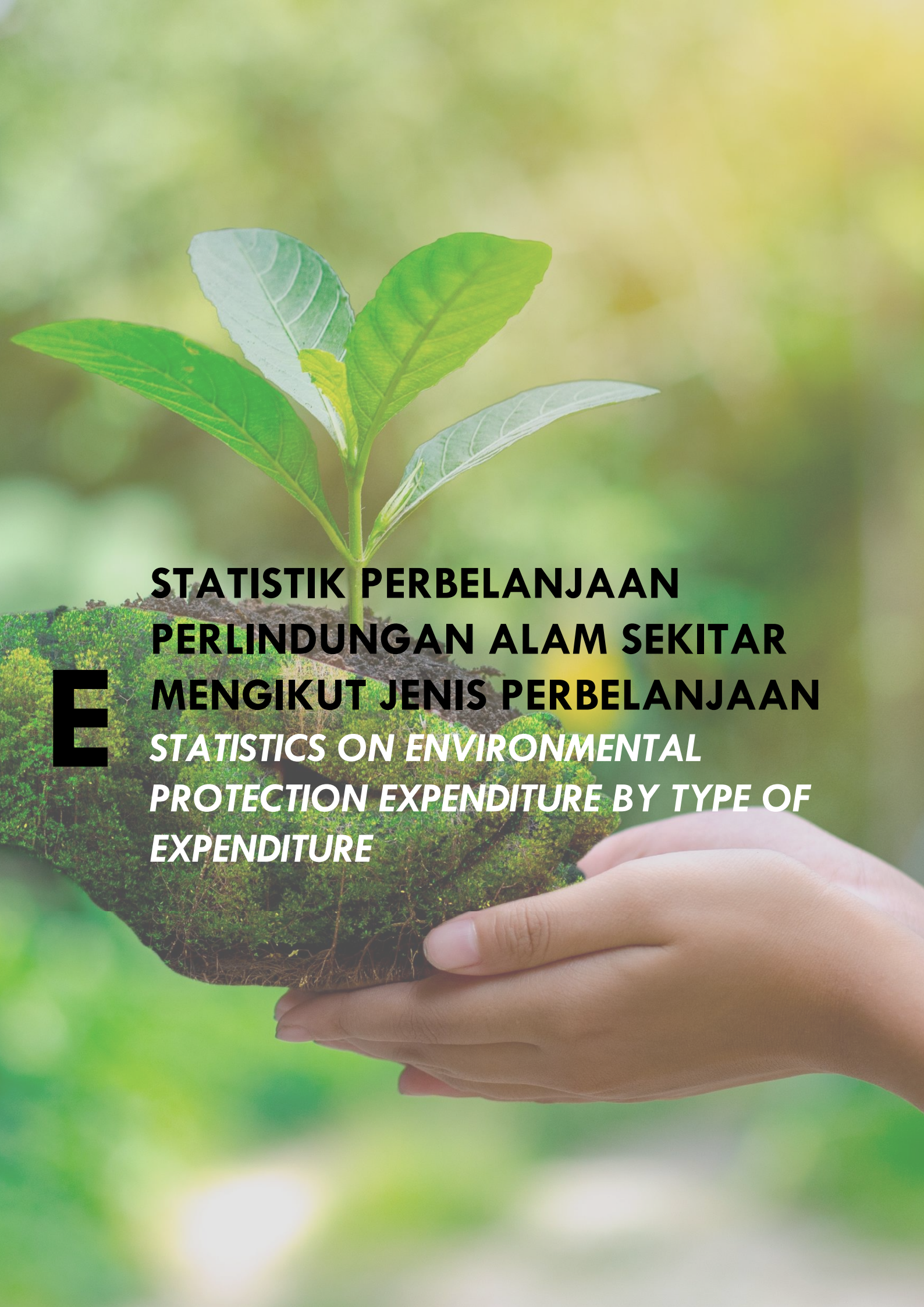
Sektor *Sector*	**Jumlah** *Total*		**Media**			
			Udara *Air*	**Air permukaan** *Surface water*	**Tanah dan air bawah tanah** *Soil and groundwater*	**Bunyi, gegaran dan radiasi** *Noise, vibration and radiation*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**2,210,166**	**100.0**	**717,516**	**1,352,681**	**80,698**	**59,271**
%	**100.0**		**32.5**	**61.2**	**3.7**	**2.7**
Pertanian *Agriculture*	**21,022**	**1.0**	**3,718**	**9,240**	**7,109**	**955**
Perlombongan & pengkuarian *Mining & quarrying*	**85,181**	**3.9**	**16,000**	**62,819**	**1,281**	**5,082**
Pembuatan *Manufacturing*	**1,863,312**	**84.3**	**614,519**	**1,163,617**	**48,289**	**36,886**
Pembinaan *Construction*	**51,639**	**2.3**	**16,010**	**19,267**	**6,147**	**10,216**
Perkhidmatan *Services*	**189,012**	**8.6**	**67,269**	**97,738**	**17,873**	**6,132**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	16,973	0.8	6,499	7,945	499	2,030
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	52,175	2.4	7,387	42,987	1,404	397
Pengangkutan & penyimpanan *Transportation & storage*	88,407	4.0	44,499	29,851	13,369	688
Lain-lain perkhidmatan *Other services*	31,457	1.4	8,884	16,956	2,601	3,016

Jadual 6.1: Perbelanjaan modal untuk pengurusan pencemaran mengikut sektor dan jenis media, 2021
Table 6.1: Capital expenditure for pollution management by sector and type of media, 2021

Sektor *Sector*	**Jumlah** *Total*		**Media**			
			Udara *Air*	**Air permukaan** *Surface water*	**Tanah dan air bawah tanah** *Soil and groundwater*	**Bunyi, gegaran dan radiasi** *Noise, vibration and radiation*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**615,428**	**100.0**	**291,386**	**300,773**	**10,683**	**12,586**
%	**100.0**		**47.3**	**48.9**	**1.7**	**2.0**
Pertanian *Agriculture*	**7,759**	**1.3**	**2,127**	**3,099**	**2,382**	**151**
Perlombongan & pengkuarian *Mining & quarrying*	**7,276**	**1.2**	**2,715**	**2,999**	**107**	**1,455**
Pembuatan *Manufacturing*	**474,501**	**77.1**	**237,248**	**223,835**	**6,785**	**6,634**
Pembinaan *Construction*	**13,670**	**2.2**	**4,197**	**7,107**	**560**	**1,805**
Perkhidmatan *Services*	**112,222**	**18.2**	**45,099**	**63,733**	**849**	**2,541**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	7,148	1.2	3,053	2,526	3	1,566
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	24,359	4.0	411	23,806	138	3
Pengangkutan & penyimpanan *Transportation & storage*	65,604	10.7	40,183	25,078	83	260
Lain-lain perkhidmatan *Other services*	15,111	2.5	1,452	12,323	625	711

Jadual 6.2: Perbelanjaan operasi untuk pengurusan pencemaran mengikut sektor dan jenis media, 2021
Table 6.2: Operating expenditure for pollution management by sector and type of media, 2021

