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Workstream Targets and Schedule Risk in Hazardous-Waste Treatment: A Documentary Case Study of Egypt's P116230

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Abstract- ***Treatment projects often support a completion date with procurement milestones, although delivery depends on when treatment capacity is ready and how much it can process and have accepted before the deadline. This embedded documentary case study examines that scheduling problem in Egypt's Sustainable Persistent Organic Pollutants Management Project (P116230), which carried separate 1,000-tonne targets for obsolete-pesticide disposal and for treatment of oil contaminated with polychlorinated biphenyls (PCBs). Appraisal, restructuring, supervision, procurement and completion records publicly available by 31 August 2022 were coded by milestone, treatment stage and evidence type. The completion report reported 1,082 tonnes of pesticides disposed of and a total of 417.6 tonnes of oil treated; whether that oil had been treated and accepted by grant close on 31 December 2021 cannot be established from the public record. On the completion-report figures, pooled attainment was 74.98% and target-capped attainment 70.88%, leaving a gross outstanding balance of 582.4 tonnes, all in oil. In July 2021 the supervision report showed no oil treated, expected equipment delivery in September and retained a November completion forecast. Treating September delivery as an optimistic proxy for readiness, completing the oil target by 30 November required 11.11–16.39 tonnes per calendar day; the record reports no sustained operating rate against which to test that requirement. The case shows how a workstream target balance combined with a dated required-rate check raises capacity questions that pooled totals and procurement status leave open. The resulting controls are proposals for monitoring relevant to Sustainable Development Goal (SDG) target 12.4, not tested interventions.***

Index Terms- ***documentary case study, hazardous waste, polychlorinated biphenyls, project controls, schedule forecasting, SDG 12.4***

I. INTRODUCTION

A completion forecast for physical treatment is only as reliable as the evidence that treatment capacity will be ready in time. Award of a supply contract shows that a procurement decision has been made, and delivery shows that plant has arrived. Neither establishes when plant, operators, feed stock, permissions and testing resources will come together, or how many tonnes the system can treat and have accepted before the deadline. When procurement milestones are used to support a completion date, the forecast can remain unchanged while the conditions on which it depends move later.

The difficulty grows when a programme reports progress as a single mass total. Extra disposal on one workstream can raise that total without reducing another workstream's obligation, because a tonne of pesticide destroyed does not discharge a commitment to treat a tonne of contaminated oil. The two problems interact: a pooled total can appear on track while the workstream whose completion depends on unready capacity has not started.

Both problems matter for legacy persistent organic pollutants (POPs). Part II of Annex A to the Stockholm Convention sets 2025, subject to review by the Conference of the Parties, for eliminating the use of PCBs in equipment, and requires each Party to make determined efforts designed to lead to environmentally sound waste management of PCB liquids and of equipment contaminated with PCBs above 0.005 per cent as soon as possible but no later than 2028 (Stockholm Convention 2001). A 2016 assessment by the United Nations Environment Programme estimated that only about 17% of PCB-containing equipment and materials had been eliminated and that roughly 30% of countries were on track for those dates (United Nations Environment Programme 2016). For obsolete pesticides, the Food and Agriculture Organization's 2001 baseline study estimated stocks of up to 500,000 tonnes in non-OECD countries and noted that detailed pre-shipment inventories often find larger quantities than initial surveys (FAO 2001).

Egypt, which ratified the Convention in 2003 (World Bank 2019), pursued both waste streams under P116230. The project's original design combined disposal of obsolete pesticides with decontamination of transformer oil containing PCBs. Each workstream carried a 1,000-tonne commitment and shared the closing date of the parent grant, but they relied on different institutions, specialist assets and delivery routes. A tonne in the oil indicator is a tonne of

contaminated oil treated, not a tonne of PCB removed (World Bank 2014, pp. 5–8 and 19–22; World Bank 2021b, pp. 3–5). Because the public record includes appraisal, restructuring, supervision, procurement and completion documents, it is possible to reconstruct what the reporting record showed at successive points before the grant closed.

The study asks two questions:

- RQ1. What evidence about procurement, operational readiness and remaining treatment was publicly available when the completion forecast was reported?
- RQ2. What additional information does a required-rate check provide when existing workstream indicators are read alongside the pooled programme total?

The paper claims originality for two things: a dated reconstruction of what the public reporting record showed at successive control points, and the combination, in this setting, of obligation-specific progress measures with an explicit schedule test. It does not claim that the project lacked workstream reporting. The July 2021 supervision report already carried a separate oil indicator, which stood at zero. A target-capped headline improves the interpretation of the pooled result, but it adds little to what the oil indicator already disclosed. What the rate check adds is a specific capacity question that a zero-output indicator does not answer on its own: given the earliest date on which capacity could plausibly be ready, what sustained daily rate would the forecast require, and does the record contain evidence that such a rate was achievable? None of the measures is presented as a new scheduling algorithm.

Section 2 reviews research on aggregation, readiness and the forecasting of physical output. Section 3 sets out the case boundaries, corpus, coding and measures. Section 4 reports the schedule evidence, the two workstreams, the reported outcomes and the required rates. Section 5 shows what a controller could have done at three reporting points, proposes controls and states the limitations. Section 6 concludes.

II. ANALYTICAL BACKGROUND

A. Aggregation and compensability

Multidimensional project-performance research recognises that aggregation helps managers interpret many measures but that indicators must keep their decision relevance at the activity level. Lauras, Marques and Gourc (2010) address that problem through multicriteria assessment across project tasks and dimensions. The composite-indicator handbook of the OECD and the European Commission's Joint Research Centre distinguishes weighting from compensability: an arithmetic sum lets a surplus in one component offset a deficit in another (OECD and European Commission 2008, pp. 31–34 and 102–105). Munda and Nardo (2009) show that the linear weighted sums commonly used to build composite indices are fully compensatory, and they develop non-compensatory aggregation rules for settings in which such offsetting is not acceptable.

The issue here does not arise because tonnes are incompatible units. It arises because a common physical unit does not make the underlying deliverables substitutable. A pooled total describes material managed; it does not show whether each obligation was discharged. Measurement choices also shape behaviour. Campbell (1979) argued that the more a quantitative indicator is used for social decision-making, the more it is exposed to corrupting pressures and the more apt it is to distort the processes it is meant to monitor. A pooled target does not need to be gamed to mislead: it is enough that the more tractable workstream carries the headline while the harder one lags.

Stage distinctions matter as well. The Independent Evaluation Group's assessment of the Africa Stockpiles Program distinguished completed inventories, actual stockpile elimination and measures to prevent recurrence (Independent Evaluation Group 2016). Those distinctions inform the coding used here: identification, dispatch and receipt do not count as final treatment. Likewise, SDG target 12.4 gives a reason to distinguish final management routes, but not to treat project target attainment as the national measure of hazardous-waste treatment (United Nations General Assembly 2015).

B. Readiness and production control

Production-control research treats readiness as a precondition for reliable output. Ballard and Howell (1998) argue that production control should be built around the work assignment and that production units should be shielded from upstream uncertainty by committing only work whose prerequisites are in place. In treatment projects the equivalent prerequisites are deployable plant, trained operators, accessible feed stock, permissions and testing capacity. A forecast that counts procurement or delivery as readiness assumes that those prerequisites will follow.

Resource-loaded scheduling makes a related distinction between calendar time and the time in which the necessary resources can operate. Lu and Lam (2008) show that resource calendars can change activity timing and float, and the US Government Accountability Office (GAO) *Schedule Assessment Guide* treats resource loading and regular updating with actual progress as separate requirements (GAO

2015, Best Practices 3 and 9). Front-end research adds that early choices about concept and alternatives carry uncertainty that later controls inherit (Williams and Samset 2010). The present study examines schedule constraints from the public record; it does not reconstruct a critical path or solve a resource-constrained schedule.

C. Forecasting physical output

Forecasting research gives two reasons to treat dated completion forecasts with caution. First, planners tend to underestimate completion times. Buehler, Griffin and Ross (1994) found that people predicting their own task completion focus on plan-based scenarios rather than relevant past experience, and so underestimate how long tasks will take even when they know that similar tasks have overrun. Second, the standard tools for in-flight schedule control assume a cost-loaded baseline. Earned value management has been reliable for cost control but less so for forecasting duration, and earned-schedule indicators were proposed partly to address that weakness (Vanhoucke and Vandevoorde 2007). Many donor-financed treatment projects instead report physical outputs against a target. In that setting a simple screening test is available: compare the average rate required to finish, the remaining quantity divided by the usable time, with evidence of the rate the deployed system can sustain.

Research on World Bank-financed projects suggests why such a screen matters. Ika (2012) argued that development projects often fall into an accountability-for-results trap and called for stronger supervision. Using data on more than 6,000 evaluated World Bank projects, Denizer, Kaufmann and Kraay (2013) found that outcomes vary much more within countries than between them, and that project-level variables, including supervision effort and early-warning indicators, account for much of that variation. Neither study examines how the structure of an output indicator affects whether an early warning can appear.

D. Analytical expectations

The literature yields three expectations, each of a different kind.

- E1 (an arithmetic property). Where workstreams are not substitutable, a pooled output measure understates the gross outstanding obligation by the amount of that obligation offset by above-target output elsewhere. This follows from the definitions in Section 3.5 and is not an empirical hypothesis; the case shows its size.
- E2 (an observed pattern). Where forecasts are anchored to administrative deadlines rather than demonstrated rates, completion dates may hold while prerequisites slip. The documents can show whether this pattern occurred; they cannot establish why.
- E3 (a screening proposition). Where a project reports physical outputs, a required-rate check converts an assumed readiness date into a capacity requirement that can be compared with evidence of deployable capacity. Its value is practical. The paper does not compare it with other forecasting methods.