Sektor *Sector*	**Jumlah** *Total*		**Media**			
			Udara *Air*	**Air permukaan** *Surface water*	**Tanah dan air bawah tanah** *Soil and groundwater*	**Bunyi, gegaran dan radiasi** *Noise, vibration and radiation*
	(RM'000)	**%**	**(RM'000)**	**(RM'000)**	**(RM'000)**	**(RM'000)**
Jumlah *Total*	**1,594,739**	**100.0**	**426,130**	**1,051,909**	**70,015**	**46,685**
%	**100.0**		**26.7**	**66.0**	**4.4**	**2.9**
Pertanian *Agriculture*	**13,263**	**0.8**	**1,591**	**6,140**	**4,726**	**804**
Perlombongan & pengkuarian *Mining & quarrying*	**77,905**	**4.9**	**13,285**	**59,821**	**1,174**	**3,626**
Pembuatan *Manufacturing*	**1,388,811**	**87.1**	**377,271**	**939,782**	**41,504**	**30,252**
Pembinaan *Construction*	**37,969**	**2.4**	**11,812**	**12,160**	**5,586**	**8,411**
Perkhidmatan *Services*	**76,791**	**4.8**	**22,170**	**34,005**	**17,024**	**3,591**
Bekalan elektrik, gas, wap & pendingin udara *Electricity, gas, steam & air conditioning supply*	9,825	0.6	3,446	5,419	497	464
Bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan *Water supply; sewerage, waste management & remediation activities*	27,816	1.7	6,976	19,180	1,265	394
Pengangkutan & penyimpanan *Transportation & storage*	22,803	1.4	4,316	4,773	13,286	428
Lain-lain perkhidmatan *Other services*	16,347	1.0	7,432	4,634	1,976	2,305



E

STATISTIK PERBELANJAAN PERLINDUNGAN ALAM SEKITAR MENGIKUT JENIS PERBELANJAAN

STATISTICS ON ENVIRONMENTAL PROTECTION EXPENDITURE BY TYPE OF EXPENDITURE

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

Jadual 7: Perbelanjaan perlindungan alam sekitar mengikut jenis perbelanjaan, 2021
Table 7: Environmental protection expenditure by type of expenditure, 2021

Jenis perbelanjaan *Type of expenditure*	Jumlah *Total*		Perbelanjaan modal *Capital expenditure*		Perbelanjaan operasi *Operating expenditure*	
	(RM'000)	%	(RM'000)	%	(RM'000)	%
Jumlah *Total*	**3,115,940**	**100.0**	**713,350**	**22.9**	**2,402,589**	**77.1**
Pengurusan pencemaran *Pollution management*	**2,210,166**	**70.9**	**615,428**	**27.8**	**1,594,739**	**72.2**
Pengawasan alam sekitar *Environmental monitoring*	454,204	14.6	132,567	29.2	321,637	70.8
Tebus guna tapak & pembersihan *Site reclamation & decommissioning*	58,210	1.9	27,396	47.1	30,814	52.9
Peredaan & kawalan pencemaran *Pollution abatement & control*	1,485,860	47.7	363,461	24.5	1,122,399	75.5
Pencegahan pencemaran *Pollution prevention*	211,892	6.8	92,004	43.4	119,887	56.6
Perlindungan hidupan liar & habitat *Protection of wildlife & habitat*	**12,189**	**0.4**	**4,007**	**32.9**	**8,182**	**67.1**
Perbelanjaan penilaian dan caj alam sekitar *Environmental assessment and charges expenditure*	**70,599**	**2.3**	**16,488**	**23.4**	**54,111**	**76.6**
Perbelanjaan pengurusan sisa *Waste management expenditure*	**803,705**	**25.8**	**75,886**	**9.4**	**727,819**	**90.6**
Perbelanjaan lain untuk perlindungan alam sekitar *Other environmental protection expenditure*	**19,281**	**0.6**	**1,542**	**8.0**	**17,739**	**92.0**

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

NOTA TEKNIKAL

TECHNICAL NOTES

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

1. PENGENALAN

Penerbitan ini adalah berdasarkan hasil daripada Survei Ekonomi Tahunan yang dijalankan pada tahun 2022. Ia memaparkan statistik perbelanjaan perlindungan alam sekitar bagi tahun rujukan 2021. Survei Perbelanjaan Perlindungan Alam Sekitar telah dijalankan secara tahunan mulai 2008. Namun begitu, bagi 2011 dan 2016, survei ini diliputi di bawah Banci Ekonomi. Tiada survei dijalankan pada tahun 2017 (tahun rujukan 2016).

2. OBJEKTIF

Objektif survei adalah untuk mengumpul statistik berkaitan pertubuhan yang mempunyai perbelanjaan perlindungan alam sekitar meliputi perbelanjaan modal dan operasi mengikut aktiviti, media dan jenis perbelanjaan.

3. KUASA PERUNDANGAN

Survei ini dilaksanakan di bawah **Akta Perangkaan 1965 (Disemak-1989)**. Seksyen 5 di bawah Akta ini menghendaki mana-mana pertubuhan yang beroperasi di Malaysia untuk memberi maklumat sebenar atau anggaran terbaik kepada Jabatan. Mengikut Akta ini, kandungan soal selidik yang diterima adalah sulit dan hanya angka agregat diterbitkan.

4. SKOP DAN LIPUTAN

Survei ini meliputi pertubuhan dalam sektor berikut:

i. pertanian;
ii. perlombongan & pengkuarian;
iii. pembuatan;
iv. bekalan elektrik, gas, wap & pendingin udara;
v. bekalan air; pembetungan, pengurusan sisa & aktiviti pemulihan;
vi. pembinaan;
vii. pengangkutan & penyimpanan;
viii. penginapan;
ix. aktiviti perkhidmatan makanan & minuman;
x. maklumat & komunikasi;
xi. aktiviti hartanah;

xii. aktiviti profesional, saintifik & teknikal;
xiii. pendidikan;
xiv. aktiviti kesihatan kemanusiaan & kerja sosial;
xv. kesenian, hiburan & rekreasi;
xvi. aktiviti pentadbiran & khidmat sokongan; dan
xvii. aktiviti perkhidmatan lain.

Liputan industri merujuk kepada Piawaian Klasifikasi Industri Malaysia (MSIC) 2008 Ver. 1.0.

5. POPULASI

Semua pertubuhan meliputi 460 industri lima digit berasaskan kod Piawaian Klasifikasi Industri Malaysia 2008 Ver. 1.0 (MSIC).

6. RANGKA PENSAMPELAN

Rangka pensampelan adalah melibatkan pertubuhan aktif berjumlah 13,027 pertubuhan.

7. REKA BENTUK PENSAMPELAN

Reka bentuk pensampelan bagi survei ini adalah pensampelan rawak strata satu peringkat. Kategori sektor telah diklasifikasikan sebagai strata manakala pertubuhan sebagai unit pensampelan.

Setiap strata (sektor) telah dibentuk kepada empat substrata untuk memastikan sampel yang diagihkan mengambil kira ciri-ciri ekonomi industri tersebut. Substrata utama bersifat heterogen diliputi secara liputan penuh. Manakala, substrata selainnya bersifat homogen disampelkan.