III. METHODS

A. Case boundaries and selection

The case is the parent grant of P116230 (trust-fund grants TF-17336 and TF-B3715). Its two tonnage-based workstreams, obsolete-pesticide disposal and PCB-contaminated oil treatment, are embedded units within a single programme, not matched cohorts. A later air-quality component had a separate financing deadline and is excluded. Two dates are kept distinct throughout: the grant-level closing date, an administrative deadline that moved from 30 November 2018 to 31 December 2021, and the forecast date for completing oil treatment, which the June and July 2021 reports gave as November 2021.

The case was selected purposively for analytical leverage rather than typicality. In Seawright and Gerring's (2008) terms, the workstreams offer a diverse within-case contrast: they share a grant, a borrower, a supervising institution and a closing date. Holding those conditions constant removes several programme-level explanations that would confound a comparison across separate projects. The workstreams differ, however, in waste type, regulatory approvals, procurement route and institutional ownership, and each of these is a plausible alternative explanation for their different outcomes; the design does not discriminate among them. The aim is analytical rather than statistical generalisation (Flyvbjerg 2006), and the embedded design follows Yin (2018).

B. Corpus, search and evidence window

This embedded documentary case study uses operational records publicly available by 31 August 2022. The corpus covers the parent grant and its two tonnage-based waste-treatment workstreams. The search used the World Bank Documents & Reports archive, keyed to the project identifier P116230, and followed references from the supervision and completion reports to appraisal, restructuring, procurement and safeguard documents. A document was included if it added a baseline, a dated output or forecast, a material change in schedule or route, or a reconciliation of final quantities. Documents relating only to the air-quality component, and assessments published after 31 August 2022, were excluded even

where they describe earlier activity. The corpus is purposive, not a systematic review of the project archive (Bowen 2009; Baxter and Jack 2008).

Table 1 lists the ten included documents. The evidence window, which closes on 31 August 2022, is distinct from the retrieval date: documents were retrieved for analysis in November 2022. A cover date and a disclosure date can differ; disclosure dates are shown where they are printed on the document or its catalogue entry. Two documents describe events after the decisions they inform: the June 2022 completion report gives retrospective explanations for delays, and its oil quantity is attached to more than one date. Those passages are coded as retrospective and flagged where they are used.

Table 1. Documentary corpus (evidence window to 31 August 2022).

Key	Document and identifier	Document date	Disclosed	Evidence used
World Bank 2014	Project Appraisal Document, Report No. PAD71	23 May 2014	Not recorded	Targets; original closing date (data sheet; pp. 5–8, 19–22)
World Bank 2017	Implementation Status and Results Report (ISR), Sequence 7	3 Aug 2017	Not recorded	July 2017 pesticide entry (p. 8)
World Bank 2018	Restructuring paper	Aug 2018	Not recorded	Revised closing date and forecasts; share of oil identified (PDF p. 3)
ElSheikh 2019	Environmental and social impact assessment, North Upper Egypt	2019 (cover)	2021	Appraisal of a domestic pesticide route
World Bank 2020	ISR, Sequence 13	21 Dec 2020	Not recorded	11 December 2020 indicators; closing date (pp. 4–6)
World Bank 2021a	Restructuring paper	Jun 2021	Not recorded	Deployment and completion forecasts; extension; reallocation (paras. 3–4, 10–13)
World Bank 2021b	ISR, Sequence 14	19 Jul 2021	Not recorded	12 July 2021 indicators; delivery and completion forecasts (pp. 2–5)
World Bank 2021c	Procurement plan, May 2021 revision	May 2021	Not recorded	Planned and actual contract signing (goods, p. 1)
World Bank 2021d	Procurement plan, STEP58842	29 Dec 2021	29 Dec 2021	Status of the rental package (PDF pp. 4, 6)
World Bank 2022	Implementation Completion and Results Report (ICR), ICR00005467	28 Jun 2022	Not recorded	Final quantities; route reconciliation; oil annex; costs; retrospective explanations

Note: Direct URLs, page and table locators for every coded extract are given in the supplementary files sources.csv and ledger.csv.

C. *Evidence coding*

Each extract was entered in a workstream-by-stage matrix (baseline commitment, inventory, procurement, readiness, processing, reported completion, acceptance and residual obligation) with its document date, event or status date, any forecast or target date, unit, locator and an interpretation note (Bowen 2009; Gale et al. 2013). Each value received one of eight codes: target, planned milestone, forecast, observed progress, reported completion, documented acceptance, retrospective explanation or analytical calculation. Forecasts were never converted into actual milestones. Where versions of a schedule conflicted, each version was retained as a separate dated entry rather than replaced. Rounded measurements were kept at source precision, and reconciled values were computed separately and labelled as calculations. No public document in the corpus records acceptance of treated oil, so the documented-acceptance code is not assigned. Appendix A gives the codebook and a completed example. Statements in this paper about what controllers knew are limited to what is visible in the public reporting record.

D. *Independence and reliability*

Supervision reports and the completion report draw on borrower information and frequently share an underlying reporting chain, so their agreement is not equivalent to independent corroboration. Each

document was also appraised against Scott's (1990) criteria of authenticity, credibility, representativeness and meaning. Authenticity is high, because every document comes from the World Bank's disclosure system and carries a report or sequence number. Credibility is more qualified, because the documents were produced by parties with an interest in how progress was presented. Representativeness is limited: aide-mémoires, contractor reports and acceptance certificates are not public.

Extraction and coding were carried out by a single researcher. No independent second reading of the source documents was undertaken. To make the procedure transparent, every coded extract carries a locator, and every calculation is reproduced by a script from the coded ledger. The analysis is otherwise deliberately conservative: where a convention must be chosen, the one that makes the November forecast easiest to meet is used, so that high required rates cannot be attributed to pessimistic assumptions.

E. Measures

Progress measures. For workstream i, let T_i be the target and A_i the reported output at a stated snapshot. Individual attainment is $100\ A_i / T_i$. Pooled attainment is $100\ \Sigma A_i / \Sigma T_i$, so workstreams are weighted by target mass. The gross outstanding balance is $G = \Sigma \max(T_i - A_i, 0)$, and the net pooled shortfall is $N = \max(\Sigma T_i - \Sigma A_i, 0)$. Target-capped attainment is $100\ \Sigma \min(A_i, T_i) / \Sigma T_i$, equivalently $100\ (1 - G / \Sigma T_i)$. The difference $O = G - N$ is the amount of outstanding obligation offset in pooling. In general O is bounded by G and equals the smaller of G and the total above-target output, so it can differ from total overdelivery; in this case the two coincide. Weighting by target mass does not express relative toxicity, statutory priority or social benefit, and capping does not remove above-target output from the physical total.

Rate measure. The required rate is $r = R / (D - S)$, where R is the outstanding target quantity in tonnes, D the deadline and S the assumed readiness date, meaning the date from which production could begin with all prerequisites in place. Days are the calendar difference $D - S$, so readiness on 1 September and a deadline of 30 November give 90 days, and every calendar day counts whether or not treatment is possible. Because the oil indicator was zero on 12 July 2021, R is the full 1,000-tonne target. Where only a month is known for a milestone, its first and last days bracket the assumed readiness date; treating delivery or deployment as readiness is an optimistic proxy, since neither establishes commissioning. Where a forecast gives only a completion month, its last day is used, which is the least demanding reading. Delay cases add 14 or 28 days as sensitivity tests, not as estimates of installation time. Where $R > 0$ and $D - S \leq 0$, the result is reported as no feasible window under the stated assumptions rather than as a zero rate. The required rate is an average acceptance rate. It is distinct from equipment nameplate capacity and from observed accepted throughput, neither of which is reported.

IV. RESULTS

A. Schedule evidence at successive reporting points

Table 2 separates the date on which evidence became available from the event or status it describes and from any forecast it contains.

Table 2. Schedule evidence by reporting point.

Evidence available (source)	Event or status reported	Forecast or target date	Code	Interpretation
23 May 2014 (World Bank 2014)	Separate 1,000-tonne targets	Grant close 30 Nov 2018	T, PM	Original closing date. The ICR summary labels June 2021 "Original Closing"; that is not the appraisal baseline.
Aug 2018 (World Bank 2018)	76% of the oil target identified	Close 30 Sep 2020; pesticides by end-2019; oil by Sep 2020	OP, PM, FC	Identification is not readiness. Records disagree on the approval day; the month is used.
21 Dec 2020 (World Bank 2020)	At 11 Dec 2020: oil 0 t; pesticides 786 t; target oil stock identified by the Sep 2019 mission	Close 30 Jun 2021	OP, PM	The gap between inventory and treated output was visible six months before the then closing date.

Evidence available (source)	Event or status reported	Forecast or target date	Code	Interpretation
May 2021 (World Bank 2021c)	Oil-equipment supply contract signed 25 Mar 2021	Planned signing 14 Jun 2020	OP, PM	A 284-day variance on one package. The June 2021 restructuring paper's account of more than six months spent on security clearance may overlap it; the two are not additive.
Jun 2021 (World Bank 2021a)	Late award of the oil-equipment contract attributed partly to security clearance	Deployment of two purchased and one rented unit in July; treatment completion in November; close 31 Dec 2021	FC, PM	Deployment milestone. Third extension of 184 days.
19 Jul 2021 (World Bank 2021b)	At 12 Jul 2021: oil 0 t; pesticides 786 t	Equipment delivery in September; treatment completion in November	OP, FC	Delivery milestone. A later prerequisite date appeared without a later completion date.
29 Dec 2021 (World Bank 2021d)	Rental package listed as under implementation	—	OP	Does not establish when a unit was received or passed readiness checks.
31 Dec 2021	Grant closes	—	PM	Administrative deadline, distinct from the November treatment forecast.
28 Jun 2022 (World Bank 2022)	417.6 t of oil reported, attached to more than one date (Table 4); 1,082 t of pesticides	—	RC, RE	Retrospective. Report date, indicator date and batch dates must be kept apart.