Substrata utama meliputi pertubuhan kategori besar yang mempunyai jumlah hasil yang signifikan dalam industri liputan manakala bagi substrata kedua hingga keempat berdasarkan kategori perusahaan kecil dan sederhana (PKS).

8. SAIZ SAMPEL

Statistik utama yang digunakan untuk penganggaran saiz sampel adalah jumlah hasil. Kaedah penentuan saiz sampel adalah mengikut peratus sumbangan nilai hasil kepada domain analisis (2D/1D) bagi Survei Perbelanjaan Perlindungan Alam Sekitar.

Saiz sampel optimum bagi survei ini adalah 5,832 pertubuhan. Pertubuhan kategori besar diliputi sepenuhnya, manakala pertubuhan bagi substrata kedua hingga keempat dipilih secara rawak mengikut kaedah pensampelan bersistematik.

9. WAJARAN

Analisis berwajaran disediakan menggunakan wajaran bagi memastikan sampel yang dipilih dapat menggambarkan populasi survei. Wajaran yang diperlukan adalah wajaran di peringkat reka bentuk pensampelan dan wajaran tiada respons.

Wajaran reka bentuk pensampelan pada substrata *h* adalah seperti berikut:

$$W_h = \frac{N_h}{n_h} \quad , \quad h = 1,...,4$$

di mana;

N_h = Bilangan populasi bagi substrata h; dan

n_h = Bilangan sampel bagi substrata h

Wajaran tiada respons pada substrata h adalah seperti berikut:

$$NRW_h = \frac{1}{n_h' / n_h}, \quad h = 1,...,4$$

di mana;

n_h' = Bilangan sampel respons bagi substrata h

n_h = Bilangan sampel bagi substrata h

Kaedah pengiraan wajaran reka bentuk pensampelan selepas survei (*adjusted weight*) pada substrata h seperti berikut:

$$W_h^{'} = W_h \times NRW_h \ , \quad h = 1,...,4$$

di mana;

W_h = Wajaran reka bentuk pensampelan pada substrata h

NRW_h = Wajaran tiada respons pada substrata h

10. KAEDAH PENGUMPULAN

Survei ini secara umumnya dijalankan dengan menggunakan tiga kaedah pengumpulan data iaitu kaedah atas talian melalui portal e-AES; kutipan data melalui e-mel, pos, faks dan telefon; dan kutipan data secara bersemuka.

11. UNIT PELAPOR

Unit pelapor bagi survei ini ialah **pertubuhan**. Sesebuah pertubuhan secara ideal ditakrifkan sebagai satu unit ekonomi yang bergiat di bawah satu hak milik atau penguasaan tunggal, iaitu di bawah satu entiti yang sah. Ia menjalankan satu jenis subsektor ekonomi utama di satu tempat/ lokasi fizikal. Setiap pertubuhan diberikan klasifikasi industri berdasarkan aktiviti utamanya dan bukannya mengikut aktiviti syarikat induk.

Setiap cawangan daripada organisasi yang mempunyai beberapa cawangan di lokasi yang berbeza dari segi konsep dianggap sebagai pertubuhan yang berlainan. Pertubuhan berkenaan diminta memberikan penyata yang berasingan bagi setiap kegiatannya dari segi nilai. Walau bagaimanapun, dari segi praktis akaun biasanya disediakan secara berpusat kerana kesukaran untuk memperoleh data yang berasingan bagi setiap unit atau cawangan. Entiti atau *'enterprise'* ini akan dianggap sebagai satu unit pelapor dan dibenarkan mengemukakan soal selidik yang menggabungkan semua unit atau cawangannya.

12. TAHUN SURVEI

Tahun survei adalah merujuk kepada tahun pelaksanaan survei.

13. TAHUN RUJUKAN

Tahun rujukan bagi penyiasatan ini adalah tahun takwim 2021. Pertubuhan yang mempunyai tahun kewangan yang berbeza daripada tahun takwim diminta menyediakan laporan mengikut tahun perakaunan atau kewangan yang meliputi sekurang-kurangnya enam (6) bulan dalam tahun rujukan.

14. KONSEP DAN DEFINISI

14.1 Perbelanjaan perlindungan alam sekitar[1]

Perbelanjaan ini merujuk kepada semua perbelanjaan modal dan perbelanjaan operasi dan baik pulih oleh pertubuhan selaras dengan pematuhan alam sekitar, konvensyen atau perjanjian secara sukarela. Ia termasuk perbelanjaan untuk:

a. Perbelanjaan pengurusan pencemaran meliputi pengawasan alam sekitar; tebus guna & pembersihan tapak; peredaan & kawalan pencemaran dan pencegahan pencemaran;
b. Perlindungan hidupan liar & habitat;
c. Penilaian dan caj alam sekitar;
d. Pengurusan sisa; dan
e. Perbelanjaan lain untuk perlindungan alam sekitar termasuk program dan latihan, kempen kesedaran, kursus dan sumbangan.

14.2 Perbelanjaan modal

Termasuk segala perbelanjaan melibatkan pemasangan, pembinaan, pembinaan semula, lanjutan, pemulihan, penyesuaian atau pemodenan berkaitan peralatan dan kelengkapan berbentuk harta modal, di mana tujuan utama adalah untuk mengumpul, merawat, memantau dan mengawal, mengurangkan, mencegah, atau menghapuskan pencemaran atau degradasi lain persekitaran yang terhasil daripada aktiviti operasi pertubuhan. Perbelanjaan ini tidak termasuk mana-mana peruntukan untuk liabiliti persekitaran akan datang.

[1] Konsep dan definisi berdasarkan kepada *Environmental Expenditure Statistics: Industry Data Collection Handbook 2005* oleh *Eurostat, Environmental Protection Expenditures in the Business Sector* yang diterbitkan oleh *Statistics Canada* dan *CEPA 2000*

14.3 Perbelanjaan operasi

Perbelanjaan operasi meliputi kos buruh, bayaran sewa, penggunaan bahan & tenaga, penyelenggaraan dan pembaikan, serta pembelian perkhidmatan di mana tujuan utama adalah untuk mengumpul, merawat, memantau dan mengawal, mengurangkan, mencegah atau menghapuskan pencemaran atau degradasi lain persekitaran yang terhasil daripada aktiviti operasi pertubuhan. Ia termasuk kos dalaman (kos operasi dan penyelenggaraan peralatan perlindungan alam sekitar serta caj alam sekitar), kos perkhidmatan yang diberikan oleh entiti luar, caj untuk rawatan air sisa dan pengumpulan sisa, kos sistem kawalan, pemantauan, penyelidikan makmal, pengurusan dan lain-lain.

14.4 Media alam sekitar[2]

Media alam sekitar merujuk kepada komponen abiotik alam semula jadi iaitu udara, air dan tanah. Media alam sekitar yang diliputi dalam Survei Perbelanjaan Perlindungan Alam Sekitar ini adalah udara, air permukaan, tanah, air bawah tanah serta bunyi, gegaran dan radiasi.

14.5 Perbelanjaan pengurusan pencemaran mengikut aktiviti

a. Pengawasan alam sekitar

Pendekatan yang sistematik untuk memerhati, mengkaji dan memantau alam sekitar. Ia melibatkan pengumpulan sampel dan spesimen dari udara, air dan tanah untuk menentukan sama ada apa-apa faktor fizikal atau biologi yang memberi kesan negatif terhadap ekosistem semula jadi dan habitat. Perbelanjaan ini melibatkan kos berkaitan perkakasan, buruh dan perkhidmatan yang dibelanjakan bagi memenuhi peraturan dan konvensyen untuk mengawasi bahan cemar yang dilepaskan oleh pertubuhan contohnya pemasangan alat pemantauan (CEMS) dan P.H meter.

[2] Konsep dan definisi berdasarkan kepada *Glosarry of Statistical terms by the Organisation for Economic Co-operation and Development (OECD)*

b. Tebus guna & pembersihan tapak

Tebus guna tapak adalah bertujuan untuk memulihkan tapak kepada keadaan stabil yang menghampiri keadaan asal. Pembersihan tapak adalah proses penyingkiran struktur dan kemudahan projek selepas pertubuhan menghentikan operasi. Pembersihan diperlukan untuk menghilangkan bahan kimia atau bahan berbahaya kepada alam sekitar untuk menjadikan tapak industri selamat dan estetik. Perbelanjaan ini melibatkan aktiviti pemulihan dan pembersihan bagi kerosakan alam sekitar yang disebabkan oleh pertubuhan. Tidak termasuk penalti/ kompaun yang dikenakan kerana kerosakan alam sekitar atau sebarang tanggungan kepada alam sekitar pada masa hadapan.
Contoh: Pemulihan tapak pelupusan (*landfill*) dijadikan taman rekreasi.

c. Peredaan & kawalan pencemaran

Aktiviti ini bertujuan untuk pengurangan dan penghapusan pencemaran atau gangguan yang timbul daripada sisa pengeluaran atau penggunaan barangan dan perkhidmatan. Perbelanjaan ini meliputi kos perkakasan/ kemudahan yang dipasang untuk mengekang atau mengurangkan pelepasan bahan cemar. Contoh: Pemasangan cerobong asap, *wastewater treatment plant* dan *noise boundary wall.*

d. Pencegahan pencemaran

Aktiviti pencegahan pencemaran adalah termasuk pengubahsuaian ke atas kaedah pengeluaran, teknologi, proses operasi, peralatan (atau sebahagian daripadanya) yang direka untuk mencegah atau mengurangkan pencemaran yang terhasil di peringkat sumber, sekali gus mengurangkan kesan alam sekitar yang berkaitan dengan pelepasan pencemaran di hujung paip. Perbelanjaan meliputi pembelian teknologi dan peralatan yang mengurangkan atau menghapuskan pencemaran dan sisa yang bukan di hujung paip atau timbunan sebelum pencemaran atau bahan buangan terhasil. Contoh: Penggunaan *silencer* untuk generator dan mengguna peralatan teknologi hijau.

14.6 Perlindungan hidupan liar & habitat

Aktiviti ini bagi melindungi spesies haiwan dan tumbuhan liar dan memulihara habitat hidupan liar, terutamanya spesies yang terpelihara. Perbelanjaan bagi mematuhi peraturan dan konvensyen bagi melindungi hidupan liar dan habitat dari mana-mana kesan operasi/ aktiviti pertubuhan. Contoh: Menyediakan laluan khas bagi hidupan liar *(wildlife crossing)* di lebuhraya.

14.7 Perbelanjaan penilaian alam sekitar

Ini merujuk kepada perbelanjaan bagi menilai impak alam sekitar (EIA) daripada program/ aktiviti pertubuhan termasuk kos perundangan dan perundingan yang berkaitan. Bayaran perundangan dan audit dalam operasi semasa serta kos lain untuk mendapatkan sijil alam sekitar.

14.8 Caj alam sekitar

Caj alam sekitar adalah caj yang mesti dibayar untuk penggunaan sumber asli dan juga untuk kerugian yang disebabkan oleh pencemaran alam sekitar. Contoh: Perbelanjaan bagi permit, yuran, denda, penalti atau pampasan kerosakan yang dibayar kepada agensi kerajaan atau individu dan caj lain yang dibayar kepada badan-badan yang mengawal selia untuk membenarkan operasi dijalankan di pertubuhan ini.

14.9 Perbelanjaan pengurusan sisa

Perbelanjaan ini merujuk kepada kos yang terlibat dalam aktiviti dan tindakan yang diperlukan untuk menguruskan sisa yang terhasil daripada operasi pengeluaran produk bermula dari penghasilan sisa hingga pelupusan akhir. Ini termasuk pengumpulan, penyimpanan, pengangkutan, rawatan dan pelupusan sisa bersama-sama dengan pemantauan dan peraturan.

a. Sisa pepejal tidak berbahaya

Sisa pepejal tidak berbahaya merujuk kepada bahan sekerap atau benda lebihan lain yang tidak dikehendaki atau keluaran yang ditolak yang timbul daripada penggunaan apa-apa proses dan benda yang perlu dilupuskan. Rujuk kepada Akta 672-Akta Pengurusan Sisa Pepejal dan Pembersihan Awam 2007.

b. Sisa terjadual (pepejal/ cecair)

Sisa terjadual ialah sisa toksik dan/ atau sisa berbahaya kecuali patogenik, kuarantin dan sisa boleh letup yang termasuk dalam kategori sisa yang tersenarai dalam Jadual Pertama Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005.

14.10 Perbelanjaan lain untuk perlindungan alam sekitar

Perbelanjaan lain untuk perlindungan alam sekitar termasuk kempen kesedaran alam sekitar, kursus, seminar dan bengkel alam sekitar. Sumbangan kepada sekolah, universiti dan agensi berkaitan bagi menjalankan aktiviti kesedaran untuk melindungi alam sekitar seperti Hari Bumi, Hari Hijau, program kitar semula, menanam pokok bakau dan program pemuliharaan hidupan liar di zoo atau menjadikan sungai sebagai sungai angkat untuk memantau kebersihan.

Bekerjasama dengan agensi kerajaan dan swasta atau orang ramai melaksanakan aktiviti membersih kawasan hutan simpan dan sebagainya. Tidak termasuk pembersihan yang dilakukan di kawasan pertubuhan.

14.11 Pensijilan alam sekitar

a. ISO 14001

Merupakan piawaian pengurusan alam sekitar di peringkat antarabangsa. Ia menyediakan satu set keperluan standard bagi sistem pengurusan alam sekitar (EMS). Ia juga menyediakan rangka kerja bagi pengurusan alam sekitar amalan terbaik untuk organisasi bantuan untuk mencegah pencemaran, mengurangkan kesan alam sekitar, mematuhi undang-undang alam sekitar dan membangunkan perniagaan dengan cara yang mampan.

b. Pensijilan antarabangsa lain

- **ISO 14004** menyediakan panduan mengenai pembangunan, pelaksanaan, penyelenggaraan dan penambahbaikan sistem pengurusan alam sekitar serta diselaraskan dengan sistem pengurusan yang lain. Garis panduan dalam ISO 14004 adalah terpakai kepada mana-mana organisasi, tanpa mengira saiz, jenis, lokasi atau tahap matang. Walaupun garis panduan ISO 14004 adalah selaras dengan model sistem pengurusan alam sekitar ISO 14001, ia tidak bertujuan untuk memenuhi keperluan ISO 14001.