Note: Codes as defined in Appendix A. T, target; PM, planned milestone; FC, forecast; OP, observed progress; RC, reported completion; RE, retrospective explanation.

Three points follow from Table 2. First, the 284-day signing variance is measured on a single procurement package and is not a measured delay on the critical path; the security-clearance period described in the June 2021 restructuring paper may fall within it and must not be added to it. Second, the June forecast of deployment in July and the July forecast of delivery in September describe different milestones. Deployment implies plant in place and operating; delivery implies only arrival. The documents therefore show that the expected arrival of equipment moved later while the November completion month held (E2), but the length of the slippage in readiness cannot be measured in days. Third, the June restructuring moved US$107,000 from goods and services to operating costs to support project management during the extension. That was a financing response, not evidence that additional treatment capacity had been mobilised (World Bank 2021a, paras. 4 and 10–13; World Bank 2021d, PDF pp. 4 and 6).

B. Pesticide status classification and the oil capacity constraint

The pesticide workstream shows why status classification matters. The July 2017 indicator recorded 220 tonnes under a disposal label, while the same entry described the material as packaged and loaded for export, not yet destroyed (World Bank 2017, p. 8). In December 2020 the 786-tonne field reconciled to 241 tonnes in a first export batch, 471 tonnes in a second batch and 74 tonnes in early domestic disposal, yet a passage in the same report described only 92% of the second batch as disposed (World Bank 2020, pp. 4–5). The June 2021 restructuring paper reported about 150 tonnes transported to cement plants within a separately contracted 214-tonne lot; transported material was not added to the disposal indicator (World Bank 2021a, para. 3).

The completion report's own reconciliation gives the final pesticide total as 712 tonnes exported plus 370 tonnes managed domestically, a total of 1,082 tonnes. The domestic subtotal comprises 86 tonnes at ports, 106 in the Delta, 118 in Greater Cairo and 60 in

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Upper Egypt; the 86 port tonnes are part of the 370, not additional to it. Reading a separate narrative reference to the port tonnes as additional would give 1,168 tonnes, contrary to both the cost table and the formal indicator (World Bank 2022, pp. 13 and 16–17). The difference of 296 tonnes between the July 2021 indicator and the completion-report total is a change between two reported snapshots; the documents do not show when within that interval the additional disposal occurred or how long it took. The shift from export to domestic cement kilns, appraised in a safeguard assessment (ElSheikh 2019) and linked in the completion report to new regulatory arrangements and higher overseas prices, gave the pesticide workstream route flexibility.

The oil workstream had no comparable flexibility. The completion report separates barriers before equipment delivery (feasibility and contracting delays, transport, permissions and access to electricity-sector sites) from barriers after delivery (delayed on-site training, use of two units because the rented third unit was unavailable, longer treatments than expected and repairs) (World Bank 2022, pp. 14, 20–22 and 35–36). These explanations are retrospective and could have operated together: available machine time does not become accepted output if access, operators or testing are limiting. Equipment counts alone therefore do not support a counterfactual that three units would have produced 50% more than two.

C. Reported outcomes

Table 3. Separate targets and reported outcomes, metric tonnes: reconciliation of completion-report figures.

Workstream	Target	ISR value, 12 Jul 2021	ICR total, report of 28 Jun 2022	Attainment (ICR)	Gross outstanding
Obsolete pesticides	1,000	786	1,082	108.20%	0
PCB-contaminated oil	1,000	0	417.6	41.76%	582.4
Total (reconciliation)	2,000	786	1,499.6	74.98%	582.4

Note: The ICR column reports the values recorded in the June 2022 completion report. It is not verified performance at grant close on 31 December 2021; Table 4 sets out the dates attached to the oil total. The formal combined ICR field is 1,500 t (75.0%). Sources: World Bank 2021b, pp. 2–4; World Bank 2022, pp. 30–35.

On the completion-report figures, pooled attainment was 74.98% and target-capped attainment 70.88%. The net pooled shortfall was 500.4 tonnes and the gross outstanding balance 582.4 tonnes, all of it in oil. The offset in pooling was 82.0 tonnes, equivalent to 4.10 percentage points of the combined target. This is the size of the arithmetic property stated in E1: the pooled figure understates the gross outstanding obligation by 82.0 tonnes, and the gross balance is 16.4% larger than the net shortfall. Repeating the calculation at the ICR's rounded headline precision gives 75.0% pooled, 70.9% capped and a gross balance of 582 tonnes; no conclusion changes. At the July 2021 snapshot, with neither workstream above target, pooled and capped attainment coincided at 39.30%.

Table 4. Oil date and sample reconciliation in the completion report.

Item	What the ICR shows	Interpretation
Indicator date	Results-framework field of 417.6 t, dated 31 Dec 2021	Date of the indicator entry, in a report dated 28 Jun 2022
Narrative timing	Several passages describe 417.6 t as treated "by June 2022"	Implies some treatment may have occurred after grant close
Rounded statement	Annex 4 states that decontamination of 418 t was completed in 2021	Conflicts with the narrative timing; neither is preferred
Asset rows	13 undated rows in Annex 1, Table A1.3, summing to 417.6 t	Confirms the arithmetic, not the treatment dates
Legible after-treatment readings	11 rows, 287.6 t, readings of 8–49	All below the 50 ppm level discussed in the report
Indeterminate readings	2 rows of 65 t each, printed as ">10"	A lower bound only; indeterminate against 50 ppm
Printed percentages	Values such as −1306% for 689 to 49	Equal (after − before) / after; recalculated reductions relative to baseline (e.g. 92.9%) are in the supplement

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Note: Annex row data are transcribed in oil_annex_A1_3.csv. For the two ">10" rows, the printed percentages are consistent with an after value of 11, but the printed reading itself remains a lower bound and is not treated as a measurement. No row constitutes certified acceptance. Sources: World Bank 2022, results framework, narrative, Annex 1 (Table A1.3) and Annex 4.

The oil total is therefore reconciled in mass but not in time. If reported cumulative treatment is non-decreasing, with consistent scope and no downward reclassification, 417.6 tonnes is a conditional upper bound on the quantity treated by grant close under the June 2022 reading. The oil target falls short under either reading, and the paper does not select an unsupported exact quantity for 31 December 2021.

D. Required rates under proxy readiness assumptions

Table 5. Calendar-day rates required to treat 1,000 tonnes: proxy scenarios and sensitivity cases, not observed productivity.

Scenario	Type	Assumed readiness *S*	Deadline *D*	Days	Required t/day
A. June deployment forecast treated as readiness	Proxy scenario	1–31 Jul	30 Nov (forecast completion)	152–122	6.58–8.20
B. July delivery forecast treated as readiness	Proxy scenario	1–30 Sep	30 Nov (forecast completion)	90–61	11.11–16.39
C. As B, to grant close	Proxy scenario	1–30 Sep	31 Dec (grant close)	121–92	8.26–10.87
D. As C, readiness 14 days after delivery	Sensitivity	15 Sep–14 Oct	31 Dec (grant close)	107–78	9.35–12.82
E. As C, readiness 28 days after delivery	Sensitivity	29 Sep–28 Oct	31 Dec (grant close)	93–64	10.75–15.63

Note: Days are $D - S$. R = 1,000 t, because the oil indicator was zero on 12 July 2021. All calendar days count. Delivery and deployment are treated as readiness only as optimistic proxies. Sources: World Bank 2021a, para. 4; World Bank 2021b, pp. 2 and 4–5.

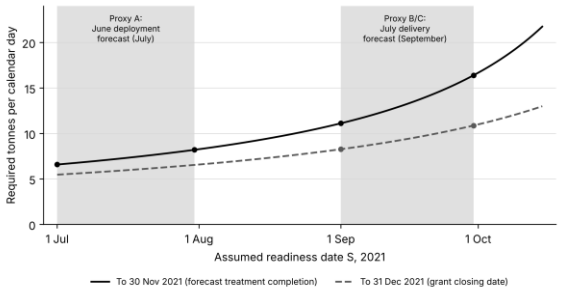


Figure 1. Required average rate to treat 1,000 tonnes, in tonnes per calendar day, as the assumed readiness date moves later. The solid line uses the forecast treatment-completion date of 30 November 2021; the dashed line uses the grant closing date of 31 December 2021. Shaded bands are the proxy readiness windows of Table 5 (July for the June deployment forecast; September for the July delivery forecast), and points mark their endpoints. The bands are assumptions, not observed readiness.

Under the July delivery proxy, the November forecast required 11.11–16.39 tonnes per calendar day, against 6.58–8.20 under the June deployment proxy. Measured to grant close, the requirement fell to 8.26–10.87 tonnes per day, rising to 10.75–15.63 if readiness lagged delivery by 28 days. The public record reports no sustained accepted rate, so the November forecast is indeterminate on the evidence: neither demonstrably feasible nor demonstrably infeasible. That indeterminacy is itself the finding relevant to E3. A forecast that requires a specified daily rate from a specified date can be tested against batch cycle times, crew availability and testing capacity; a forecast supported only by a delivery date cannot. Fitting a line between the July zero and the completion-report total would fold procurement waiting time, operating time and date uncertainty into one average and would not measure the productivity of usable equipment.