- ***Forest Stewardship Council*** **(FSC)** adalah pensijilan secara sukarela, ia bertujuan memastikan produk hutan diurus secara bertanggungjawab dan memberi manfaat kepada alam sekitar, sosial dan ekonomi. Terdapat 2 jenis sijil iaitu pengurusan hutan dan penjagaan rantaian yang melibatkan pengurusan pengeluaran produk hutan sehingga kepada pengguna akhir.

- ***Roundtable on Sustainable Palm Oil*** **(RSPO)** adalah satu jaminan proses pengeluaran minyak kelapa sawit yang mampan kepada pelanggan dan penghasilan komoditi yang tidak menyebabkan kerosakan kepada alam sekitar atau bahaya kepada masyarakat.

  Satu set kriteria alam sekitar dan sosial yang mesti dipatuhi oleh syarikat untuk mendapatkan *Certified Sustainable Palm Oil* (CSPO). Ia boleh membantu untuk mengurangkan kesan negatif daripada ladang kelapa sawit terhadap alam sekitar dan masyarakat di kawasan-kawasan pengeluar minyak sawit.

- ***Malaysian Timber Certification Scheme*** **(MTCS)** adalah sijil yang dikeluarkan oleh Majlis Pensijilan Kayu Malaysia (MTCC). Ia merupakan skim sukarela yang memperuntukkan penilaian bebas mengenai amalan pengurusan hutan, untuk memastikan pengurusan ladang hutan dan hutan semula jadi Malaysia yang mapan dan juga untuk memenuhi permintaan bagi produk kayu disahkan.

15. KADAR PERTUMBUHAN TAHUNAN

Pengiraan kadar pertumbuhan tahunan (r) adalah berdasarkan formula berikut:

$$r = \frac{Y_t - Y_0}{Y_0} \times 100$$

Di mana;

Y_t = Nilai pada tahun semasa

Y_0 = Nilai pada tahun sebelum

t = Bilangan tahun, $Y_t - Y_0$

r = Kadar pertumbuhan tahunan

16. SIMBOL DAN SINGKATAN

Simbol dan huruf ringkas berikut telah digunakan di dalam keseluruhan penerbitan:

&	dan
%	peratus
-	tiada
0	kurang daripada 0.5
0.0	0.0 kurang daripada 0.05
RM	Ringgit Malaysia
W.P.	Wilayah Persekutuan
e	Anggaran

17. PEMBUNDARAN

Jumlah bagi komponen mungkin berbeza dengan jumlah besar dalam jadual penerbitan disebabkan oleh pembundaran.

1. INTRODUCTION

This publication was based on the outcome of the Annual Economic Survey conducted in 2022. It displays environmental protection expenditure statistics for the reference year 2021. Environmental Protection Expenditure Survey was canvassed annually starting from 2008. However, in 2011 and 2016, this survey was covered under the Economic Cencus. No survey was conducted in 2017 (reference year 2016).

2. OBJECTIVE

The objective of the survey was to collect statistics regarding establishments that have environmental protection expenditure covering capital and operating expenditure by activity, media and type of expenditure.

3. LEGAL AUTHORITY

This survey was conducted under the provisions of the ***Statistics Act 1965 (Revised-1989)****. Section 5 under this Act, requires any operating establishment in Malaysia to furnish the correct information or their best estimate to the Department. Accordingly, the Act stipulates that the contents of the individual returns received are confidential and only aggregated figures are published.*

4. SCOPE AND COVERAGE

This survey covered establishments in the following sectors:

i. agriculture;
ii. mining & quarrying;
iii. manufacturing;
iv. electricity, gas, steam & air conditioning supply;
v. water supply; sewerage, waste management & remediation activities;
vi. construction;
vii. transportation & storage;
viii. accommodation;
ix. food & beverage service activities;
x. information & communication;
xi. real estate activities;
xii. professional, scientific & technical activities;

xiii. education;

xiv. human health & social work activities.

xv. arts, entertainment & recreation;

xvi. administrative & support service activities; and

xvii. other service activities.

The coverage of industry refers to Malaysia Standard Classification (MSIC) 2008 Ver. 1.0.

5. POPULATION

All establishments encompass of 460 industries at five digits based on Malaysia Standard Industrial Classification 2008 Ver. 1.0.

6. SAMPLING FRAME

From the identified population, sampling frame are covered 13,027 active establishments.

7. SAMPLING DESIGN

Sampling design of the survey is a one-stage stratified random sampling. Categories of sector have been classified as stratum and the establishment as the sampling unit.

Each stratum (industry) has been set up to four substratum to ensure the distributed sample takes into account the economic characteristics of the industry. The main substratum is heterogeneous covered in full coverage. Where as, the others homogenous substratum was sampled.

Major substratum include large-scale establishments that have significant revenue streams in the coverage industry while for second and fourth sub-sectors based on small and medium enterprise (SME) categories.

8. SAMPLE SIZE

The main statistics used to estimate the sample size is the total eviromental expenditure. The method of determining the sample size is according to the percentage contribution of the environmental expenditure to the domain of analysis (2D/1D) for the Environmental Protection Expenditure Survey.

The optimal sample size for this survey was 5,832 establishments. The large establishments were fully covered, while the establishments for the second to fourth substrates were randomly selected according to a systematic sampling method.

9. WEIGHT

Weighted analysis is done using sampling weight to ensure that the selected sample can reflect population survey. The weights required are the sampling design weight and non-response weight.

The sampling design weight for the establishment at stratum h is as follows:

$$W_h = \frac{N_h}{n_h} \quad , \quad h = 1, ..., 4$$

Where;

N_h = *Total population of substratum h; and*

n_h = *Total sample of substratum h*

Non response weight at substratum h as below:

$$NRW_h = \frac{1}{n_h' / n_h} \quad , \quad h = 1, ..., 4$$

Where;

n_h' = *Numbers of response sample size for substratum h*

n_h = *Numbers of sample size for substratum h*

The method of calculating the sampling design weight after the survey (adjusted weight) on substratum h as below:

$$W'_h = W_h \times NRW_h \quad , \quad h=1, ..., 4$$

Where;

W_h = *Sampling design weight at substratum* h

NRW_h = *Non response weight at substratum* h

10. METHOD OF DATA COLLECTION

This survey was generally conducted through three methods of data collection, namely, online method through the e-AES portal; data collection via e-mail, post, fax and telephone; and face-to-face data collection.

11. REPORTING UNIT

The reporting unit used in the survey was ***establishment****. An establishment is defined as an economic unit that engaged in one activity, under a single legal entity and operating in a single physical location. Each establishment was assigned to an industry classification based on its principal activity.*

Each branch of a multi-branch organisation at a different location was conceptually treated as a different establishment. The establishment was requested to give separate returns for each activity in terms of value. However, if in practice, the accounts were centrally kept such that it was not possible to obtain separate data for each individual unit or branch. That entity or enterprise was treated as a single reporting unit and allowed to submit a consolidated questionnaire covering all units or branches.