Reported costs are described here only for context. The completion report gives domestic pesticide costs of US$261–418 per tonne for listed batches and US$1,239 and US$1,914 per tonne for the two overseas batches; these are nominal batch or contract figures whose boundaries differ in material, origin, logistics and contract scope, so the full differential cannot be attributed to route choice. For oil it reports US$5,935 per tonne at the reported quantity, against an appraisal estimate of US$6,600; a figure of

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US$2,478 per tonne is a contingent estimate that assumes capital costs spread over the full 1,000-tonne target. The report also notes that some operating and laboratory costs were borne by Egyptian institutions, which may not be reflected in these figures (World Bank 2022, pp. 16–17 and 59).

V. DISCUSSION

A. What the controller could have done

Table 6 applies the measures at three reporting points. For each it separates the evidence and recorded action visible at the time from the retrospective recommendation that this paper proposes. The recommendations are not recorded in the documents.

Table 6. Decision table at three reporting points.

Date	Contemporaneous evidence and recorded action	Monitoring signal	Additional finding from the schedule check	Proposed response (retrospective)
Dec 2020	ISR, 11 Dec 2020: oil 0 t; pesticides 786 t; oil stock identified since Sep 2019; closing 30 Jun 2021	Oil indicator at zero with about six months to close	No readiness date is reported, so no rate can be computed: the start date and achievable rate are open	Require a dated equipment-to-acceptance plan; list unresolved prerequisites with owners
Jun 2021	Restructuring paper. Forecast: July deployment of three units; November completion. Recorded action: closing extended to 31 Dec 2021; US$107,000 reallocated	Last oil observation (11 Dec 2020) at zero	Full balance by 30 Nov requires 6.58–8.20 t/day from July	Request commissioning, crew, equipment and testing evidence against that rate
Jul 2021	ISR, 12 Jul 2021: oil 0 t; equipment now expected in September. Recorded action: November forecast retained	Separate oil indicator at zero	Requirement rises to 11.11–16.39 t/day to 30 Nov (8.26–10.87 to grant close) under the delivery-as-readiness proxy	Seek verified readiness dates, batch cycle times, access and testing capacity; then retain the forecast on evidence or escalate for review

In December 2020 the monitoring record already showed the oil workstream at zero, but the schedule check could not be applied because no readiness date was reported; its contribution at that point is to identify the missing information. By July 2021 the separate oil indicator still showed zero, as it had since the start. The incremental contribution of the check was to turn the later equipment milestone into a required daily rate 69–100% higher than the June plan implied, a quantity that could be tested against operating evidence.

B. Proposed controls

The case suggests the controls in Table 7. They are proposals derived from one case, not tested practices. The forecast unit is acceptable tonnes expected by the same date: at each control date, each open workstream would report the tonnes it expects to have treated and accepted by the reporting deadline, not treatment starts or tonnage delivered to a facility. An initial ceiling is the minimum of feed stock ready for processing, attainable plant and crew output, and access and acceptance capacity. Where observed batch and downtime data exist, they would set lower and upper forecasts; where they do not, the forecast is shown as indeterminate, with an owner for the missing evidence and a date by which it is due.

Table 7. Proposed workstream-level controls.

Signal against the target balance	Proposed response
Readiness or acceptance evidence missing	Assign an owner and a due date to each blocking prerequisite. Do not enter an order or delivery as deployable capacity.
Required rate exceeds the upper evidenced rate	Escalate. Compare additional resources, sequence changes, authorised alternative routes or an extension with a funded plan for the remaining stock.
Lower evidenced forecast falls short but upper meets the balance	Test the dominant assumption first; protect access and acceptance slots; track the downside separately.

Signal against the target balance	Proposed response
Lower evidenced forecast meets the balance	Continue to monitor accepted throughput, downtime and access; reforecast if a prerequisite slips or batch composition changes.
Grant closes with a balance	Publish reported and verified figures with separate dates; record the amount, custodian, budget authority and milestone for each residual obligation.

Three design choices make the controls usable. Prerequisite ownership names who is responsible for each readiness condition. Reporting cadence aligns the forecast with every supervision report and with any restructuring, so that a forecast is never older than the last change in a prerequisite. The escalation threshold is the point at which the required rate exceeds the upper rate supported by evidence, or at which no evidence of an achievable rate exists within a set number of weeks of the assumed readiness date. Choosing between response options requires the incremental cost and the additional accepted output of each option, measured to the same deadline and under comparable cost boundaries; cost per tonne alone cannot override legal obligations or risk-based priorities.

C. SDG 12 and sustainability claims

Delivery governance of this kind helps track progress towards the environmentally sound management of chemicals and wastes under SDG target 12.4. It does not compute national indicator 12.4.2, whose denominator is not a programme's tonnage target (United Nations General Assembly 2015; United Nations General Assembly 2017). Reported treatment is also distinct from certified acceptance, from verified reuse of treated oil, from reductions in toxicity and from avoided emissions; the public record supports only the first. The pooled measure remains a useful physical total. The capped measure and the workstream balance prevent it from being read as fulfilment of every commitment. The Stockholm Convention's PCB provisions, summarised in Section 1, frame the regulatory relevance: where Parties must make determined efforts towards environmentally sound management of PCB liquids by 2028, the question is whether specific quantities are treated by fixed dates, which is the question a dated required-rate check addresses.

D. Contribution

Relative to the aggregation literature (Munda and Nardo 2009; OECD and European Commission 2008), the case shows compensability operating within a single project, where it is easy to overlook because the components share a physical unit. Relative to the forecasting literature, the pattern in Table 2, in which a prerequisite moved later while the completion month held, is consistent with what planning-fallacy research would lead one to expect (Buehler et al. 1994), but the documents cannot distinguish optimism from strategic presentation or undisclosed information. Relative to production control (Ballard and Howell 1998), the case illustrates the cost of counting delivery as readiness. Relative to research on development-project supervision (Ika 2012; Denizer et al. 2013), it suggests that the structure of an indicator conditions what an early warning can say: a zero indicator signals a problem, but only a dated rate requirement says how large the capacity question is.

E. Limitations

The public archive cannot isolate the causes of the oil shortfall: waste type, approvals, procurement route and institutional ownership all differ between the workstreams. It cannot verify how much oil had been treated and accepted by grant close, because the completion report attaches its total to conflicting dates and no acceptance records are public. It cannot validate the November forecast or the proposed controls, because no accepted throughput series is reported. Nor can it estimate what a third unit would have delivered, because utilisation, access and testing constraints are not documented. The records are weighted towards institutional reporting and may omit contractor actions, downtime or later progress. Extraction was by a single researcher. Dated commissioning and acceptance logs, approved resource-loaded schedules, contractor records and verified residual custody would strengthen any further test.

VI. CONCLUSIONS

Egypt's P116230 reported disposing of more obsolete pesticide than planned but fell materially short on PCB-contaminated oil. The pooled headline accurately summarised the reported mass, and the supervision reports carried a separate oil indicator that showed the shortfall. What the public record did not show was the capacity implication of the schedule: in July 2021, a later equipment milestone sat alongside an unchanged November completion forecast. Read against the oil balance, a dated required-rate check converts that combination into a specific question, whether 11.11–16.39 tonnes per day could be sustained from September, that pooled reporting and

procurement status leave unanswered. The bounded contribution of the case is to show how a workstream target balance plus a dated required-rate check exposes such questions. Whether these controls would lead to earlier escalation or more accurate forecasts is a proposition for prospective testing, not a finding of this study.

VII. APPENDIX A. CODEBOOK AND COMPLETED EXAMPLE

Table A1. Evidence codes.

Code	Label	Definition	Decision rule
T	Target	A commitment against which output is measured	Recorded at source precision; never treated as progress
PM	Planned milestone	A date set in advance (closing date, planned signing)	Each revision is a new entry; earlier versions are kept
FC	Forecast	An expected future date or quantity stated at a reporting point	Never converted to an actual milestone; reporting date and forecast date recorded separately
OP	Observed progress	A monitoring observation of status or quantity at a stated date	Observation date recorded; dispatch or receipt is not treatment
RC	Reported completion	A quantity reported as complete	Every date the source attaches to it is recorded; none is preferred
DA	Documented acceptance	Evidence that output met acceptance criteria	Not assigned: no acceptance records are public
RE	Retrospective explanation	A later account of why something happened	Flagged when written after the decision it describes
AC	Analytical calculation	A value computed from coded entries	Reproduced by script; never mixed with source values

Table A2. Completed example: ISR Sequence 14 (World Bank 2021b), dated 19 July 2021.

Entry	Extract (summarised)	Code	Status or event date	Forecast or target date	Note
L14	Oil treated indicator: 0 t	OP	12 Jul 2021	—	Observation date differs from report date
L15	Pesticide disposal indicator: 786 t	OP	12 Jul 2021	—	Unchanged since Dec 2020
L16	Equipment expected to arrive in September	FC	19 Jul 2021 (reported)	Sep 2021	Delivery milestone, distinct from June deployment forecast (L08)
L17	Treatment completion still expected in November	FC	19 Jul 2021 (reported)	30 Nov 2021 (month end)	Kept alongside L09; not converted to an actual
—	Required rate under proxy B	AC	—	—	11.11–16.39 t/day; computed by calc.py

DECLARATIONS

Data availability. The following files are supplied as supplementary material with this submission: README.md, sources.csv, ledger.csv, codebook.csv, oil_annex_A1_3.csv, calc.py, expected_outputs.txt and figure1.png. Running calc.py reproduces every headline number, table value and Figure 1. All underlying documents are publicly disclosed by the World Bank at the URLs given in sources.csv and the references.

Ethics. The study used only publicly disclosed documents and did not involve human participants, confidential data or new field measurements; ethical approval was therefore not required.

Use of AI tools. an AI assistant (Claude, Anthropic) was used while preparing the manuscript for publication for copy-editing, for some sections. This was not an independent reading of the sources.

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