12. SURVEY YEAR

Survey year refers to the year in which a survey was conducted.

13. REFERENCE YEAR

The reference year of this survey was the calendar year 2021. Establishments whose accounting year differed from the calendar year were requested to report according to the accounting year or financial year covering at least six months in the reference year.

14. CONCEPTS AND DEFINITIONS

14.1 Environmental protection expenditure[1]

This expenditure refers to all capital expenses and operating & repair expenditures incurred by businesses in order to comply with environmental regulations, conventions or voluntary agreements. They consist of expenditures for:

a. *Expenditure for pollution management covered environmental monitoring; site reclamation & decommissioning; pollution abatement & control and pollution prevention;*
b. *Protection of wildlife & habitat;*
c. *Environmental assessment and charges;*
d. *Waste management; and*
e. *Other environmental protection expenditure include programme and training, awareness campaigns, courses and donation.*

14.2 Capital expenditure

Environmental capital expenditure involved installment, construction, re-construction, continuation, recovery, adjustment or modernisations related to capital form of equipments and tools, where the main purposes are to collect, treat, observe and control, reduce, prevent, or eliminate pollution or environmental degradation that resulted from establishments' activities. This expenditure does not include any provisions for future environmental liability.

[1] *Concepts and definitions are based on the Environmental Expenditure Statistics: Industry Data Collection Handbook 2005 by* the *Eurostat, Environmental Protection Expenditures in the Business Sector published by the Statistics Canada and CEPA 2000*

14.3 Operating expenditure

Environmental operating expenditure includes labour cost; rental; uses of materials & energy; maintenance and repair; and where the main purposes are to collect, treat, observe and control, reduce, prevent, or eliminate pollution or environmental degradation that resulted from establishments' activities. It includes internal costs (including operating cost and maintenance of environmental protection equipment and environmental charges), cost of services provided by external entities, charges for wastewater treatment and waste collection; control system cost, monitoring, lab researches, management and others.

14.4 Environmental media[2]

Environmental media refers to abiotic components of the natural environment, namely, air, water and land. Environmental media covered by Environmental Protection Expenditure Survey were air, surface water, soil and groundwater and noise, vibration and radiation.

14.5 Expenditure for pollution management by activity

a. Environmental monitoring

A systematic approach to observing, studying and monitoring the environment. It involves collection of samples and specimens from air, water and land to determine whether any physical or biological factors gives negative impact on natural ecosystem and habitat. This expenditure refers to costs related to equipments, labour and services spent to comply with regulations and convention to monitor contaminants released by establishments. Example: Install monitoring tools (CEMS) and P.H meter.

[2] *Concepts and definitions are based on the Glossary of Statistical Terms by the Organisation for Economic Co-operation and Development (OECD)*

b. Site reclamation & decommissioning

Site reclamation aims to rehabilitate site to stable condition that approximates to the original condition. Site decommissioning is a process of removal of structure and project's facilities after establishments stop their operations. This is needed to remove chemical or harmful substances to the environment to make the industrial site more safe and aesthetic. This expenditure involved recovery and cleaning activities for environmental damages caused by establishments. Excludes penalties/compounds imposed due to environmental damages or any liability to the environment in the future. Example: Recovery of landfill for recreational park.

c. Pollution abatement & control

These activities aimed in reducing or eliminating pollution or disturbance arises from waste production or uses of goods and services. This expenditure covers cost of equipments/ facilities installed to restrain or reduce the release of contaminants. Example: Installation of smoke chimney, wastewater treatment plant and noise boundary wall.

d. Pollution prevention

Pollution prevention activities include modification of production methods, technologies, operation processes, equipments (or part thereof) which is designed to prevent or minimize pollution at source level, thereby reducing the environmental impact associated with the end-pipe pollution discharge. Expenditure includes purchases of technologies and equipments that reduces or eliminates pollution and waste at the source instead of at the end-of-pipe or stack before the pollution or waste is created. Example: The use of silencer for generator and use of green-technology equipment.

14.6 Protection of wildlife & habitat

These activities involved practices of protecting animal species and wild plants and conserving habitat for wildlife, especially on conservation-dependent species. Expenditure in compliance with laws and convention to protect wildlife and habitat from the outcome of establishment's operation/ activities. Example: Provide a specific route for wildlife (wildlife crossing) at the highway.

14.7 Environmental assessment expenditure

This refers to expenditure to evaluate environmental impact (EIA) of establishment's programs/activities including related legal and consultation costs. Legal and audit fees in current operations and other cost incurred prior environmental certificates.

14.8 Environmental charges

Environmental charges are charges that needed to be paid for using of natural resources as well as for losses caused by environmental pollution. Example: Expenditure for permits, fees, fines, penalties or damage compensation paid by government agencies or individuals and other charges paid to regulatory body to allow operations to be carried out by establishments.

14.9 Waste management expenditure

This expenditure refers to cost incurred in activities and actions required to manage waste generated from production of products operations; begins from producing waste until final disposal. Includes collection, storage, transportation, treatment and disposal of waste along with monitoring and regulation.

a. Non-hazardous solid waste

Non-hazardous solid waste refers to any scrap material or unwanted surplus substance or rejected products arising from the application of any process and substance required to be disposed. Refer to Act 672-Solid Waste and Public Cleansing Management Act 2007.

b. Scheduled waste (solid/liquid)

Scheduled waste refers to toxic waste and/or hazardous waste, except pathogenic, quarantined and flammable which is included in the waste category listed in the First Schedule Environmental Quality Regulation (Scheduled Waste) 2005.

14.10 Other environmental expenditure

Other environmental expenditure includes environmental awareness campaign, courses, seminar and environmental workshop. Contribution to schools, universities and related agencies to carried out awareness activities to protect the environment such as Earth Day, Green Day, recycling programme, mangrove trees' planting and conservation programme at zoo or using rivers as a medium to monitor cleaning.

Collaboration with government and private agencies or the public to carry out cleaning of reserved forest and others. Excludes cleaning done in the establishments area.

14.11 Environmental certification

a. ISO 14001

An international standard environmental management. It provides a set of standard requirements for environmental management system (EMS). This also provides a framework for best practices of environmental management to aid the organisations to prevent pollution, reduce environmental impact, comply with environmental laws and develop businesses in a sustainable manner.

b. Other international certification

- ***ISO 14004*** *provides guidance on the development, implementation, maintenance and improvement of environmental management system and their co-ordination with other management systems. The guidelines in this document are intended applicable to any organisation, regardless of size, type, location or maturity level. Although ISO 14004 guideline is aligned with ISO 14001 environmental management system model, it is not intended to meet the requirements of ISO 14001.*

- ***Forest Stewardship Council (FSC)*** *is a voluntary certification, which aims to ensure the forest products are being managed responsibly and benefically to environment, social and economy. There are 2 types of certificates; forest management and chain-of-custody which involved the management of production for forest products all the way to the end user.*

- ***Roundtable on Sustainable Palm Oil (RSPO)*** *is a guarantee of sustainable palm oil production process and commodity production that does not bring any damage to the environment and harm to the comunity.*

  A set of environmental criteria and social that need to be complied by establishments to obtain Certified Sustainable Palm Oil (CSPO). It is to help in reducing the negative impact from oil palm plantations to the environment and communities around the producers of palm oil.

- ***Malaysian Timber Certification Scheme (MTCS)*** *is a certificate issued by Malaysian Timber Certification Council (MTCC). It is a voluntary scheme that provides an independent assessment about practices on forest management, to ensure a sustainable management of forests and natural forests, as well as to meet the demand for certified timber products.*

15. ANNUAL GROWTH RATE

The annual growth rate (r) is calculated based on formula of:

$$r = \frac{Y_t - Y_0}{Y_0} \times 100$$

Where;

Y_t = *Value at current year*
Y_0 = *Value at previous year*
t = *Number of years,* $Y_t - Y_0$
r = *Annual growth rate*

16. SYMBOLS AND ABBREVIATIONS

The following symbols and notations have been used throughout the publication:

&	*and*
%	*per cent*
-	*nil*
0	*less than 0.5*
0.0	*less than 0.05*
RM	*Ringgit Malaysia*
W.P.	*Wilayah Persekutuan*
e	*Estimate*

17. ROUNDING

The sum of components may not add up to the totals in the tables presented in this publication due to rounding.

LAMPIRAN

APPENDICES

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

CLASSIFICATION OF ENVIRONMENTAL PROTECTION ACTIVITIES AND EXPENDITURE (CEPA 2000)

1. ***PROTECTION OF AMBIENT AIR AND CLIMATE***
   - *1.1 Prevention of pollution through in-process modifications*
     - *1.1.1 for the protection of ambient air*
     - *1.1.2 for the protection of climate and ozone layer*
   - *1.2 Treatment of exhaust gases and ventilation air*
     - *1.2.1 for the protection of ambient air*
     - *1.2.2 for the protection of climate and ozone layer*
   - *1.3 Measurement, control, laboratories and the like*
   - *1.4 Other activities*
2. ***WASTEWATER MANAGEMENT***
   - *2.1 Prevention of pollution through in-process modifications*
   - *2.2 Sewerage networks*
   - *2.3 Wastewater treatment*
   - *2.4 Treatment of cooling water*
   - *2.5 Measurement, control, laboratories and the like*
   - *2.6 Other activities*
3. ***WASTE MANAGEMENT***
   - *3.1 Prevention of pollution through in-process modifications*
   - *3.2 Collection and transport*
   - *3.3 Treatment and disposal of hazardous waste*
     - *3.3.1 Thermal treatment*
     - *3.3.2 Landfill*
     - *3.3.3 Other treatment and disposal*
   - *3.4 Treatment and disposal of non-hazardous waste*
     - *3.4.1 Incineration*
     - *3.4.2 Landfill*
     - *3.4.3 Other treatment and disposal*
   - *3.5 Measurement, control, laboratories and the like*
   - *3.6 Other activities*
4. ***PROTECTION AND REMEDIATION OF SOIL, GROUNDWATER AND SURFACE WATER***
   - *4.1 Prevention of pollutant infiltration*
   - *4.2 Cleaning up of soil and water bodies*
   - *4.3 Protection of soil from erosion and other physical degradation*
   - *4.4 Prevention and remediation of soil salinity*
   - *4.5 Measurement, control, laboratories and the like*
   - *4.6 Other activities*
5. ***NOISE AND VIBRATION ABATEMENT*** *(excluding workplace protection)*
   - *5.1 Preventive in-process modifications at the source*
     - *5.1.1 Road and rail traffic*
     - *5.1.2 Air traffic*
     - *5.1.3 Industrial and other noise*
   - *5.2 Construction of anti-noise/vibration facilities*
     - *5.2.1 Road and rail traffic*
     - *5.2.2 Air traffic*
     - *5.2.3 Industrial and other noise*
   - *5.3 Measurement, control, laboratories and the like*
   - *5.4 Other activities*
6. ***PROTECTION OF BIODIVERSITY AND LANDSCAPES***
   - *6.1 Protection and rehabilitation of species and habitats*
   - *6.2 Protection of natural and semi-natural landscapes*
   - *6.3 Measurement, control, laboratories and the like*
   - *6.4 Other activities*
7. ***PROTECTION AGAINST RADIATION*** *(excluding external safety)*
   - *7.1 Protection of ambient media*
   - *7.2 Transport and treatment of high level radioactive waste*
   - *7.3 Measurement, control, laboratories and the like*
   - *7.4 Other activities*
8. ***RESEARCH AND DEVELOPMENT***
   - *8.1 Protection of ambient air and climate*
     - *8.1.1 Protection of ambient air*
     - *8.1.2 Protection of atmosphere and climate*
   - *8.2 Protection of water*
   - *8.3 Waste*
   - *8.4 Protection of soil and groundwater*
   - *8.5 Abatement of noise and vibration*
   - *8.6 Protection of species and habitats*
   - *8.7 Protection against radiation*
   - *8.8 Other research on the environment*
9. ***OTHER ENVIRONMENTAL PROTECTION ACTIVITIES***
   - *9.1 General environmental administration and management*
     - *9.1.1 General administration, regulation and the like*
     - *9.1.2 Environmental management*
   - *9.2 Education, training and information*
   - *9.3 Activities leading to indivisible expenditure*
   - *9.4 Activities not elsewhere classified*

Muka surat ini sengaja dibiarkan kosong

This page is deliberately left blank

PERTANYAAN BERHUBUNG DENGAN PENERBITAN INI BOLEH JUGA DIBUAT DI PEJABAT PERANGKAAN NEGERI SEPERTI BERIKUT:

Pengarah,
Jabatan Perangkaan Malaysia Negeri Johor,
Tingkat 14, Menara Tabung Haji,
Jalan Air Molek,
80000 Johor Bahru, Johor.
Tel. : 07-225 3700
Faks : 07-224 9972
E-mel : jpjohor@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Kedah,
Aras 1, Zon C, Wisma Persekutuan,
Pusat Pentadbiran Kerajaan Persekutuan,
Bandar Muadzam Shah,
06550 Anak Bukit, Kedah.
Tel. : 04-700 1240
Faks : 04-733 8412
E-mel : jpkedah@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Kelantan,
Tingkat 8, Bangunan Persekutuan,
Jalan Bayam,
15514 Kota Bharu, Kelantan.
Tel. : 09-741 9449
Faks : 09-748 2142
E-mel : jpkelantan@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Melaka,
Aras 7 & 8, Wisma Persekutuan,
Jalan MITC, Hang Tuah Jaya,
75450, Ayer Keroh,
Melaka.
Tel. : 06-252 2725
Faks : 06-252 2711
E-mel : jpmelaka@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Sembilan,
Tingkat 12, Wisma Persekutuan,
Jalan Dato' Abdul Kadir,
70000 Seremban,
Negeri Sembilan.
Tel. : 06-765 5000
Faks : 06-765 5002
E-mel : jpnsembilan@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Pahang,
Tingkat 7, Bangunan Persekutuan,
Jalan Gambut,
25000 Kuantan, Pahang.
Tel. : 09-516 3931/7
Faks : 09-514 4636
E-mel : jppahang@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Pulau Pinang,
Tingkat 6, Bangunan Persekutuan,
10400 Jalan Anson,
Pulau Pinang.
Tel. : 04-226 6244
Faks : 04-229 9499
E-mel : jppulaupinang@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Perak,
Tingkat 3, Blok A, Bangunan Persekutuan Ipoh,
Jalan Dato' Seri Ahmad Said (Greentown),
30450 Ipoh, Perak.
Tel. : 05-243 6107
Fax : 05-255 1073
E-mel : jpperak@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Perlis,
Bangunan Perodua Kangar,
No. 2C, Persiaran Jubli Perak
01000 Kangar, Perlis.
Tel. : 04-976 7381/9025
Faks : 04-976 8950
E-mel : jpperlis@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Selangor,
Tingkat 9, Bangunan Darul Ehsan,
Jalan Indah, Seksyen 14,
40000 Shah Alam, Selangor.
Tel. : 03-5515 0200
Faks : 03-5518 0408
E-mel : jpselangor@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Terengganu,
Tingkat 9, Wisma Persekutuan,
Jalan Sultan Ismail,
20200 Kuala Terengganu, Terengganu.
Tel. : 09-622 3062
Faks : 09-622 9659
E-mel : admin_jptrg@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Sabah,
Tingkat 1-3, Blok C,
Kompleks Pentadbiran Kerajaan Persekutuan Sabah,
Jalan UMS, Beg Berkunci 2046,
88999 Kota Kinabalu, Sabah.
Tel. : 088-484 602
Faks : 088-484 659
E-mel : jpsabah@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia Negeri Sarawak,
Tingkat 7 & 8, Bangunan Tun Datuk Patinggi
Tuanku Haji Bujang, Jalan Simpang 3,
93514 Kuching, Sarawak.
Tel. : 082-240 287
Faks : 082-242 609
E-mel : sarawak@dosm.gov.my

Pengarah,
Jabatan Perangkaan Malaysia
Wilayah Persekutuan,
Tingkat 14 & 15, Wisma FGV,
Jalan Raja Laut,
50350 Kuala Lumpur.
Tel. : 03-2267 2400
Faks : 03-2691 0639
E-mel : dosmwp@dosm.gov.my

ENQUIRIES ABOUT THIS PUBLICATION CAN ALSO BE MADE AT THE FOLLOWING STATE STATISTICS OFFICES:

Director,
Department of Statistics, Malaysia Johor,
14th Floor, Menara Tabung Haji,
Jalan Air Molek,
80000 Johor Bahru, Johor.
Tel. : 07-225 3700
Fax : 07-224 9972
Email : jpjohor@dosm.gov.my

Director,
Department of Statistics, Malaysia Kedah,
1st Floor, Zon C, Wisma Persekutuan,
Pusat Pentadbiran Kerajaan Persekutuan,
Bandar Muadzam Shah,
06550 Anak Bukit, Kedah.
Tel. : 04-700 1240
Fax : 04-733 8412
Email : jpkedah@dosm.gov.my

Director,
Department of Statistics, Malaysia Kelantan,
8th Floor, Bangunan Persekutuan,
Jalan Bayam,
15514 Kota Bharu, Kelantan.
Tel. : 09-741 9449
Fax : 09-748 2142
Email : jpkelantan@dosm.gov.my

Director,
Department of Statistics, Malaysia Melaka,
7th & 8th Floor, Wisma Persekutuan,
Jalan MITC, Hang Tuah Jaya,
75450, Ayer Keroh,
Melaka.
Tel. : 06-252 2725
Fax : 06-252 2711
Email : jpmelaka@dosm.gov.my

Director,
Department of Statistics, Malaysia Negeri Sembilan,
12th Floor, Wisma Persekutuan,
Jalan Dato' Abdul Kadir,
70000 Seremban,
Negeri Sembilan.
Tel. : 06-765 5000
Fax : 06-765 5002
Email : jpnsembilan@dosm.gov.my

Director,
Department of Statistics, Malaysia Pahang,
7th Floor, Bangunan Persekutuan,
Jalan Gambut,
25000 Kuantan, Pahang.
Tel. : 09-516 3931/7
Fax : 09-514 4636
Email : jppahang@dosm.gov.my

Director,
Department of Statistics, Malaysia, Pulau Pinang,
6th Floor, Bangunan Persekutuan,
10400 Jalan Anson,
Pulau Pinang.
Tel. : 04-226 6244
Fax : 04-229 9499
Email : jppulaupinang@dosm.gov.my

Director,
Department of Statistics, Malaysia Perak,
3rd Floor, Block A, Bangunan Persekutuan Ipoh,
Jalan Dato' Seri Ahmad Said (Greentown),
30450 Ipoh, Perak.
Tel. : 05-243 6107
Fax : 05-255 1073
Email : jpperak@dosm.gov.my

Director,
Department of Statistics, Malaysia Perlis,
Bangunan Perodua Kangar,
No. 2C, Persiaran Jubli Perak
01000 Kangar, Perlis.
Tel. : 04-976 7381/9025
Faks : 04-976 8950
Email : jpperlis@dosm.gov.my

Director,
Department of Statistics, Malaysia Selangor,
9th Floor, Bangunan Darul Ehsan,
Jalan Indah, Seksyen 14,
40000 Shah Alam, Selangor.
Tel. : 03-5515 0200
Fax : 03-5518 0408
Email : jpselangor@dosm.gov.my

Director,
Department of Statistics, Malaysia Terengganu,
9th Floor, Wisma Persekutuan,
Jalan Sultan Ismail,
20200 Kuala Terengganu, Terengganu.
Tel. : 09-622 3062
Fax : 09-622 9659
E-mel : admin_jptrg@dosm.gov.my

Director,
Department of Statistics, Malaysia Sabah,
Level 1-3, Block C,
Kompleks Pentadbiran Kerajaan Persekutuan Sabah,
Jalan UMS, Beg Berkunci 2046,
88999 Kota Kinabalu, Sabah.
Tel. : 088-484 602
Fax : 088-484 659
Email : jpsabah@dosm.gov.my

Director,
Department of Statistics, Malaysia Sarawak,
7th & 8th Floor, Bangunan Tun Datuk Patinggi
Tuanku Haji Bujang, Jalan Simpang 3,
93514 Kuching, Sarawak.
Tel. : 082-240 287
Fax : 082-242 609
Email : sarawak@dosm.gov.my

Director,
Department of Statistics, Malaysia
Federal Territories,
14th & 15th Floor, Wisma FGV,
Jalan Raja Laut,
50350 Kuala Lumpur.
Tel. : 03-2267 2400
Fax : 03-2691 0639
Email : dosmwp@dosm.gov.my

www.dosm.gov.my

@StatsMalaysia

BANCI EKONOMI 2023
DATA PEMANGKIN EKONOMI NEGARA

20 OKT 2016-2030

PSSN

MALAYSIA MADANI